THE COFFEE PLANTER OF CEYLON.

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COFFEE-PLANTER

OF

CEYLON.

By WILLIAM SABONADIÈRE.

With an Appendix,

CONTAINING VARIOUS EXTRACTS AND LETTERS FROM OTHER AUTHORITY, BEARING ON THE SAME SUBJECT.

SECOND EDITION, ENLARGED AND REVISED.

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Dedicated to

F. R. SABONADIÈRE, Esq.,

OF DELTA, PUSSILAVA, CEYLON,

BY HIS AFFECTIONATE BROTHER,

THE AUTHOR.

PREFACE.

As planters, like doctors, often disagree, it may be thought presumption on my part to come forward with a work on the subject of Coffee-planting, as at present practised in Ceylon; yet I think that my twenty years' experience in the districts of Pussilava, Hewahette, and Rambodde justify me in the desire to employ usefully the leisure time at my disposal for the benefit of beginners, in writing a work which may hereafter be useful as a book of reference.

I trust I need not say that I have no wish, neither do I pretend, to teach men who are as old and experienced planters as myself; for had I not felt confident, before I commenced this book, that a *modern* work or manual for young coffee-planters was required (the want of which has often been deplored), I would not have undertaken the task.

I have appended numerous extracts from Laborie's work, which, though written many years since, is still in some respects excellent of its kind, though not fully

equal to present requirements — so much that is new having been learnt since Laborie wrote.

I have also availed myself of various letters, published either by the Planters' Association or in the local papers, all of which I gratefully acknowledge. They will, I am certain, add to the value of my book, as affording corroborative professional authority. I also acknowledge, with thanks, much statistical information derived from Ferguson's 'Ceylon Directory,' 1864–5, a compilation very useful to anyone who has interests in that island.

In conclusion, I trust my fellow-planters will excuse the many deficiencies that may be found in my work, and rely upon their kind and friendly criticism.

WILLIAM SABONADIERE.

GUERNSEY, *February*, 1866.

PREFACE TO SECOND EDITION.

THE First Edition of my treatise on Coffee-planting being out of print, several friends have suggested that I should publish a second.

I have endeavoured to make the present Edition more complete by adding an entirely new chapter on Manuring, as, since I wrote in 1866, I have acquired much more experience in the use of artificial manures.

I have added to the Appendix several papers bearing on Coffee-planting, and the latest statistical information of Exports, and the Revenue of Ceylon; and beg to return thanks to those gentlemen to whom I am indebted for this addition to my work.

In conclusion, I trust this book may meet with the same support as was accorded to the first publication.

WILLIAM SABONADIÈRE.

DELTA, PUSSILAVA,
20th August, 1870.

THE

COFFEE-PLANTER OF CEYLON.

INTRODUCTORY REMARKS.

THE date when the coffee-plant was first introduced into Ceylon has, I believe, never been definitely ascertained. It is generally supposed to have been brought from Arabia during the time of the Dutch occupation of Ceylon, when it was, doubtless, at the same time conveyed to Java. There the Dutch encouraged its cultivation, but not so in Ceylon, it being left to British capital and enterprise to make this beautiful island become one of the largest coffee-producing countries of the world; that coffee, too, being of the best description, and most in favour in the London markets, whence the Continent is also now largely supplied.

In some of the Kandian villages there are coffee-trees, which must have been planted during the last century. I remember General Braybrooke telling me, that when he first visited Badulla, in 1817, he noticed there a very large coffee-tree (which I believe is still extant) in a flourishing condition; which proves that planters who have good soil, and carefully cultivated and manured estates, need not fear their dying out—as it was once supposed they would, after a period of years not exceeding twenty. The pioneers

of coffee-planting in Ceylon were the justly celebrated governor, Sir Edward Barnes, K.C.B., and Lieut.-Colonel Byrde, of the 16th and Ceylon Rifle Regiments. In 1823, they severally opened "Gangarooa" near Paradenia, and "Sinnapittia" near Gampola. The superintendents were W. S. Northway, of the Staff Corps, for Gangarooa, and Mr. George Byrde for Sinnapittia. Both these estates are 1600 feet above the sea. When first planted, the flats near the river were selected, and I have heard elephants were employed to plough the land—a system which would now find no advocates. Of these first plantations only small portions remain, chiefly under clumps of jack-trees, where they grow in the native state and are very fine. Some of the same land that had been "cheenaed" by natives has now been formed into a very productive estate, called "Veean Watte," and belongs to the heirs of Colonel Byrde, the original proprietor. Both here and at Gangarooa, the upper portions of the estate have been planted; and these two old estates, commenced forty-two years ago are still in existence and producing coffee.

Between 1823 and 1835, nothing further seems to have been done to extend the cultivation; but in that year, under the auspices of the firm of Acland, Boyd, and Co., some estates were opened at even a lower elevation, on the banks of the Mahavilla Ganga, at Kondasalle, Dodangalla, Palakelle, and Rajahwelle. Some of these estates did not turn out well, but Rajahwelle and Palakelle are now most productive and celebrated properties, the former especially for its water-works, and the grand law case, which was only settled by appeal to the Privy Council.

In 1837–8, Lieutenant H. C. Byrde, C.R.R., son of the proprietor of Sinnapittia, commenced planting coffee at high elevations (3000 feet above the sea). It was then thought a very fool-hardy experiment, it being predicted that cold and wet would kill the trees. At about the same period, Archdeacon Glennie commenced at Glenloch, Colonel Macpherson, of the 78th Highlanders, at Helbodde, and Captain Kelson, C.R.R., and the Rev. N. Garstin, Colonial Chaplain, at Pallagolla. The success of these before-named properties was so evident, that by 1843 many estates had been opened in different districts; and by the time I reached the island, in July, 1845, coffee-planting may be said to have fully developed itself. I find as much as 140,000 cwt. was the average export from 1841 to 1846, which, in 1865, has risen to 884,051 cwt., giving an average of 703,502 cwt. for the last five years. I must not omit to record the rush that was made for land at Ambegammoa, between 1840 and 1844, mostly by civil servants, and how ruinous a speculation it proved to most of them. Bad soil, lavish expenditure, and inexperience, combined with the disastrous crisis of 1847, resulted in the abandonment of most of these properties.

Referring to Ferguson's Ceylon Directory for 1864–5, I find no less than the names of 802 coffee estates, more than 600 of which must have been opened during the last twenty-three years. It is, therefore, no matter of surprise that the exports have risen proportionately, and will ere long exceed 1,000,000 cwt., when the recently-formed districts of Dick Oya, Happootella, Madoolseema, Hewa Ellia, Uda Pussilava, Nitre Cave, and Mooroowee Korle

come into full bearing. Let us hope, by God's blessing, that the prosperity which has hitherto attended Ceylon may continue, by the supply of labour equalling the demand. The increasing scarcity of labour is our only fear. That of over-production we need not dread, for, at the rate at which the population of the world is increasing, there is ample room not only for the planters of Ceylon, but also for those of India and the Eastern Archipelago.

Reference to the Appendix will show that in December, 1869, the number of estates had augmented from 802 to 913; while estates are still being opened in Dimboola and the Maskelyia valley.

My prediction in 1866 that the export of coffee would before long amount to 1,000,000 cwt., was realized in 1868, when 1,007,214 cwt. were shipped from Ceylon.

In the Appendix will be found Table of Shipments from 1849 to 1869.

SELECTION OF LAND, SOIL, ELEVATION, ETC.

THE selection of forest land, for the formation of a coffee plantation, should be most carefully made—if possible, by an experienced person, who has a knowledge of the country, the climate, and the best soil suitable for the growth of coffee-trees. Had those gentlemen who, in 1843, looked upon Ambegammoa as a future El Dorado, possessed more experience, or had they been able to secure the advice of competent judges, the mistake of sinking money on such land would have been avoided, and many fortunes would probably have been saved, instead of lost. The too continuous rains of that region, and the stiff, clay-like soil, caused the trees to suffer from what has been termed "wet feet;" and though, in many instances, the bushes looked luxuriant, they never bore remuneratively, and bad times ensuing, the abandonment of most of these properties followed. Had draining and trenching been tried in those days, the soil might have been rendered more friable; but, even then, I much doubt whether the soil of Ambegammoa proper was ever meant to grow coffee; as that of Matelle, Doombera, and Ouvah undeniably seems intended by nature to produce not only luxuriant growth, but heavy bearing. In Ceylon, there is no doubt that an eastern aspect is generally considered the best adapted for coffee.

The most suitable soil for the coffee-bush is that which

grows soft timber. The hard "doon" wood (useful, however, for shingles and beams) is usually found on high, quartzy ridges, which both the nature of the soil and exposure to wind render unsuitable; while the valleys usually abound in trees of a more tender nature, indicative of a richer and freer soil. The best land for coffee is a dark chocolate-coloured soil, mixed with small stones, and overspread here and there with boulders of granite; for, as Laborie observes, "if the pivot (tap-root) finds the quick-stone, gravel-stone, or clay, the tree will not last long; but if it as well as the roots find their way through stony ground, and if there be a good proportion of mould, it suffers no inconvenience—nay, the tree may do better, as the stones keep the mould together." There is no doubt of this, for, in my opinion, the finest estates in Ceylon are of this latter character of soil, and have given consecutive heavy crops with the assistance of little or no manure; while estates with a lighter soil, having lost nearly all the top mould and having no good subsoil, have to be regularly manured, and those where slab-rock, gravel, or clay prevail are worked at a questionably remunerative return, and must ere long be abandoned, as not paying for their cultivation. Ceylon not being famed for its good soil, it follows as a consequence that very fine estates are the exception, not the rule; and that draining to prevent wash, and manuring to keep up and enrich the soil, must be largely resorted to. The railway, therefore, has not come too soon, for it will enable planters to get manures from Colombo expeditiously, and at a more moderate rate than at present. Of draining and manuring I shall treat in their proper

place, and now proceed to write of the best elevation above the sea at which coffee should be planted.

In Ceylon, undoubtedly, that from 2000 to 3500 feet is the best, but climate has also a good deal to do with it. Coffee grows well at Kaigalle, Kornegalle, and in the Doombera valley, between 800 and 1500 feet above the sea. In Ouvah, coffee bears well at between 4000 and 5000 feet above the sea, owing to the dry air and climate; while on the more western side of the island, at the same elevation, it either bears only two or three hundredweight an acre, is a mass of leaves, or gets covered with black bug—the two latter being chiefly caused by the extreme quantity of rain that falls. So it is that, while Rambodde is suffering from excessive rains, Ouvah is doing so from drought—though, as the crow flies, they are not really more than twenty miles apart. Could it be managed otherwise, and Rambodde exchange some of its super-abundant rain for Ouvah sunshine, the beneficial results to both sides of the country would be very great.

In recapitulating this chapter, we come to the conclusion that a dark chocolate-coloured soil, mixed with small stones, under ledges of rock, and bestrewn with boulders, is most suitable for coffee-trees, and that the best medium elevation is, say 3000 feet above the level of the sea.

FELLING, CLEARING, AND LOPPING.

In the early days of coffee-planting—say from 1840 to 1845—the felling was a far more arduous undertaking to the planter than it has since become, because he generally had to live in a temporary hut in the forest or pattena, to superintend the felling himself, and make his own nurseries; but as the country became more opened up, a new comer to a district was able to secure a temporary domicile in a neighbour's bungalow, whence he could visit his work, or—as has lately been much practised in the new Dick Oya district—the felling and opening of estates was undertaken by neighbouring planters, who received payment, and who managed to do the work either entirely by Cinghalese contract labour, or with their spare hands before the thick of crop-time. Malabar coolies are but poor hands at felling forest; and where they have to be so employed, many accidents happen from their inexperience and carelessness. None can come up to the Cinghalese, both maritime and Kandian, for this occupation. They are perfect adepts, and it is a wonderful and interesting sight to see a large body of them at work.

Coffee estates being generally formed on hill-sides more or less steep, the process of felling is to commence from the bottom upwards. First, the small undergrowth and trees that can be cut down by a "cattie" or bill-hook are

laid low; the large trees are then half cut through on the lower side, where there is sufficient incline to admit of it; and then, when all is ready, a few large ones at the summit are simultaneously let fall upon those already half cut through. These, in turn, falling on the others, cause a whole piece—sometimes several acres in extent—to come crashing down at almost the same moment. The way Cinghalese fell a tree is to commence the cut on the side upon which the tree is meant to fall, then to cut somewhat above this incision on the reverse side; by this means the tree of its own weight comes down before it is fully cut through. Thus, labour is saved and danger avoided; for unless a severe puff of wind interferes, the trees never fail to fall in the direction they are meant to do. It sometimes takes four or more men to cut down one of the large doon trees I have mentioned in another chapter. They are so enormous at the stem, that a staging has to be erected some eight or ten feet above the ground, to enable the men to work. When the tree begins to show signs of falling, only one man remains. It requires great nerve on his part, for he has to cut until the tree creaks and commences to fall, and has to get off the staging the best way he can before the grand crash takes place; but these woodmen are so agile, that few accidents befall them.

After the felling, lopping is compulsory to secure a good burn. Lopping is to cut and lay low the branches that stick up when the trees are felled, so as to make the mass of wood as compact as possible, that the fire may run evenly through it. Of course, where the land is undulating,

or on an unbroken hill-side, the burns will generally be best; but where rocks abound, the forest is not only in general smaller, but the broken nature of the ground prevents the even run of the fire. The subsequent operation of "clearing up" has to follow. Where the burn has been good very little has to be done, but where it has been partial much expense is entailed, from having to pile and burn what the fire has passed over; but this expense, of course, falls upon the contractor. The advantages of a good burn are, that lining and other operations are more easily carried out, and that weeds grow less readily. A clearing, taken in hand after a good burn, can be kept clean by monthly weeding at a very small annual expense. The disadvantages of a good burn are, that the upper and best part of the soil is burnt up, and is lost for filling in the holes; but at the same time, it is a very great advantage to have a new estate free of weed-seeds, the fire doing much to kill and eradicate any there may have been in the original forests.

In parts of Ceylon, many estates have been formed out of what are termed "cheena lands." These are patches that have originally been forest, but have been cultivated by natives and allowed to grow up again. These, of course, are far more full of the seeds of weeds than virgin forest, and all the more care is necessary to keep them clean from the commencement. I would, in all cases, recommend the weeding to be commenced immediately the burn is over; and believe such a course would doubly ensure the future cleanliness of the property, as well as be the saving of much future expense.

The cost of felling, lopping, burning, and clearing up may be named at from 2*l.* to 2*l.* 10*s.* an acre, more being paid in some districts than in others; but as everything is advancing in price in Ceylon, it will be no matter of surprise to me if these rates are ere long exceeded.

The superintendent cannot be too careful in keeping his eye upon the contractor, to ensure the efficacious and workmanlike carrying out of the contract. The lopping, particularly, should be well looked to, as the success of the burn much depends thereon. In Ceylon, felling is usually commenced about October and November. The forest should lie fully six or eight weeks to dry. The best time for putting fire is between the 1st and 15th of February, when the usually prevailing dry weather and not too boisterous north-easterly wind favour the operation. The contractor should be made to fell every tree. Some estates have many dead trees left standing; these are often great sources of damage to the coffee and danger to the coolies, when they are blown down in windy weather.

On an estate I once took charge of, there were more than a hundred of these large dead trees left standing in the coffee-fields. I had them all cut down. The damage was not great, because the whole estate was being heavily pruned, and many were cleverly thrown down in the rows. Thus a great source of danger and damage was removed and the appearance of the estate very much improved, for the dead trees standing here and there in the fields gave a most melancholy aspect to the property.

N.B.—The young planter must understand that the lopping should commence as soon as a few acres are down,

as the branches are more easily cut when green than dry. Felling contractors should have first-rate tools provided for them by the superintendent of the estate, the value to be afterwards recovered from the balance due to them; when the tools would remain the property of the contractor.

NURSERIES.

A LEVEL piece of virgin ground, not far from water, where the soil is rich and crumbly, is the most eligible for the construction of a nursery. First, the land must be thoroughly cleared, and all but the largest stumps of the forest trees rooted out; the soil must be dug to the depth of nine or twelve inches, and be made as friable as possible, then divided into beds with narrow paths between them. The seed, in parchment (generally taken from the cisterns after being pulped), should be put in row by row, about six inches apart. A rope the length of the beds is used for this purpose, stretched from top to bottom of the beds. Boys or women then make a furrow an inch or two deep, the seed is strewn along about an inch apart, and lightly covered over with mould by the hand; and the rope is then moved on to the next row, when the same process is repeated. The seed, if sown in suitable weather, soon makes its appearance above the surface; so that a nursery, made in May or June of one year, has plants fit to put out at the same date in the following year. Care must be taken to have the nursery well drained, and a deep trench cut above it in an oblique direction, to prevent its being damaged by heavy rains and wash. Perhaps a slightly inclined piece of land is

even more suitable than a dead flat, because the natural drainage would be better.

The advantage of having a nursery within easy reach of water is to facilitate watering during the prevalence of dry weather. Every estate should be provided with a nursery for the supply of failures. Any excess of plants it is generally easy to dispose of to neighbours or to young estates, at a remunerative figure. I have seen pattena or grass land tried for a nursery, but my experience of it is that it is not suitable for the purpose. The only advantage is, saving the expense of cutting down the forest, rooting up the stumps, and clearing the ground; the disadvantages are, inferior soil, exposure to the sun and wind, heavier wash, and fertility of this land in producing grubs, which are injurious to the young plants.

When the seed comes up too thickly, the young plants should be thinned out and replanted in a bed, which should be ready for that purpose. Care must be taken, in replanting, not to double up the tap-root; and if a stick is used to dibble in the plants, the earth should be so passed down as to ensure no space being left for water to accumulate and rot the roots. When the tap-root is very long, I would recommend its being carefully cut and shortened: it soon shoots again, and there is less chance of its being bent and damaged.

One bushel of parchment coffee is calculated to yield about 30,000 plants; so that for a clearing of 100 acres, four or five bushels of seed would be required. When the young trees in a nursery have attained a growth and age at which their being planted out as *plants* becomes rather

a doubtful proceeding, with reference to the probability of their succeeding and taking root, it is better to make "stumps" of them. This is done by pulling them up, with as little injury as possible to the roots, and cutting them down to about six inches above the root; then, to shorten the tap-root by a careful sloping cut; next, to trim the other lateral roots, which are often needlessly extended. If this be not done, coolies are generally so careless that they will not spread out the roots properly, but double them up, as well as break or injure the tap-root.

The best instrument for pulling up plants is a two or three pronged manure fork. This is preferable to the "alavunga" or spade-bar, because it causes less injury to the roots of the plants; being pointed, it enters the ground freely, and very little leverage brings up the plants, with nice clods of earth adhering to them. Coolies have a trick of pulling up plants by the hand: this should be guarded against, as most injurious to the bark and roots. I am confident that too much care cannot be taken in this respect, as well as in the actual planting, of which more anon.

When coffee estates were first opened, nursery plants were scarce, and planters, not wishing to lose a year in waiting till they could form nurseries of their own, purchased stumps largely from the Kandian villagers, around whose houses there are patches of native coffee, underneath which plants of different ages and sizes usually abound. Even in later years village stumps have been extensively made use of; but I much prefer nursery plants, as, being

planted in prepared soil, the roots are much straighter and more healthy ; while the native plant, on the contrary, growing up as it falls to the ground, has generally crooked tap-roots, is much harder and more difficult to extract from the earth, and the roots are consequently exposed to greater damage, and the bark of the plants to be scraped off.

LINING, HOLING, AND PLANTING.

As it is advisable to have as much as possible of the estate ready for planting before the wet season sets in, lining should be commenced soon after the burn.

Two methods of lining, or staking out the clearings, are practicable. First, that spoken of by Laborie—*viz.* a long line, divided at the several distances designed for the trees with scraps of red cloth. Secondly, ten or more lines of stout coir rope of any length, to be used as follows: first, a base line must be laid down, as nearly straight up and down the hill as possible, that the rows may be so arranged that, in the event of stones rolling down or other causes, the bark and roots of the trees may be less likely to receive injury. The base line being determined on, a cross line, perfectly in the square, must be set off from it (for this purpose a carpenter's square should be provided); then, the distances at which the pickets are to be placed are marked off with the measuring pole, a picket being put in at every six feet, or whatever the fixed distance may be. To the pickets on the transverse line the ropes are securely tied, and a boy being provided for each rope, takes his rope down the hill, or up and down the undulations, as the case may be.

The next process is to settle these ten ropes: this is done from the base line as follows. Three or four measuring poles must be provided, and with those the distances

from rope to rope are measured; so that the ropes are perfectly straight, and at an equal distance from each other. This is a somewhat tedious process where the timber is heavy, where the ground is rocky, or ravines have to be crossed over; nevertheless, straight lining is a very important matter for the future working of the estate—as well as regards its appearance—so that no expense should be spared, and the work be effectually superintended.

It will be necessary, every here and there, where the lines have to go over either rocks, stumps, or ravines, to keep them close to the ground with heavy stones, or by twisting the rope round a picket, and knocking it into the earth. When these lines are correctly laid down, the boys, every here and there, place small heaps of pickets handy to be driven in; and when all is ready, a common piece of stout coir rope is taken and stretched across the ten lines, held at each end by the men who have the measuring poles. These measure the distance, and drive the pegs in the two side rows. The rope is then hauled taut, and the boys, who are ready in the eight rows with mallets, strike the pegs in where the ropes meet; and so they move down, measuring as they go, until they arrive at the end of the line, when the ropes are loosened and the same process is renewed, either in continuation of the same lines or by recommencing at the top. This process of lining is much more difficult to describe than to actually perform. Once seeing it done is sufficient to teach any superintendent of common intelligence.

I will add a few more observations, which may be useful. When one set of pegs is put down, the measuring

with the stick is only necessary on the unfinished side, as the cross rope is held from the pegs already put in. Care must be taken to use the square in settling each set of ropes, so that the trees, when they grow up, may be as nearly in squares as such rough ground admits of. Ten boys and a good experienced cooly should put in about 2400 pegs a day; much, however, depends upon the nature of the ground. The best trees for making pegs are "malaboddy" and "keena;" they are soft to cut, and split easily. Eighteen inches to two feet is a sufficient length for pickets; a cooly can split about one thousand for a day's work.

I must not omit to describe the process of Laborie's plan. "Two men hold the line well stretched, and lay it upon the ground. If any obstacles (as stumps of trees) happen to be in the way, the line must not decline to a side, but must rather be placed straight over it. Other negroes are provided with pointed wooden pickets, about eighteen inches long, and plant them where the marks lie, and always at the same side. When the line is above ground, the picket is set perpendicularly over the scrap of scarlet, and being dropped, is placed exactly in its place. Next, the line is moved on, and its change, determining the distances between two rows, is measured at both ends and in the middle with sticks of certain length—so the line goes on."

The above-described plan would be an excellent one were coffee planted in grass lands, where there are no stumps of heavy timber (often taller than a man), no rocks or ravines. My objection to the single rope with the

scarlet rags is, that in a forest clearing it is impossible to keep it near the ground, and consequently the red marks very seldom lie in their correct places; and thus the cross or transverse rows are never straight. This is not the case with the moving cross rope I have described. If the ropes meet high off the ground, a stone or picket perpendicularly held up should be dropped, to ascertain the exact spot where the picket is to be placed. Also, the rope not being marked out, it does not matter how much it stretches or how many logs or stumps it goes over, so long as the straight lines are preserved; for the cross rope settles the square.

Where a large stone, rock, or stump comes in the place where a peg should lie, that tree must be lost. It must not be placed at the side; the rows would not only become crooked, but the trees would grow into each other.

A tally of the number of pegs daily put in should be kept, and entered in the journal; as well as of holes and plants, when those works are being carried on.

The best average distance for lining out an estate is six feet square: this gives 1200 trees to the acre. Some planters plant five by six feet, or even less; but in my opinion, to be over six by six is better than to be under. In good soil and favourable sheltered localities, six feet between the trees and seven feet width of row would, I think, be a very good distance. It is evident from Laborie, that in the West Indies coffee was planted much wider apart than is now the Ceylon custom; but then plantains, yams, &c., were cultivated amongst the coffee. This has not been found to answer in Ceylon, as exhausting the soil

and producing too much shade; on the contrary, quite open clearings are now universal.

The best lined estate I have ever seen is that portion of Delta (Pussilava district) which was planted in 1845, under the supervision of Mr. Henry Glennie, son of the Archdeacon of Colombo. The distance is eight by eight feet—somewhat too wide—but the rows are so straight and perfect, that they extend from one end of the estate to the other without a break. Very long lines and the ten-rope system were used. The cost was, I believe, 17*s.* an acre, which, in those days of cheap labour, was a very high rate. Nevertheless, I think it has paid, by facilitating weeding and all other field labours; and, moreover, the trees are much larger and finer than they would have been if more closely planted.

Another advantage of wide planting is, that coolies can get along the rows without doing damage to the branches, either by breaking them, or knocking off blossom and berries; also, that the trees get plenty of air and sunshine. The sole drawback is, that more of the surface is exposed for the growth of weeds.

Quincunxing is a system I totally deprecate, as entirely obliterating the rows, as well as causing the trees to grow one into the other; thus doing away with all the advantages in favour of wider planting above alluded to. A badly lined or quincunxed estate is far more difficult to work, because, from the frequent running into each other of the rows, the coolies are always quarrelling and make it an excuse for idleness.

HOLING.—The tools best suited to this work are a strong

steel-faced hoe, or "mamotie," and a spade-bar; besides which, the cooly usually provides himself with a cocoa-nut shell, with which to scoop out the loose earth. Before the picket is removed a circle should be cut round it, to preserve as much as possible the centre, represented by the picket. Coolies, to avoid the labour of cutting out a root or removing a big stone, are disposed to cut the hole to one side: this should be prevented, and the straight line preserved. Eighteen inches square is the size of hole most commonly approved of; it is sufficiently wide and deep to give ample play to the young roots.

The system of dibbling is much practised on the Ouvah side of the country, where the soil is rich and loose, so that a stick can with ease be pushed into it one or two feet deep, but it would not answer in stiff and poor land; and, for my own part, had I a property to plant in soil equal to Ouvah, I should still be disposed in favour of holes, which need not, however, be more than one foot square. The stiffer and poorer the soil, the larger the hole should be. Thus, in the Pussilava district, it is usual, when planting pattena or grass lands (which was largely done by the Messrs. G. and M. B. Worms), to cut holes two feet square, or even larger; besides which, to dig up the whole surface nine inches to one foot deep, to loosen the soil, and extricate the fern roots with which it abounds.

I have seen very fine young coffee in patena lands, but it was very highly cultivated and manured. It is generally admitted that nothing equals virgin forest land for the growth of coffee. There may be a few exceptional patches of pattena that might be named, but they are few and far

between; and, in any case, this soil is not likely to last as long as that of forest land.

The process of dibbling is done in two ways. The first is to give each cooly a stout stick, pointed at the end, about four feet long; sometimes a spade-bar is used. The pointed stick is stuck into the ground exactly where the picket was placed, and moved about until a sufficient depth is obtained; the plant is then slipped into this hole, and the loose earth pushed in with the foot. The stick is used to tighten the earth and ram it in round the plant, and a tread or two of the foot finishes the operation.

The second system is to dig with a spade-bar about a foot deep around the peg, and loosen the earth around it without turning it over. A cooly follows with the plant; he makes a hole in the loose earth with his hand, inserts the plant, spreads out the roots (or ought to), and takes care not to bend the tap-root; he then carefully treads around the tree, until it is so well fixed in the ground that a medium attempt to pull it up does not prove successful. Of these two plans, I much prefer the latter.

It appears, therefore, that by the dibbling system the holing, filling in, and planting are done at the same time, and much expense saved; as two coolies should put in 160 trees a day by the second plan, while by the first a single man might plant—I should say—150. One objection to this mode of planting is, that a hole for the accumulation of water is often left, which causes the roots to rot and the young plant to die. There is also much more likelihood of damage to the roots, than by the process of planting to be subsequently described.

FILLING IN is the operation that follows holing. I have been told by an experienced planter, that leaving the holes open for some time is very beneficial to the soil in a chemical point of view. Consequently, by the dibbling system the soil does not derive the same benefit, as the plant is at once put into the ground, no hole being required. Filling in, like every other work on a coffee estate, should be carefully superintended; it being a comparatively light work, women and boys are usually employed.

The process must greatly depend upon local circumstances. If the top soil is good, it should be used to fill up the hole; but all roots, stones, and gravel should not be scraped in. If the soil that has come out of the holes is better than the top soil—for instance, where quartz abounds on the surface—that soil should be returned. I have heard of cases where good earth has been carried from a distance to fill up holes, rather than use the inferior top soil. The hole should be well filled up with earth, to allow for the subsequent treading in, and a picket should be placed in the centre to mark it.

Coolies are very apt to scrape in everything as it comes. This, I am sure, is injurious to the young roots; for it stands to reason that the more the soil put in to fill up the holes is like garden mould, the more quickly are the young plants likely to take root and thrive. It is no use filling up a hole that has a very large stone or slab-rock at the bottom, because the tree will die when the tap-root comes in contact with the stone.

PLANTING.—Of all operations in the formation of a coffee plantation, the actual placing of the plants in the

holes is the one that requires the utmost care and attention. The planting season commences in May, and extends to the end of November. It stands to reason that early planting is advantageous, because the trees have the benefit of the entire rainy season, and are sure to give a larger maiden crop.

First of all, the plants must be carefully removed from the nursery, as previously described in the chapter on Nurseries—that is, with as little injury as possible to the roots and bark. The plants should be carried out to the field in baskets, as great harm ensues from letting them be exposed to the sun; the roots should be covered with wet moss, which will prevent their being withered before they can be put into the hole. I have been assured by Mr. John Whyte, of Coldstream estate, that by following the above plan he never lost a plant; and that he could plant with success, even in uncertain weather. It appears he examined the small fibrous roots through a microscope, and found that when they had been exposed to the sun they were dried up and withered, which he imagined accounted for the numerous failures common in most new clearings. If it were only the case of a few hundred, instead of many thousand, plants, undoubtedly the best mode would be to put in each plant with the original ball of earth, and thus doubly ensure its success in its at once commencing to grow; but the time and labour required for this, and the additional expense, put it out of the question; besides which, the nurseries would have to be immense, and the plants sown very wide apart, to secure an unbroken clod of earth for each. The usual course

adopted is as follows. When the plants are pulled up, those with crooked roots should be picked out and thrown away. An experienced cooly should then trim the roots with a sharp knife, diminishing the length of the tap-root sufficiently to prevent the likelihood of its being bent or broken. When the plants are put in, the fibrous roots should also be trimmed, as they are generally too extended, and coolies have a trick (if not prevented) of doubling them up and putting them in anyhow. Their being reduced in length puts a stop to this injurious mode of procedure, and enables the cooly to spread them out similar to what they were before they were taken out of the ground. It is the practice of some planters to allow the cooly to use a mamotie when putting in a plant. He should certainly have one at hand, to cut more earth if required to fill up the hole; but should not, in my opinion, be allowed to use anything but his hands when actually planting the young tree. The cooly should level the piled-up earth over the hole, and remove any bits of stick or stones that may have got amongst it; he should then, with one hand, scoop a hole of sufficient depth, put the plant carefully into it with the other, and gradually fill up the space, taking care to keep the fibrous roots extended and the tap-root straight. The plant should not be put deeper into the earth than it was before it was pulled up. When the earth has been thus filled in it must be carefully pressed down with the hands; then the cooly must stand up and tread the earth firmly down, commencing at the outer edge of the hole and gradually approaching the plant. The test whether a plant is sufficiently firm in the ground

is to endeavour, not too forcibly, to pull it up; if it resists, it is a proof that all is well. Care must be taken not to allow any hollow to remain for the accumulation of water, which is likely to kill the plant by rotting the roots. A picket may be put in, in a slanting position, to protect the plant and prevent its being trodden on or injured by coolies when weeding; and in case of the plant's death, the picket marks the hole.

I observe that Laborie thus writes about planting: "Three or four inches of the hole are left open, which the earth above will, in process of time, fill up. The sapling must be set so deep that its two inferior branches be rather under the level of the ground." This plan, I have heard, was tried on Nilambe estate, and, I suppose, on estates planted about the same period (1838). Mr. Louis Byrde, the then superintendent, has informed me that it totally failed, and that some time afterwards the trees had to be raised. Nature should be followed as closely as possible, but having two pair of branches underground is running contrary to it. Besides this, new roots are generated above the natural ones; the top soil is often washed away and exposes them, resulting in many instances in the destruction of the tree.

Another objection is, having branches too near the ground, the evil effects of which are: first, causing too much shade and damp, and preventing the circulation of air; secondly, such branches seldom bear much fruit, being too full of leaves to bear, and only needlessly exhaust the tree; thirdly, being so near the ground, these branches are in the way of the labourers, who cannot help knocking

them about, either when weeding or cutting holes for manuring; and fourthly, they tend to conceal, and act as a nursery for, weeds or young plants, which come up if any crop has fallen to the ground. It is better, in my opinion, to sacrifice lower branches even in full-grown coffee, for the reasons I have given above. I have often ordered it to be done by pruners, much to the relief and future improvement of the tree.

STAKING becomes necessary on the generality of estates, when the trees are about one year old. This work should be completed by the middle of May, before the setting in of the south-west monsoon, when the high winds are injurious to the young trees, and the soil being much softened by the heavy rains renders the trees all the more liable to be blown over. The pegs or pickets for staking should be fully four feet long, or even longer if the young trees are two instead of one year old, and they must be pointed at one end. Pickets may be made of young forest saplings, called in Tamul "varrachies," or wood from logs may be split. The stakes must be driven in, in a sloping direction, on the side from whence the wind blows, fully eighteen inches deep to ensure firmness. The tie or fastening is made either with coir or jungle rope: perhaps the latter is the most serviceable, if of the best quality and easily procurable, because it is less likely to cut into or damage the bark of the young trees.

Some planters tie the young plant to the stake, but I believe this mode to be injurious, because the friction of the stake and tree rubs off the bark. A brother-planter (Mr. W. W. Wynn) taught me the system of tying in a

loop, which I deem to be by far the best. The advantages of this system are, that while the stem of the plant can move slightly without being chafed, the loop prevents its being blown over, and there is less likelihood of the rope cutting the bark. The width of the loop must, of course, depend upon the size of the tree—allowance being made for growth—and there must be a double knot between the tree and the stake, to which it must afterwards be firmly tied. It is not a bad plan to coal-tar the rope at the conclusion of the operation, as it prevents its being stolen by coolies, renders it less liable to the attacks of insects or rats, and prevents rotting from wet and exposure. Attention should be directed occasionally to the young fields, to repair damages caused either by wind or by ropes becoming untied.

SUPPLYING is the term in use with planters for filling up the vacancies caused by the death of plants. If possible, this should be looked too once or twice during the planting season, because it ensures regularity in the fields, and no spare ground is lost. During the dry weather, in February, March, and April, young plants in many districts suffer from the attacks of a very large grub, which eats the bark in a circle just above the ground; and the flow of the sap being thus stopped, the trees droop and die. Estates with a light reddish or quartzy soil suffer more than those where rocks and stones are plentiful. All these failures must, of course, be supplied or replaced, the holes being reopened and the process of planting gone over a second time. The younger the plantation is, the more likely are the supplies to succeed; so the operation should not be delayed, for

young plants seldom come on well amongst old trees. The cause of this is attributed partly to the soil being in some measure exhausted, and the tendency of the roots of the old trees to make their way to the new hole and fresh soil prepared for the supply; thus it is choked by the roots of the old trees, and generally wears a stunted appearance. The best remedy is to manure the supply and occasionally cut a trench round it, to prevent the roots of the old trees from stopping the growth of the young plant.

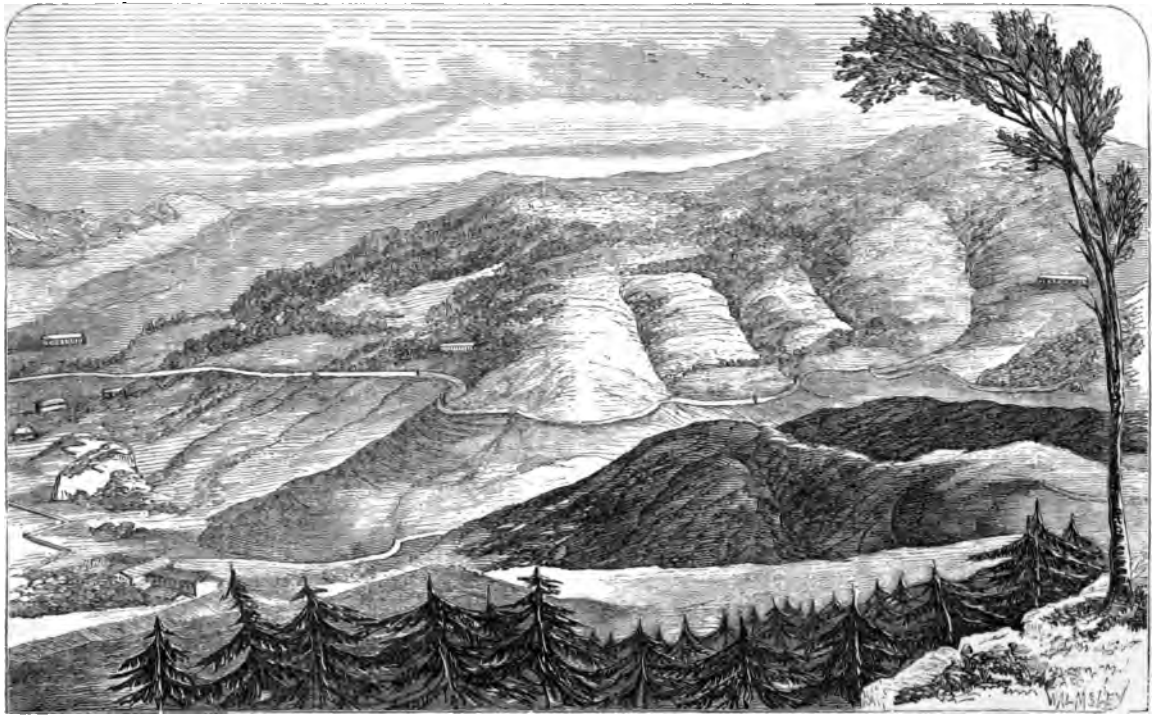
A very injurious system prevails among coolies of topping, or nipping off the young supplies before they have arrived at a proper age and height. The consequence is, the plants are forced into blossom and crop before they are old enough to bear, and generally die from exhaustion. Supplies should be allowed to bear the maiden crop before they are topped; by that time they should have attained age and strength to bear the process without injury. In old coffee all supplies should be planted with manure.

Stumps are often considered more suitable than plants for supplies, as, being more hardy, they will throw out three or four shoots or suckers, the best of which should be selected after they have attained a height of from six to nine inches, and the others should be carefully pulled off without damage to the bark. A supply should always be protected by a strong picket, for on weedy estates they are apt to be hidden by the weeds and cut down by the weeders, if their position is not indicated by the picket; there is then no excuse, and the cooly uses his hand to pull up the weeds, instead of his hoe or mamotie.

ROADS AND DRAINS.

To cultivate and supervise a coffee plantation in an effective manner requires that it should be well "roaded." If the "lay" of the land and natural facilities admit, a road of easy gradient, running through the centre of the property, should be opened sufficiently wide for the passage of manure-carts; and, if possible, branch roads leading to the different fields may also be opened, of the same width. From these main lines paths must be cut, communicating with other parts of the estate; these should not, if possible, exceed a gradient of one foot in ten, rise or fall.

It is not often that it is possible to carry a cart-road to the summit of an estate; but it is evident that the more the estate is opened to cart traffic, the greater are the facilities for carting manure, grass, crop, or any materials required for the working of the property; and that a greater amount of expense, labour, and wear and tear of coolies is thereby saved is undeniable. Strange to say, this fact is often lost sight of, because a somewhat larger expenditure is entailed at first; whereas a judicious outlay at the commencement, in opening cart-roads, is sure to more than repay itself from the saving of labour ere much time has elapsed. Unfortunately, in many cases the labour may not be forthcoming at the right time to open cart-roads; so that in after years, when the coffee is full-



Coffee District near Pussilawa, Ceylon.

grown, proprietors are loth to cut down trees in full bearing, as well as to incur the injury that the coffee, through which the road has to be cut, must sustain; consequently, it is best to open these roads of the requisite width while the plantation is quite young.

I do not, however, mean to say, that if an estate has not been well roaded at the commencement it should never be so. My opinion is, that the coffee must be sacrificed, as roads and paths are indispensable for the proper working of the estate. Even where the ground is steepest and most rocky, there is all the more need of its being made accessible, both to the superintendent and the workmen. In rocky ground it is impossible to keep a regular gradient, so that the paths must be traced in accordance with the obstacles which may intervene, and in and out amongst them; but as long as people can traverse them, it does not signify much how steep or undulating they are. Facility for the cooly to get to his work, and easy access for the master to look after him, is the grand desideratum. It is only natural that one should avoid those places which are difficult of access; while the cooly himself, knowing that the particular locality is not likely to be efficiently supervised, slurs over his work, to the detriment of the field, which, had it been opened up, might have been as fine coffee as any other portion of the estate.

During my twenty years' experience of coffee-planting, it has fallen to my lot to be put in charge of several estates, which were not only in wretched order as regards cultivation, but sadly deficient in roads and paths. My attention was invariably at once directed to remedy this deficiency,

and the result was a marked improvement in the cultivation and appearance of the fields thus opened up.

Coffee-trees below a road always look and bear well, because the soil about them is loose, and is constantly being renewed from the sweepings of the drain and road. This proves that cutting numerous paths and drains, and loosening the soil, would be most beneficial. All roads and paths should, if possible, act also as drains; and where cross drains are necessary, they should be carried on through the coffee into the nearest natural ravine or artificial drain, so that wash may be avoided.

The cost of cutting roads varies very much, and entirely depends upon the nature of the land through which they pass and the manner in which they are completed. Through average ground, I should say a bridle-road, six feet in the solid, and with an inner drain one foot wide and deep, might be cut for from 20*l.* to 25*l.* a mile; and a cart-road, ten feet in the solid, with eighteen-inch square drain, for from 75*l.* to 100*l.* a mile; but if gravelled or macadamized, the cost would of course be much greater. Estate cart-roads may be cut at as steep a rise as one foot in fifteen, but a more gradual ascent is far preferable, and does not try the bullocks and carts nearly so much.

I have found it a very good plan to cut what I called a boundary road or path along the entire edge of the estate. This is not only serviceable as a boundary line, but prevents the growth of the jungle and thorns into the coffee, as well as gives access to corners and out-of-the-way places which would otherwise be neglected. These boundary paths must of necessity often be so steep, that the only way is to cut

steps. The contract weeders should be made to keep all paths clean and drains open.

DRAINS have only within the last few years come into general use. Their utility had, strangely—like shingled roofs for bungalows and lines, stone buildings and pillars, spouting, and compost manures—not previously been considered necessary. Drains, like roads and paths, should be cut as soon as the estate is commenced, or at all events before the trees cover the ground, or the same causes will obtain with reference to damage being caused to the coffee-trees. These drains must be about fifteen inches wide and deep, at the distance of every fifteen to twenty trees—*i. e.* 120 feet apart; the gradient should not be more than from one foot in ten to one foot in fifteen. These drains should be directed into the natural ravines, and these may also with advantage be cleared of obstacles, such as logs and large stones, so as to open out the water-way.

I have been told by a fellow-planter (Mr. W. King), that the whole of his estate at Matelle is thus thoroughly drained, and that he has made a large pit at the bottom of the estate into which the drains empty themselves. A great deal of the washed soil is by this means saved, boys and women being employed before crop in top-dressing the adjacent coffee with it, to the evident benefit of the trees. Drains should be constantly kept open. I believe it would be worth while to tell off one or two men for that special purpose; and after heavy rains, even a large force should be employed to repair any damages that may have been caused by the choking up of the drains or by land-slips.

I should also recommend one or two coolies (as required)

being employed to keep roads and paths in order, as weeders cannot be expected to do more than sweep them. At Glenloch I kept more than a mile of Bandy road in excellent condition, by having one man constantly employed upon it; and during the fine weather, he was able not only to complete his work on the cart-road proper leading to the store, but also kept the ground about the bungalow in order, and some portions of the roads on the estate. I have always been much in favour of the mileage system for the up-keep of roads, and have ever regretted its not being adopted by the Commissioner of Roads, for there is no truer old adage than "a stitch in time saves nine."

WEEDING.

WEEDING should be commenced as soon as the clearings are burnt off, even before the plants are put in. Weeds are the bane of coffee estates. Thus, allowing 800 coffee estates (see Ferguson's Diary, 1864–5), of an average extent of 200 acres, and that the cost of weeding averages 3*s.* per acre per annum, we have the enormous sum of 288,000*l.* expended annually in Ceylon solely for the one item of weeding. Kanganies and coolies are very willing to take weeding contracts, particularly on new estates. I have known contracts as low as 18*s.* per acre per annum; the average will, however, probably be 24*s.* per acre on new and clean estates, and 40*s.* on old weedy estates. Thus, a 300-acre estate of the latter description, if weeded once a month, would cost 600*l.* per annum for weeding alone. The cost of weeding old weedy estates might in some measure be reduced if the weeding were kept up monthly, without a break, for two or three years, as it might be hoped that much of the seed would by that time be eradicated; but, unfortunately, the cases where weeding can be kept up through crop are few and far between from scarcity of hands, the contractor's coolies having in most cases to be taken off the weeding to save crop. The only way to keep an old estate clean that has once been weedy, is to have it weeded regularly once a month. This can be

done on the generality of estates at the cost of 3*s.* per mensem, or 36*s.* per annum, per acre. In the case of some fields where the soil is more rich, and the ground stony and rocky, 3*s.* 6*d.* or even 4*s.* per acre may have to be given during the rainy season, *viz.* from July to December inclusive. I tried six weeks' weeding and found it did not answer, as it gave the weeds time to seed; moreover the cost is the same, as monthly weeding costs only 3*s.*, whilst six weeks' weeding costs 4*s.* 6*d.* per acre. Objection has been made to monthly weeding on the supposition that such frequent disturbance of the soil must cause additional wash; there need be no fear on that score, if the earth is well scraped round the stem of the trees, and the fields are properly drained.

On new estates the weeding is usually done with a pointed stick or a "scraper;" however, the less the soil is scraped the better—indeed, where the burn has been a good one, and the coolies have only to look for weeds, the few they meet with (whether grasses or seed-weeds) are best taken up with the pointed stick, which eradicates the root effectually. These weeds are generally gathered into a small bag which each cooly carries round his waist, and are afterwards burnt on the paths or other convenient places.

On old estates the system has to be different: the weeding-hoe or mamotie has to be used, and the soil must unavoidably be cut up. This is when the drains come in usefully by preventing any great accumulation of water during heavy rains, thereby saving much of the soil that would otherwise be washed away into the ravines and lost.

On weedy estates coolies, finding it easier, usually weed *out* from, instead of *in* towards, the stem of the tree; the consequence is, that in process of time the earth accumulates in a mound in the middle of the row, and the rain-water passes near the trees, washing away the soil and exposing the roots. This is very injurious, and should be guarded against. The cooly must be made to scrape the earth towards the trees, by which means the roots will be kept well covered, and the wash will pass down the middle of the line until it finds its way into the drains. All ravines should be kept clean, and swampy places cleared up, drained, and planted with Mauritius grass, which makes capital fodder for cattle. As this grass is given to spread, a drain should be cut round the boundaries of the swamp as a limit for the grass; and the weeders should be made to keep this drain open, and so prevent the grass spreading into the coffee.

It is usually a portion of the weeder's duty to pull off the suckers or shoots, which grow up from the top of the coffee-trees where they have been topped. Where a new plantation adjoins a weedy one, all the more care is required as regards weeding, because the seed is blown in and will very quickly spread, unless eradicated the first time it springs up.

The most common weed on estates is the white goat-weed—the "hoolangtalla" of the Cinghalese. It is called the wind-weed because the seed is blown about, and has now spread itself all over the country, having, I have been told, been originally introduced as a flower into the botanical gardens, Paradenia, by a Mr. Moon, who—unfortunate

man—little knew the evil he was bringing upon the country, for the weed is not indigenous. The Spanish needle is another very common weed. Cootch and other grasses also get into the soil, particularly on old estates, the former being very difficult to eradicate.

I have noticed that a discussion has lately taken place in the Ceylon papers relative to a system of contract weeding. I am in favour of it for the following reasons. I believe it to be an additional inducement to kanganies and coolies to resort to the estate as a means of making money. I have tried giving the whole estate contract to one man, but found it injurious. It was putting one's self too much into his power, gave him an unbounded opinion of his importance, and, as he did not behave well to his own coolies, it worked very badly for the estate.

The system of small contracts to different kanganies works well. It prevents jealousies, and while it enables them to earn a little more than their pay it makes them content, and is the means of inducing them to keep up the labour supply of the estate. The weeding being provided for, what is generally the all-absorbing work of the property becomes merely a matter of routine. Daily visits should of necessity be paid to the contractors, to keep them up to their work. Still, the superintendent is able to devote his chief attention to other estate operations; and I am sure all planters will agree with me, that it is an immense relief to the mind to be assured that the weeding is provided for, and goes on like clock-work.

Another advantage is that, undoubtedly, the kanganies can get the coolies to do more for them than for the master.

This I have pointed out to them, but with no good result, and it is therefore useless to quarrel with a system which benefits the estate indirectly. I am certain that the weeding would cost more if done on estate account. Most works on estates should, if possible, be done by task, that being the best way to get work out of coolies; they will then exert themselves to get away earlier to their lines.

To return to weeding contracts. The contractors should be made to pay their coolies in the presence of the master, and all complaints should be carefully investigated, and the contract taken from the offender. While at Glenloch, I never had any complaints against the kanganies; and as I spoke the language fluently, and was ever ready to listen to complaints, I am sure I should have heard of any overbearing proceedings on the part of the contract kanganies.

The weeders should be made to sweep all paths and roads, as well as remove any earth they may push down into the drains when weeding. Light steel hoes have lately come into use for weeding, and are very handy, especially for women and boys. Another advantage of contract weeding I have omitted to mention is, that often the work is completed before the end of the month, and many additional coolies become available for other estate works. In crop-time, also, contract coolies may be looked upon as a sort of reserve to come in to help in any emergency; and last year I made my contract kanganies stipulate to give me up all the men that could prune, and do their weeding with boys and women. They of course prefer selecting the most able and intelligent of their men,

but I pointed out to them that the pruning could not be neglected, and that if they would not give me the pruning men I must find work for the women, boys, and inferior coolies, by taking the weeding upon myself. They found it their interest to yield, and so both the pruning and weeding progressed satisfactorily.

TOPPING, PRUNING, AND HANDLING.

WHEN the trees have arrived at the age of from one year to eighteen months, the operation of topping is usually commenced. The coffee-tree, if allowed to grow to its natural size, would be ten or twelve feet high. The reasons for departing from nature are the following, as given originally in Laborie's work: "First, it brings the fruit within easy reach of the hand, and prevents the branches being broken; secondly, the tree acquires strength and vigour both below and above ground, and the stem becomes larger in circumference; thirdly, it affords less hold to the winds; fourthly, the form of the tree is more beautiful; and fifthly, it loses none of its inferior original branches, which, as nearer the source of vegetation, are better nourished, and of course more productive."

The height at which trees are topped must depend upon width of planting, soil, aspect, and elevation. I prefer not topping the trees too early, and believe that if they were allowed to yield the maiden crop before they were topped, it would be very much to the future benefit and endurance of the tree.

Many planters, anxious to get crop as soon as possible, top the trees in the green sappy wood, as soon as they reach the required height, when it may be done with the

finger and nail; but I am convinced it would be better not thus to force them into a heavy maiden crop, which often weakens the tree excessively. Moreover, when topped so young, the part at which it is topped decays and dies down an inch or two, one pair of primaries being thus lost. On the contrary, if the tree is allowed to have the brown bark well formed before it is topped, there is much less likelihood of its dying down, and the tree is not hurried into giving, at too early a stage, a heavy exhausting crop.

The way I have usually topped trees is as follows, *viz.* to remove the two primaries at the required height from the ground, close to the stem, with a sloping outward cut; then to cut off the top, holding the knife in a slanting direction. Thus, the top of the tree when topped will be something in the shape of a cross. The advantage of this mode is, that a firm and natural knot is formed, and that even if the piece above it is broken off or dies there is no danger of the tree being split down, as is often the case when it is topped too early; the weight of the heavy bearing bough, or a careless pull by a cooly, causing the injury above named.

The only disadvantage of late topping is that the young trees are exposed longer to the effects of monsoon winds; this, however, may be obviated by additional staking, the stakes to be cut longer and larger, and to be driven deeper into the ground. A greater height than four feet has not been found to answer well in Ceylon, and in some windy and exposed localities, or where the soil is inferior, trees are topped at three, two and a half, and even as low as two

feet from the ground. No definite rule can be given for topping; much must be left to the judgment of the superintendent, who must be guided by circumstances. After the trees have been topped, they will soon begin to throw out numerous shoots in all directions. This is the consequence of nature having been thwarted; and if nothing is done to regulate and diminish this exuberance of vegetable juice, the trees in process of time will grow into a mass of entangled boughs, inaccessible to the genial warmth of the sun and deficient in the powers of fructification. First, vertical green suckers, or "gormandizers," spring up under the primary boughs: these must at once be plucked off, without injury to the bark. From the primaries, or original branches, other branches or secondaries shoot out, with two opposite knots along them; two, three, and sometimes four shoots at a single bud, some in a backward direction. All these superfluous shoots must be plucked off when they are young and tender, and that which is strongest, and has the best direction towards the circumference of the tree, alone retained.

This mode of plucking off superfluous wood with the hand is called "searching," and also "handling." It must be done when the shoots are so young that they will easily yield, without injury to the bark. If this system is scrupulously attended to from the commencement, pruning will become a far more easy task, and the severe pruning denounced by some planters need never be resorted to. In all cases the remedy must be consistent with the disease or actual condition of the tree. Thus, regular yearly pruning and handling will ensure much less heavy

cutting; whereas, if the trees are neglected for two or three years, they grow into such a matted and confused state that the hand-saw as well as the knife is required to restore them to their proper condition.

No secondary should be allowed closer than six inches from the stem. They must be cut close enough to destroy the eye, so that they may not shoot again. This plan secures a circumference of one foot in the centre of the tree, allows free ventilation, the sun can get at the roots, and it prevents moss and parasites from growing over the bark.

If coffee estates were no larger than nursery gardens, and only a few hundred trees had to be pruned, I believe it would be possible so to prune them—by only allowing alternate secondaries to bear year by year—as to secure heavy and regular crops; but on estates several hundred acres in extent, where the trees count by hundreds of thousands, such a course is impossible. General rules can only be given in accordance with the state of the trees. The best and most intelligent coolies must be selected for the work; even women may be taught to use the knife in a very workmanlike manner. This I found when compelled to make use of their services on account of the scarcity of men. For handling, women and boys are usually employed, and answer the purpose remarkably well.

The rules generally given to pruners are the following: first, to take off all gormandizers and shoots within six inches of the stem; to take off all branches and shoots that point in towards the tree or go across the other

branches; to thin out the shoots and only leave one at each bud, and to make the tree as orderly and neat-looking as possible. When the tree is overloaded with wood, I would recommend the sacrifice of several large secondaries or tertiaries; and in old neglected coffee, that has not been pruned for some time, it is often a good plan to take off the two lower primaries bodily. These generally lie on the ground, exclude the air and sunshine, and are in the way for either weeding or manuring operations. They are usually a mass of tangled branches, and seldom bear much fruit, being too near the ground and in the shade; so that the sacrifice is really not of consequence, while the gain, in my opinion, is very much greater. All planters will have observed that the part of the tree most exposed to the sun and air usually bears the heaviest clusters; therefore, the more the tree is thinned out the more it bears. This is exemplified by young trees in their second and third crops, which bear very heavily, chiefly from the primaries and secondaries.

The great art in pruning (yet to be attained in most cases) is to adopt a system which will yield fair and regular crops, without exhausting the tree. Commonly, coffee-trees bear heavily one year and lightly the next. In my opinion, regular pruning and searching are the best mode to arrive at this desired end. Moral courage is also required to sacrifice and cut off crop actually on the trees, if it is evident that the quantity of fruit, if allowed to come to maturity, will exhaust them. Many proprietors may not like to make this apparent sacrifice, and many superintendents would shrink from so heavy a responsibility; yet

I am of opinion that sacrificing, as above suggested, would not only secure regular crops, but increase the vigour and longevity of the trees. The trees, instead of having so much crop on them as to leave no sap for making wood for the next season, would produce both crop and wood, and thus—due allowance being made for the effects of weather, &c., over which the Almighty alone has control —would yield average crops, which would render fluctuations of labour less to be feared, and return more regular and certain profits to the planter.

Pruning should be commenced immediately after crop, and, in Ceylon, should (as in old times) be completed by the middle or end of March, if possible. On most estates, it is now very difficult to attain this desirable end, not only because the labour force is reduced, but there is nowadays a much greater proportion of women, boys, and inferior coolies, the latter not having sufficient brains to be taught to prune properly. Weeding contracts, as I have already pointed out, take off the best men, unless the superintendent is able to provide against it, as I fortunately did last year. There is no doubt that it is an advantage to have the pruning completed before the blossom comes out.

The handling should, if practicable, be done twice before crop. If the force on the estate admits of it, the prunings should be buried in trenches between the trees. They soon turn into vegetable mould, and the loosening of the soil and cutting of the long fibrous roots very much invigorate the trees. In the same manner, the young wood, after the searching, may be buried, with great advantage to the surrounding trees.

No branch should be allowed to bear more than two, or at most three, crops; it should then be removed to make room for a fresh one. As the same wood never bears twice, the branches, if allowed to bear more than three crops, degenerate into mere whips, bearing only a few berries at the extremities. No definite rule can be given for pruning old trees; it must be done according to the state of the tree, and such was the order given on the estates which I superintended. For instance, I once took charge of an estate, some portions of it at a high elevation. The trees had not been pruned for some years, and were a mass of thick cross branches and matted leaves; a man might have made a bed on the top of them. It would never have done to reduce these trees at once to mere primaries or parrot-poles. The course pursued was to saw out the cross branches, and open out the centre of the trees about eighteen inches in circumference; then to take off and thin out about half the remaining wood: the effect was wonderful. They were afterwards handled once or twice, and the result has been a very good crop, on a property which had not yielded a remunerative one for many years. This pruning also seemed to drive away the bug, and much reduced its ravages.

It does not follow, that if pruning is not finished before the end of March, it must not be proceeded with after that period; on the contrary, it must be carried on until completed, for it is one of the works absolutely necessary for the proper up-keep and welfare of the estate. Only during the three or four days of blossom-time is it advisable to stop pruning, otherwise much damage may be done and

crop lost. After the blossom and when it has set, all the more care is needed to prune carefully, the best branches being retained; while those which should have come off, even if they have crop upon them, must not be left. Sufficient pruning must be done to ensure a supply of new wood, and to give health and vigour to the tree to mature its crop. The knives and saws used for pruning should be kept sharp. It was my custom to allow one man for this purpose, who kept the other coolies' knives in order; he had always an extra knife ready, which he handed to the cooly whose knife required sharpening, so that he should not be kept waiting, but resume his work at once. If the top of the tree has to be cut it should be sloping to the north from above downwards; thus, the sun strikes less upon it, and the moisture runs off. All places where the saw has been used must be dressed and pared with the knife, because the saw tears and notches the bark. In very heavy pruning, coolies can seldom get over more than thirty or forty trees a day. In lighter pruning they may do from sixty to a hundred, but it is entirely dependent upon the condition of the trees.

The subject of pruning is so inexhaustible, that I have deemed it advisable to add to other authority on the subject many of Laborie's remarks and descriptions, which, though written many years ago, are still so much to the point and so valuable, that a place should be made for them in this book. They will be found in the Appendix, under their proper heading.

MANURING, TRENCHING, ETC.

IN the early days of coffee-planting in Ceylon, manuring was not much thought of, or even deemed necessary. The general belief was that estates would last a certain number of years, and then die out as the soil became exhausted; many probably thinking their fortunes would be made before this consummation. Now, on the contrary, the subject is one of daily increasing importance, as estates become older, and exhibit plainly the symptoms of decay.

It has now been effectually proved that draining to prevent wash and waste of soil, and a system of manuring while the trees are still young and vigorous, tend to prolong the age of estates. There is no doubt that under such a system coffee-trees may have as long an existence as other evergreens; excepting of course such contingencies as overbearing, attacks of grubs, the tap-root coming in contact with rock, or becoming rotten from swampy soil; all of which bring the tree to premature decay.

The best manure for coffee-trees is universally acknowledged to be cattle-dung; the others may be particularized as under:—

Bones,	Pulp,
Poonac,	Prunings,
Poonac Mixture,	Mânâ Grass,
Superphosphates,	Steamed Australian Bone-dust,

Salts,	Sombreorum,
Wood Ashes,	Lime,
Burnt Clay,	Guano,

and various composts, all of which are at times advertised for sale, in the Ceylon newspapers.

The usual mode of applying manure is to dig a hole on the slope of the hill above the tree, at least eighteen inches from the stem. The hole should be two feet long, eighteen inches wide, and one foot deep, when cattle manure or pulp are to be applied. Great care should be taken not to injure the large roots; the cutting of the fibrous roots, on the other hand, acts beneficially, as it is a species of pruning, and causes them to shoot with renewed vigour. Other manures being more concentrated, do not require such large or deep holes, and are usually applied by weight.

When the land is flat and the trees are regular and closely planted, a square hole may be cut between four trees to receive the manure; but on steep lands it is always best to cut the hole above the tree, that the manure may percolate down to the roots and benefit the entire tree. Another advantage of this plan is, that the manure is under the shade and shelter of the branches; whereas, if put out in the middle of the rows, it is exposed to the exhaustive heat of the sun and atmosphere, and is more likely to generate weeds, which, unless quickly pulled up, will absorb the manure before the trees have been permanently benefited.

COMPOSTS of poonac, bone-dust, guano, and other artificial manures, should be applied above the tree in semi-

circular holes, nine inches wide, and six deep. All manure holes should be filled in with any prunings, or vegetable matter at hand, covered by the loose top soil; the new earth from the hole should be used to cover the roots which are usually much exposed. The earth over the manure should be well trodden down, to prevent its being washed away by heavy rains, or turned up by careless weeders. When poonac alone is used, it should be well mixed with earth to prevent the wild pigs eating it. It is extraordinary how fond these animals are of poonac, and how soon they scent it, insomuch that I have known watchmen to be employed blowing horns during the night to frighten them away. The cost of applying cattle manure varies. On some estates near high roads, manure is procured from cart-sheds owned by natives, at a reasonable cost, and is carried up to the plantation in estate carts. On other estates bordering grass lands the cattle are grazed, so that the manure does not become so expensive as when they are stall fed, and the fodder for them has to be produced by the cultivation of ravines and forest lands felled specially for that purpose. In addition to this grass, cattle require a certain quantity of poonac, which further increases the cost of this manure.

I calculate that where the cattle are wholly stall fed, the cost per acre is from 8*l.* 10*s.* to 10*l.*, this allowing 2*l.* to 2*l.* 10*s.* per acre for the application. The benefit derived is at least three to five cwt. an acre addition a crop, and the effects will last fully three years, and even longer, if the trees are judiciously helped during heavy bearing with half a pound of pure bone-dust, or half a pound of

some good artificial manure. I have thus successfully treated very old coffee-trees, previously fertilized with cattle manure, and caused them to yield a second paying crop; whereas, had they been left alone, they would probably have overborne, and the year following would have given a very poor return.

This plan of aiding trees to mature a heavy crop should, in my opinion, be commenced when estates are young, especially where the soil is not very rich, for it stands to reason that it is better to manure at a small cost, when the trees are still vigorous, than to allow them to get impoverished, and afterwards have to undergo a much heavier outlay to bring them round.

Such manuring as above described may be done for 3*l.* an acre, and at that rate of expenditure per annum I am confident that properties of even medium soil might be kept up to an average bearing rate of eight to ten cwt. an acre, which would fully repay the cost, and leave a large profit besides. Manuring with simple bone-dust, or artificial manures should cost, when the quantity applied to each tree is one pound, from 6*l.* to 7*l.* an acre; where half a pound only is used, half that sum; as will be found by referring to the estimate, which will be given farther on in this chapter.

Bone-dust is a lasting and efficacious manure; the best comes from Australia, and the demand for it has so increased, that large supplies are now forwarded to Colombo from that colony. Bone-dust may be applied alone, or may be mixed with poonac, guano, pulp, composts, or even cattle manure. Applied alone, one pound is

sufficient for a tree in poor condition, or where the soil is weak; when used in good soil, to support trees under a heavy crop, half a pound is sufficient. But for really poor coffee in inferior soil there is nothing equal to cattle manure. When mixed with other manures, half a pound is the best quantity for each tree.

POONAC.—A very good compost is a mixture calculated by weight, of one pound of poonac, half a pound of bone-dust, and a quarter of a pound of guano: mix thoroughly, and apply one pound of the mixture to each tree. The cost of this mode of manuring would be about 6*l.* an acre. The application of artificial manures should not cost more than 17*s.* an acre, including the cutting of holes, of which 120 to 150 is a fair day's task for a cooly. It may be done if the holes are only roughly covered up, but I prefer scraping everything into the hole and covering the roots thoroughly; this I deem particularly necessary in old coffee, which from the effects of bad weeding and wash has its roots much exposed.

GUANO.—When I wrote on this subject in 1866 guano was being largely applied alone; experience has since proved that it is a very injurious manure applied by itself. Guano acts quickly and puts a good crop upon the trees, but its effects so soon go off, that the trees are very much impoverished; and nothing but cattle manure will bring them round. This is particularly observable in light soils, but when applied in small quantities to coffee in very good soil its effects are less exhaustive. I would, however, never again use guano by itself; the mixture of poonac, bone-dust, and guano previously particularized answers very

well, and it may also be applied with pulp, or other manures, but the quantity added to each must be a very small proportion of the mixture. Bone-dust, however, seems almost to have superseded guano, of which very little is now heard.

The best time to apply artificial manures is during showery weather, say from April to September; it should not be put out in the dry season, but cattle manure may be applied at any time.

SUPERPHOSPHATES are now being more extensively used than they were four years ago; I believe superphosphate of lime is an excellent manure, though I have not myself used it, but am told it is working wonders on a neighbouring property. I conclude half to one pound should be the quantity used for a tree.

LIME, SALTS, WOOD ASHES, and BURNT CLAY I have no doubt are all good, but as I have never used them, I refer the reader to Mr. Wall's very able treatise on Manuring, which will be found in the Appendix.

PULP is a very useful manure; when applied alone, two basketsful should be the quantity used for each tree. I have found pulp most beneficial mixed in equal proportions with cattle manure; the effects seem to be equal to cattle manure alone; one good basketful of this mixture must be applied to each tree; this plan makes the cattle manure go farther, and (where cattle are stall fed) effects a saving of at least 2*l.* an acre; it should of course be applied in the same manner as simple cattle manure.

Pulp is also very useful as an ingredient for making compost heaps. These heaps are made of alternate layers

of cattle manure, mânâ grass, and pulp; sal ammoniac, bone-dust, lime, poonac may also be sprinkled lightly over each layer, and thus a rich compost is formed, of which half a basketful is a fair quantity to apply to each tree. Pulp may also be beneficially mixed with such ingredients as poonac, lime, bone-dust, and artificial manures. Half a pound of compost is the usual quantity mixed with each basket of pulp.

PRUNINGS make a very good vegetable manure; they should be buried in trenches when still green, and the earth must be well-trodden down over them, but they are seldom used now, as labour is too scarce for coolies to be told off to that work.

MÂNÂ GRASS must be buried in trenches cut longitudinally across the face of the hill; the trees not only benefit from the decaying grass, but from the loosening of the soil. The benefit is most marked; and all patena lands planted with coffee should be treated in this manner. Mânâ grass has also a wonderful effect in improving poor coffee, when applied as a thick thatch to the soil six to nine inches deep. It thus not only prevents the growth of weeds and stops wash, but the decaying grass seems to give freshness to the soil; the trees make wood fast, and bear heavily. Thatching the ground as above is a successful cure for the black bug; this I can vouch for from personal experience: the cost is considerable, but the results quite justify the outlay.

POONAC MIXTURE is a compost lately invented by Messrs. G. and W. Leechman, in lieu of simple poonac, the price of which has risen so much as to make it too

costly to use as manure. The ingredients consist mainly of inferior poonac, latrine refuse, bone-dust, &c. The cost is now 5*l.* a ton in Colombo. I intend to use one pound of it per tree, if applied alone; half or three-quarters of a pound, if mixed with bone-dust or other artificial manures, should be sufficient.

LIME would doubtless be very good in most soils, a top dressing of it every five years would no doubt be very beneficial. It may also be applied with pulp; one cocoa-nut-shell full to each basket of pulp is the proper quantity.

SOMBREORUM is one of the artificial manures that has lately been manufactured, and owes its origin to Mr. R. B. Tytler, of Palakelle. As opinion varies much on its virtues, I have included in the Appendix some correspondence that has appeared in the newspapers upon the subject. My own experience of sombreorum is that it is a good manure; but having tried it on very good coffee the effects were not so perceptible as would have been the case on a poor estate. I have seen it applied to very poor coffee with most beneficial effects, but I fancy it requires to be frequently applied to afford lasting and remunerative results.

LEECHMAN'S COMPOST is a capital manure: one pound a tree is a proper quantity to be used, and the average cost including application is, say, 6*l.* an acre. It may also be beneficially mixed with other manures. On this estate it was very effective in supporting trees under heavy bearing.

In recapitulating the foregoing remarks, we find that the manures in general use on coffee estates are the following: cattle-dung, bone-dust, pulp, poonac, and artificial

composts, and that a judicious use of them is certain to bring the planter a full and remunerative return. Cattle manures being the heaviest to transport, should be applied where it can be conveyed by carts, while bone-dust, poonac, &c., being easier of carriage and requiring much less in bulk and weight for each tree, should be used for the more distant and less accessible portions of the estate.

I subjoin an estimate, showing what I consider the average cost of applying artificial manures, per acre.

Composts.

	£.	s.	d.	
Cost in Colombo	7	10	0	per ton.
Carriage to estate	2	0	0	„
Cost on estate	£9	10	0	„

Allowing 1200 trees to the acre, and applying at the rate of one pound per tree, one ton will manure 2240 trees (allowing for vacancies), in round numbers, two acres.

	£.	s.	d.
Cost of half-ton compost, at £9. 10*s.* ..	4	15	0
Application, 17*s.* 6*d.* per acre	0	17	6
Total cost per acre	£5	12	6

Steamed Bone-dust.

	£.	s.	d.
Cost in Colombo	8	10	0
Carriage to estate	2	0	0
Cost on estate	£10	10	0

Application.

	£.	s.	d.
Cost of half-ton bone-dust, at £10. 10*s.* ..	5	5	0
Application, 17*s.* 6*d.* per acre	0	17	6
Total cost per acre	£6	2	6

Where only half a pound to a tree is used, the cost should be reduced one half.

TRENCHING, or waterholing, is an operation which confers great benefit on the trees; it consists either of open or closed trenches. Open trenching is to make trenches three to four feet long, one foot to fifteen broad, and fifteen to eighteen inches deep, between four trees; they are left open, and when cut the soil taken from them is spread over the roots of the surrounding trees. These open trenches not only act as catch drains, but also as reservoirs to receive wash, weeds, prunings, decayed wood, dead leaves, &c., and will in course of time become quite filled up; but they should be emptied out twice a year, and the soil from them be spread round the roots of the trees. The trenches should be made across the face of the hill. On an old estate where there are not many roots and stones, a good cooly can easily cut forty of these trenches a day, which at the average cost of wages would be 1*l.* 2*s.* 6*d.* per acre.

CLOSED TRENCHING is to cut a ditch across the entire length of the rows of coffee (as level as possible), two feet broad and two deep, and to fill with either mânâ grass, the grass and vegetable matter of swamps, leaves, young twigs of trees, or any vegetable substance at hand; they are then covered over with earth, and well trodden down, the remaining freshly-turned-up soil being neatly spread under the tree. The effects of this costly work are very lasting, and answer particularly well in stiff soils, enabling the roots of the coffee-trees to penetrate into the softened and decaying matter with which the trenches have been filled.

Another mode of loosening stiff soil on old estates is to use a long steel-pointed bar with a cross-handle, or a strong three-pronged manure fork will also answer the purpose. Either of these tools must be deeply driven into the soil, which is then prized up, cracked, and loosened, but it must not be turned up. The effect is to loosen the soil to admit air and moisture, and to permit the free growth of the roots. After this process the application of liquid manure answers well.

The advantage of loosening the soil without turning it over is obvious, as rendering it less likely to be washed away by heavy rains; indeed, regular digging should only be practised on well-drained flat lands. The cost of loosening or renovating the soil with the fork is about the same as waterholing, as I think a cooly can do about forty trees a day. The tallest and strongest men should be selected, as it is a trying and laborious operation.

Another mode of manuring and top-dressing was mentioned to me by a brother-planter, Mr. W. King, as practised by him with much benefit to the trees. On the estate he alluded to the swamps were allowed to grow up, and every year before crop the spare labour of women and boys was employed in clearing them up, and making large heaps of this vegetable matter. This gradually decayed during crop-time, and was ready to be carried out later in the year by the same women and boys, and spread by them broadcast among the trees, which my informant told me most undeniably showed the benefit they had derived from the operation.

In closing this chapter, I can only recommend all young

and inexperienced planters to study Mr. Wall's able pamphlet, which, added to my own remarks, will give them all the necessary information on the most important item of manuring.

The keep and cost of stock is usually included in the estate accounts under the head of Manuring. Undoubtedly the stall-fed cattle produce the richest and largest quantity of manure; but the cost is more enhanced than on properties where the cattle are grazed all day and only kept in at night, when they have Mauritius grass given to them, which has been cut from the ravines and prepared for them during the day. The selling of cattle does not prevail as yet to any very large extent. I believe most planters are loth to part with their best cattle, to replace them by emaciated beasts, who may perhaps bring with them the seeds of murrain or other diseases, which in Ceylon so often decimate estate cattle.

I would recommend, when practicable, the keeping of several head of cattle suited to draw small single bullock-carts; with these the manure should be carted into the most central part of the estate, where depôt pits should be provided. These carts are also useful for carting grass or any estate materials, and if the estate is near a high road, in collecting manure at the native cattle sheds.

PICKING, CURING, AND DISPATCHING CROP.

On low-lying estates, coffee begins to ripen early in August, and crop is over by the middle of December. On high estates, not much coffee is picked before the early days of October, and crop is not over till the middle of January. Sometimes the seasons vary, and are either a month earlier or later. On high estates, coffee generally ripens more gradually than on low plantations, where the crop mostly comes in with a rush, and causes an insufficiency of labour to be even a more serious matter than it is on the former properties.

I quote Laborie for the description of the cherry, when ripe. "The fruit of the coffee, when perfectly ripe, appears like a small oval cherry, under a red and shining skin. A whitish, clammy, luscious pulp presents itself, which generally encloses two seeds. These seeds have one side flat, the other hemispherical. The first is marked with a longitudinal fissure, and the flat sides are applied to each other. If the seeds are opened, they are found covered with a white, ligneous, brittle membrane, denominated 'parchment,' on the inside of which is another silver-coloured membrane, exceedingly thin, and seeming to originate from the fissure of the seeds. Here the seeds, properly so called, lie, and seem to consist of a sprout and two original leaves. Sometimes the cherry has only one seed or grain,

which then is in the form of a small egg; but the skin, parchment, and membrane are preserved. This is peculiar to old decayed trees, or the extremities of some small branches."

This oval-shaped coffee is called "pea-berry," and usually fetches a high price in the London market. The reason assigned is that being round it roasts better, and it may also be thought more to resemble Mocha than the long canoe-shaped beans of the high estates.

When coolies are turned out for gathering or picking, they are provided with one large "jail" or "gunny bag," holding from two and a half to three bushels, and with a smaller one holding a little more than a quarter of a bushel, and called by them "koutti sacks." These small sacks are tied round the waist, the people pick into them, and when full they are emptied into the large bags, which are kept on logs, paths, or other convenient places nearest at hand. Five koutti sacks usually make a fourteen-inch box, two of which are the task in full picking on most estates, being equal to two and a half imperial bushels. If the coolies pick these two boxes, they often receive a bonus of one penny, and they are also paid at the rate of fourpence a box for any extra quantity they pick. Owing to this inducement of cash in hand, the coolies on heavy-bearing estates, where they have not very far to carry and deliver the cherry, can easily make their shilling a day during the thick of crop-time.

When gathering, it is less confusing to make the cooly pick each side of the trees in his row or line; thus he need not turn round or move into another line. The only

objection to this is that the more nimble-fingered push on ahead of the slower ones, and are apt to pick more than their share of the trees. In steep ground, my orders invariably were to pick from the top of the hill. My reasons were, that if any coffee dropped it rolled down forwards and was more likely to be seen and picked up, and because the coolies were not loaded when near the top of the field, so they had not to come down to empty their small bags and then have to go up again—perhaps to finish only a few trees—which they are very loth to do, their natural object being to complete their task as quickly as possible. Coolies should always have an efficient superintendent or assistant over them in the field. He must keep a sharp eye on the trees as he walks along, to see that they are cleanly picked and no ripe coffee left upon them. He must not allow stripping—that is, pulling off green fruit with the red. He must also keep a bright look-out, and send round a trustworthy kangany to catch any "fly-pickers"—that is, skulkers, who go here and there about the estate picking at random, and who not only do the work carelessly, letting quantities of ripe and green fruit fall to the ground, but spoil the picking for the regular pickers, who have to follow in the ordinary rotation of the estate.

It is considered best not to pick the stalks with the cherry. Tamuls, particularly the women and girls, are far better pickers than Cinghalese; these latter are generally troublesome when they have to be employed at this work, for they not only pick unripe coffee, but refuse to turn out on wet days.

As the number of estates increases annually, and coolies become proportionately more scarce, the attention of planters is naturally directed to the best mode of economizing labour. Thus, water-wheels, patent pulpers, steam-engines, and iron spouting are becoming the rule, and not the exception, on the generality of estates. Where there is a sufficient declivity and a sufficiency of water, spouting should be made use of to transmit the cherry to the pulping house from distant parts of the estate. Along the lines of spouting, here and there, in convenient spots where paths converge, receiving houses must be put up, into which the coffee is taken and spouted down to the works. The coolies, being thus enabled to deliver their loads near at hand, are not only spared the toil and labour of a long and, in wet weather, sometimes a dangerous journey to the pulping house, but time, which is always money, is saved; the coolies are able to gather a larger quantity, and they are saved bodily wear and tear. With a force of 200 coolies in the field, an increase of at least 100 bushels, or 10 cwt. a day, may be safely reckoned upon, amounting, say to 300 cwt. for the five heavy weeks of picking, and representing a money value of fully 1000*l.* in the London market.

To anyone acquainted with the danger of loss attendant on an over-ripe crop, from its splitting and falling to the ground when heavy rains come on, the value of spouting will be self-evident. The first cost should not be regarded, though heavy (I believe as much as 250*l.* to 300*l.* a mile, if of the best galvanized iron), as it may probably repay itself in one season. When practicable, the spouting

should follow the undulations of the ground; small pillars, about one foot high, must be built for it to rest upon. In crossing ravines, pillars or posts must be erected; but the former when practicable are best, as they should last as long as the estate, if well built, while wooden ones speedily decay and have to be constantly renewed.

Brass, copper, and tin checks, or tickets with the name of the estate stamped upon them, are mostly used during picking time, and are handed to the cooly as he delivers his load. They represent full boxes, half boxes, and quarter boxes. The plan I adopted for taking in cherry coffee was to have a sheet of double-foolscap paper, with the names of all the coolies, in their different gangs, written upon it, and a space of about one inch left blank between the rows of names for the insertion of moveable slips of paper, to be daily stuck on with a wafer or a little boiled rice. On these slips, opposite each name, the quantity of coffee delivered by each cooly morning and evening was marked down, and added up in the evening, when the cooly's name was also entered into the check roll as having performed a day's labour. All extra coffee was paid for in cash. The quantity of coffee picked daily was entered in the journal and the total to date brought forward, so that the quantity secured could be told at a glance.

Many planters enter the coffee as it comes in opposite the coolies' names in the check roll; but I adopted the plan I have described because it saved time in turning over leaves, and prevented the roll itself from being dirtied and torn. There was a great advantage in having all the names before me, and custom made it so easy that

the quantity picked by each cooly was put down almost as soon as he had called out his name and gang.

The ripe coffee is measured in a box raised on a form or table and swung upon a pivot, so that when full it is easily turned over by an attendant kangany or cooly on to the pulping floor. He keeps a tally of the number of men, and the superintendent, who should have a raised seat and desk from whence he can look into the box, calls out the quantity and puts it down opposite each name. When the coffee is taken in at the receiving houses, tickets and checks are mostly used, which the coolies have to deliver in the evening to have their name and quantity put down; but the double-foolscap-sheet plan saves time, and is only a little extra work for the superintendent in the evening.

CURING, in planter parlance, consists in passing the ripe coffee through the machinery, washing, and drying it in the parchment state, ready for dispatch to Colombo, where it is finally prepared for shipment. When fully ripe, the sooner the coffee is pulped the better, otherwise it heats and the colour of the parchment is spoiled. In dry weather it is sometimes necessary to sprinkle water over the cherry, and to let it soak for some hours to make it pulpable; otherwise, if passed through the pulpers in a dry state, it would be much cut and damaged.

When the coffee has passed through the machinery (to be more fully described under that head), it flows into large cisterns or stone vats; here it lies until it has sufficiently fermented the outer pulp, which is whitish and clammy. The period it should be allowed to lie varies with the elevation of the property and the state of the

weather; at 3000 feet above the sea, coffee pulped on Monday is usually fit to be washed on Wednesday morning. The receiving cisterns should have a drain underneath to carry off the water, in addition to the doorway through which it is passed into the washing cistern. When fit to be washed, water must be let into the receiving cistern; the coffee in it must be moved about with wooden "matta pallagies" (boards about two feet long and nine inches broad, with curved sides and long handles), until the body of water collected is sufficient to carry the coffee into the washing cistern. In the washing cistern, which is on a slope, it is passed through several waters until the mucilage has been entirely washed off, and the parchment then assumes a whitish-yellow appearance. The washing cistern being on a slope causes the light coffee and skins to be carried to the lower end, where they are caught in sieves or baskets; such as do not float are allowed to pass on into the "tail," or refuse cistern, which is made on purpose to receive them, and is on a lower level than the washing cistern. When washed, the clean parchment is heaped upon the draining platform, where it remains till the next morning; if, however, the weather is wet, it must lie longer; and if there is any continuance of wet weather, it is carried up to the store and laid as thin as space admits upon the coir matting floor, to be dried by the action of the wind, and must be carefully turned over at least three times a day, to prevent its getting heated. In very long spells of wet weather, when store room is exhausted, the only thing to do with wet coffee is to keep it on the barbecues, keeping it well

turned over, and preventing its heating by throwing fresh water upon it daily. I have known four weeks of continued rain and cloudy weather, in which it was impossible to dry a berry of coffee in the sun, and as a consequence some of the berries began to germinate; this was unavoidable, as I had not sufficient store room to spread it thin. Two days' exposure to a hot sun is sufficient to render it safe to dispatch the coffee to Colombo, but three days are of course preferable. When coffee has been well washed and dried soon afterwards, it has a most clean and dazzling white appearance. Indeed, the whole preparation of coffee is a clean proceeding from beginning to end; and this, added to the care with which it is cured and cultivated, has obtained for it that high position which it now justly holds with the Mincing Lane brokers.

The light coffee, tails, and dried cherry which accumulate in the tail cistern are washed over again, separated, and dried when opportunity offers. When crop is over, this inferior coffee is usually pounded and sifted by women, and sent to Colombo clean, whence, if fit for shipment, it is sent to England; if of not sufficiently good quality, it is sold in Colombo.

The greatest care must be taken in the store to prevent the coffee getting heated or musty. The parchment coffee must be constantly moved; even when quite dry it must be turned over once a day. When sufficiently dry for dispatch, the bean, when the parchment and silver skins are removed, has a bluish look, which, when perfectly dry, turns to a greyish-green.

The mode of dispatching coffee depends upon circum-

stances. When there is a carriage-road up to the store, it is at once put into the carts; bags that hold three bushels being best for the purpose. When the buildings are away from the road, the coffee has to be sent down in two-bushel bags on coolies' heads. The bags are usually sewn up with twine; some planters merely tie them round the mouth with coir rope. The cartmen take charge of the coffee, which they have seen measured, and sign the way-bill, undertaking to deliver it in like quantity and good order at Colombo within a certain number of days. Printed forms for this purpose are provided by the estates in triplicate—one to be kept, one for the cartmen, and one to be sent by post to the agents in Colombo. This and the registered number of the carts is the only safeguard left to the planter. Contract carts the contractor in Colombo is responsible for, and load as per contract—fifty bushels being a nominal load.

Robberies by cartmen have been more frequent of late years; but now that the railway between Colombo and Kandy is a *fait accompli*, coffee is mainly transported by it to the shipping port, and the rapidity of transit will doubtless do away with many opportunities for pilfering which were offered during the slower cart journeys. The coffee is sent in well-sewn bags, and in general consigned to an agent, who receives it from the cartmen, forwards it to Colombo, and delivers it to the merchant. The loss during transport on re-measurement in Colombo does not exceed half to three-quarters per cent. The cost of transmission per railway, exclusive of agency, amounts to 4*d.* or 5*d.* a bushel, but depends upon the state of the coffee,

as the railway authorities charge for weight and not by measurement.

As the planter has nothing to do with the curing in Colombo, I need only say it consists of drying the coffee until it is quite hard, peeling—that is, removing the parchment and silver skins—winnowing, sizing by perforated machines, and garbling—that is, picking out all the damaged and broken beans, which go home as "triage." The sizes of coffee are, No. 1, No. 2, pea-berry, and triage. Plantation coffee is now universally shipped in casks or barrels.

BUNGALOWS AND LINES.

THOUSANDS of pounds would have been saved in after years had those who were the pioneers of coffee-planting put up buildings of the permanent nature now considered absolutely necessary. As regards stores, perhaps such a sweeping assertion ought not to be made—instance the fine buildings on the Nilambe, Odoowelle, Dunally, and Delta estates, and a few others; but as regards bungalows and lines, I think no reservation need be made, saving the famous Huntly Lodge and Wavendon bungalows in the Rambodde district, which are commonly believed to have cost 3000*l.* each. The former, owing to the misfortunes of its original proprietor, has become a ruin; but the latter still exists in very good repair, and from its verandah commands one of the finest Ceylon hill scenery views—*i. e.* the *cul-de-sac* of the Rambodde valley, at the foot of the Newera Ellia Pass, hemmed in by high mountains, with lovely views of several waterfalls, coffee plantations, the Kotmalie valley, the noble Peacock mountain, and distant bungalows and stores dotted here and there on the landscape.

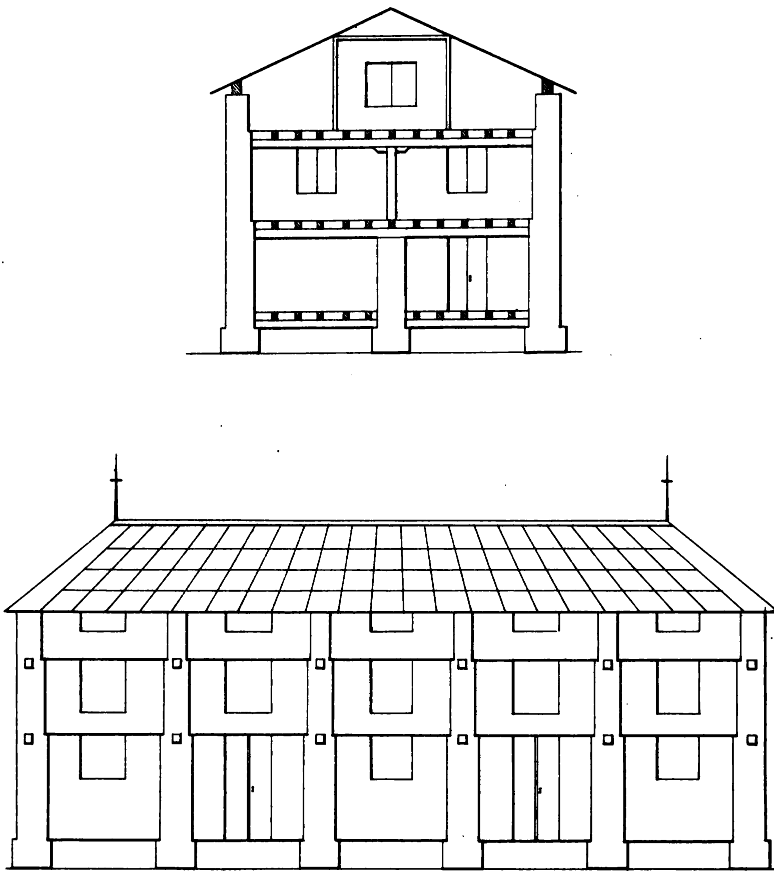
Why permanent stone and shingle-roofed buildings were not originally erected on estates can only be accounted for by the belief that inferior buildings would last the time of the proprietor, who, in the palmy days from 1840 to

1845, doubtless hoped to make his fortune, and leave the country in a very short number of years. Another reason may have been (as I have already pointed out elsewhere) the uncertainty which existed as to the number of years coffee would last, which deterred many from putting up expensive buildings. Also when the hard times of 1847–8 came, many planters who were sadly pushed for want of cash were obliged to manage as cheaply as possible. Now that the durability of estates for several decades has been certified, if kept in good order and manured, quite another system is followed. Permanent stone buildings, iron roofs, and expensive machinery are erected, and doubtless pay best in the long run, as these should last as long as the property; and the fear of having to put up new buildings, which had to be done on many of the older estates, need not be entertained.

Permanent buildings, machinery, spouting, and cart-roads, all increase the value of a property; so I advise all who have yet to put up the buildings to do so in the manner aforesaid, and not to be afraid of the first expense, which is sure to repay itself.

Bungalows are now built chiefly of mud and stone, well plastered on both sides. If the walls or pillars are very high, lime or "chunam" must be used in their construction, but for the generality of walls mud and stone have been found sufficient; but care must be taken to keep a perfectly tight roof over them, for if once they get wet the mud becomes moistened, and they will tumble down. A very good plan is to build all the *outer* walls of stone, and inner ones of sawn timber and mud; the sawn timber,

STORE.



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Newbery & Alexander lith. 43 Castle St. Holborn

E & F N Spon 48, Charing Cross, London.

however, must rest on a stone foundation, to prevent decay and the attacks of white ants. The roofs of bungalows are invariably (where procurable) made of shingles; these are split eighteen inches long and six wide, and are laid and nailed down very similarly to slates. The red doon, or any wood with a straight grain that splits easily, is best for shingles, blocks of which, eighteen inches long, are sawn for the purpose.

I have thought it well to give plans of buildings lately erected on Delmar estate, Uda Pussilava. Mr. W. Green, the superintendent, has kindly reduced the original plans to a scale suited to the size of this book. I subjoin the cost; but it must be taken into consideration that these buildings have been substantially erected, and that the district in which they are situated is many miles from a cart-road, transport of materials consequently very expensive, and skilled labour scarce and costly.

These buildings were planned by myself, and have answered very well.

STORE.—Stone pillars, roof of galvanized Morewood's tiles, sawn timber, coir-matting floors, in three stories, 485*l.*

PULPING HOUSE.—Solid masonry, pillars, and cisterns; a double floor for curing purposes, corrugated iron roof, but not including cost of machinery, 483*l.*

BUNGALOW.—Outside walls of stone, inner walls, sawn timber, mudded between sawn reapers, planked floors, and shingle roof, and including 70*l.*, as cost of Godowns, 356*l.*

The levelling of the sites has not been included.

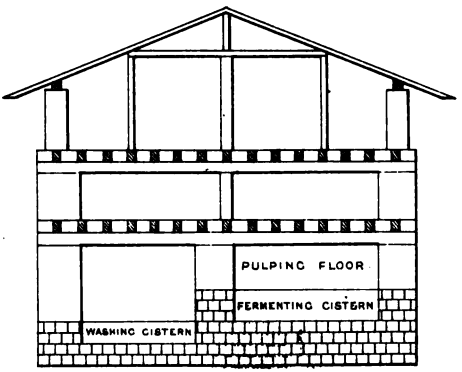
This book being written in the main for the use of

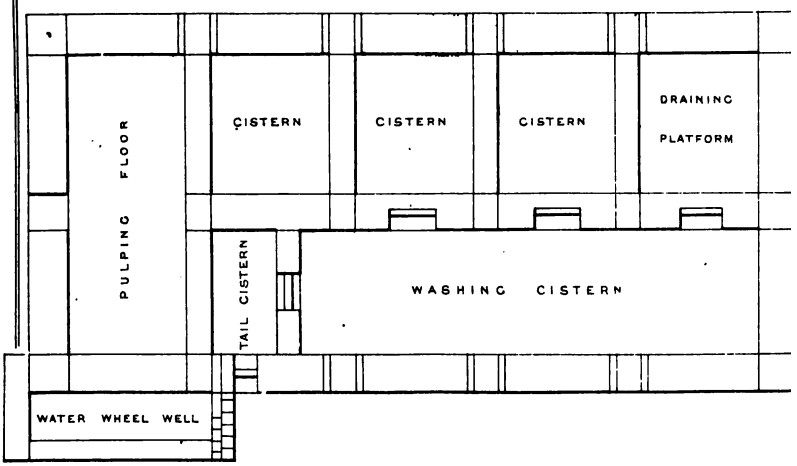
embryo planters, who will most probably be employed on or adjoining old estates, they will thus be able to judge for themselves, and select the plan of buildings they think best. Besides which, there is now in Ceylon (and there will also doubtless shortly be in South India) abundance of professional advice to be had, both as regards buildings and machinery.

For the accommodation of an unmarried man, a cottage-like bungalow, with verandah, containing five rooms, is sufficiently large—*viz.* dining and sitting rooms, two bed-rooms, and office. Outbuildings must be added—*viz.* kitchen, servants' room, store-room, bath-room, &c., with (if practicable) a stream of water running through; also stable and room for the horsekeeper. All the foregoing cannot be put up in the generality of districts for much less than 300*l.* The cost of a bungalow for a married European gentleman with a family, would be fully 200*l.* more. Twenty years ago, when materials were more abundant and skilled as well as cooly labour more reasonably priced, the cost would have been diminished nearly one-half; but I do not think I am going over the mark when giving the above figures, though there may yet be localities (such as Dick Oya) in which similar works are contracted for at a more moderate cost than in the older districts.

Lines formerly were mere mud and stick sheds, with thatched roofs; now, on the contrary, they are built of mud and stone, with sawn timber and shingle roofs. The cost is of course much enhanced, but the durability is proportionate. On some estates, double sets of lines are put

PULPING HOUSE.





Scale ½ Inch per Foot.

Newbery & Alexander, lith. 45 Castle St Holbo

E & F N. Spon, 48, Charing Cross, London.

up, with a verandah about six feet wide on each side. Coolies, however, prefer smaller houses; they consider them warmer and more "cosy." It stands to reason, however, that the larger and higher the rooms the better the ventilation, and the coolies resident therein are less liable to suffer from sickness or epidemics. Rooms twelve feet by twelve are a very fair size, and will hold ten coolies, as they have no objection to be packed tolerably close. Of the coolies' particular habits I will write more at length in another chapter. A cheap sort of lines I built at Glenloch in 1865, which were much liked by coolies, were of the following description: rooms, say eight feet by ten; walls, four and a half feet high at the back; front wall, five and a half feet high; verandah post, four and a half feet high; width of verandah, three feet. The back wall was of mud and stone; the inner walls were built up one foot high of stone, on which the jungle posts rested; thus they were not only prevented from rotting, but were in no danger of fire, as many old lines have been burnt down from the posts catching fire and setting the roof in a blaze, as the coolies invariably make their fires close up to the walls. The wall posts of the lines under remark were of jungle sticks, as also the rafters; the roof was of shingles nailed upon sawn timber reapers. Such lines would in the Pussilava district cost about 5*l.* a room, properly and neatly completed. In a new district, where timber is cheap and abundant, the cost might not be more than 3*l.* or 4*l.* a room.

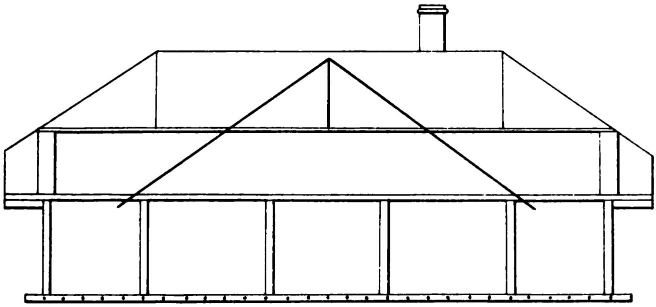
Coolies are not at all cleanly in their habits. I have therefore made it a practice to select a low-caste cooly,

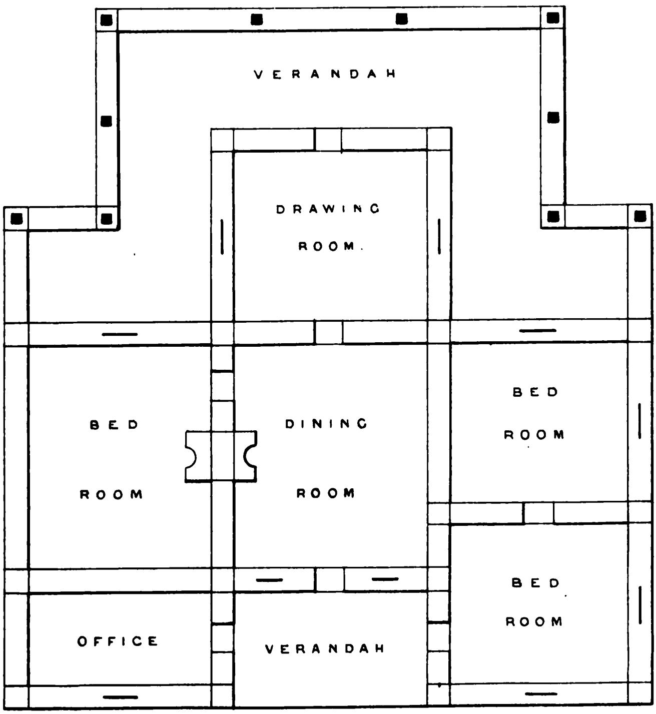
generally an old man, to act as scavenger. When the lines are full, he should be employed daily; at other times, cleaning once or twice a week is sufficient. The scavenger's duty is to sweep round the lines, keep open all drains, and bury all refuse about the lines. Coolies are extremely dirty and untidy in their habits, and offensive smells, which usually prevail about the lines, are sufficient in themselves to breed disease, even amongst a less closely-lodged number of human beings. I therefore advise all planters to pay more attention than is usually given to this matter, if they would do all in their power to make their coolies and estates healthy. Nothing is more injurious to a property than its getting a bad name as an unhealthy estate.

It is a very good plan to build lines near a running stream, or where water can be brought to them, so as to give the coolies ample opportunities for bathing, as well as to have water for cooking easily at hand. Water should also be conducted in such a manner that a running stream may circumvent the lines, passing along the drain which carries off the water from the roof; this is not only a healthy but most cleanly plan; the congee and rice-water thrown out by the coolies is thus floated away, and all offensive smells are likewise carried off.

The advantages of shingled roofs for lines are, that they are not so liable to catch fire as thatch; the smoke also passes through easily, and the ventilation is superior. Coolies usually sleep on mats on the earthen floor of the lines; this amongst Europeans is not considered a healthy custom, but coolies are used to it; still, I would recommend

BUNGALOW.





Scale 1/16 Inch per Foot.

Newbery & Alexander lith 42 Castle St

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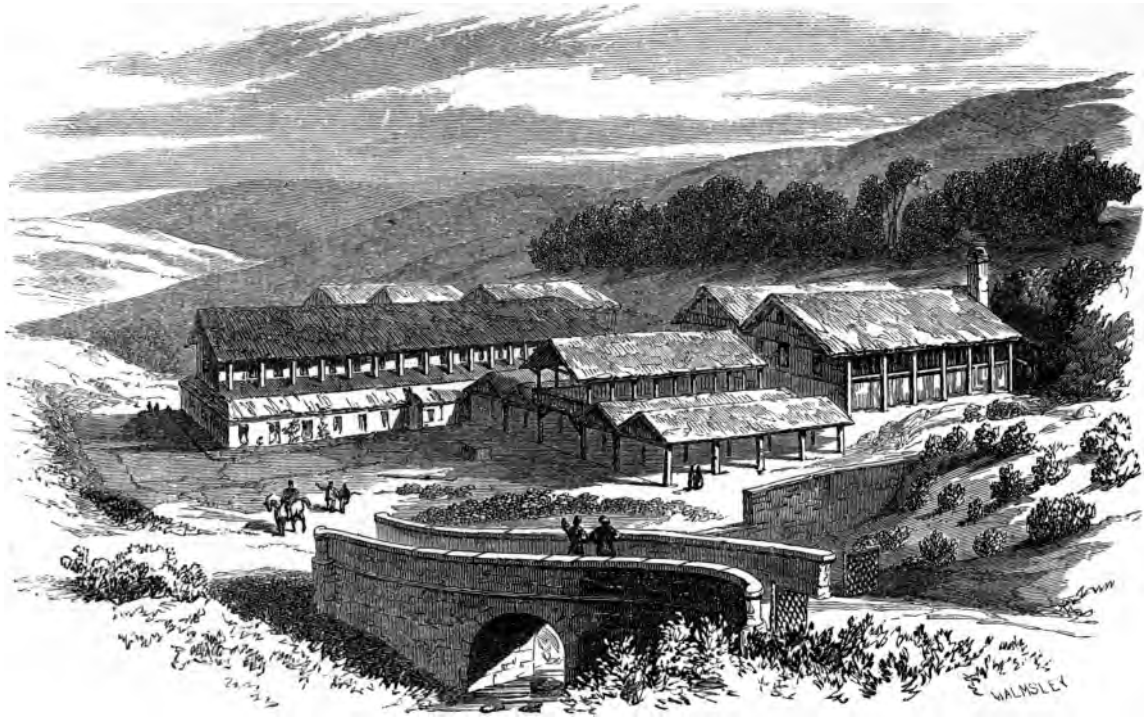
the erection of planked bed-places, something like the bunks in ships, called by coolies "attāleys," on which I am certain they would have no objection to sleep, as they often rig jungle-stick ones for themselves.

Note.—I have forgotten to mention how seldom coffee-planters take any interest in planting fruit-trees about their bungalows, making nice flower-gardens, and other improvements of the kind, which would benefit those who succeed them. This want can only be accounted for by the feeling that Europeans do not come to Ceylon as permanent emigrants, but merely as "birds of passage," in the hope of securing an independence and returning home to enjoy the fruits of their labours. I am, however, happy to say that a better feeling is springing up in this respect, and it is only right it should be so. Any amount of young fruit-trees or garden-plants may be obtained from Mr. G. H. K. Thwaites, the talented and obliging superintendent of the botanic garden at Paradenia. The attention of coffee-planters should also be directed to the planting of "cinchona" trees, for which much of the land, too elevated for coffee, is most suitable.

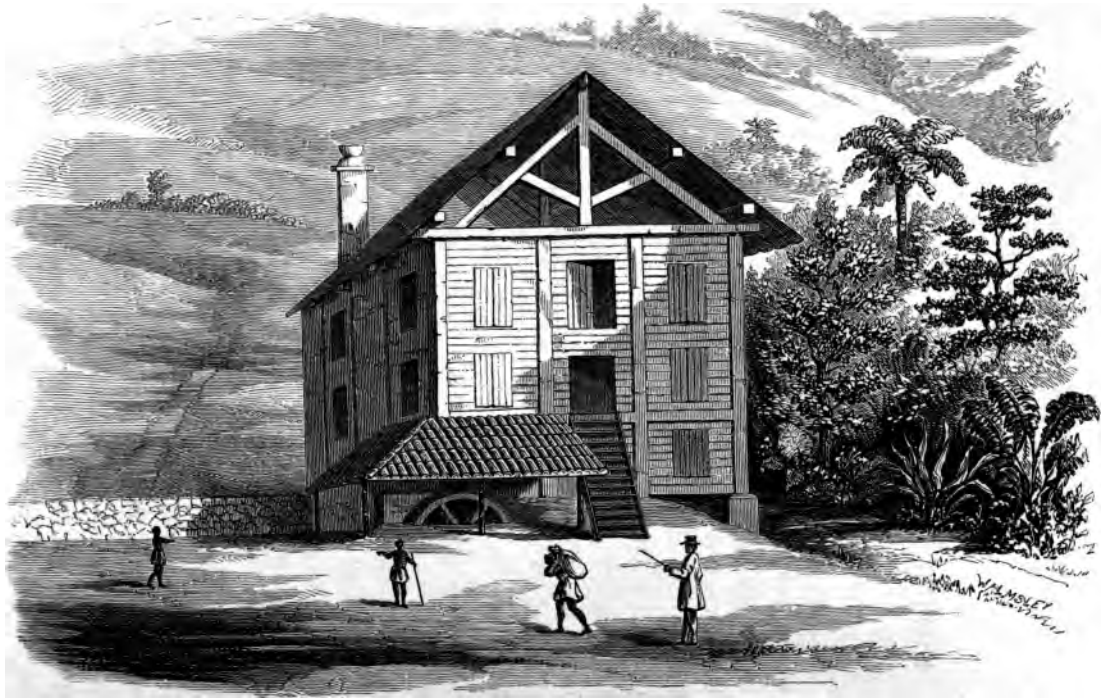


Main Works at Messrs. Worms' Estates, Pussilava, Ceylon.

STORES, PULPING HOUSE, AND BARBECUES.

THE two largest estates in Ceylon, strangely enough, adjoin each other, the highroad to Newera Ellia alone separating them; one is "Rothschild," the other "Delta." On these two properties are to be seen the largest and most complete buildings of any yet erected on a Ceylon estate. To Messrs. Worms is due the credit of putting up these fine stores, pulping house, and buildings, which have lately, as well as the estate itself, become the property of the Ceylon Company, Limited; and to my brother, Mr. F. R. Sabonadière, is solely owing the "cudos" for planning the East Delta works, put up under his inspection, with which there are few that can compare in efficiency, beauty, and completeness.

Formerly, stores were in some cases built of mud and sticks, with a thatched roof; then a system of building timber stores, supported upon large beams (which were raised off the ground on pillars two or three feet high), followed; but neither of these plans could withstand the effects of a Ceylon climate upon timber. Nothing answers so well or is so durable as stone or brick pillars, erected ten or twelve feet apart, and two and a half to three feet square; these pillars are of sufficient strength to bear the weight of two floors, the iron roof, and of several thousand bushels of parchment coffee. The lower floor of



The Pulping House, Messrs. Worms' Estates, Pussilava.

Interior View of the Pulping House of Messrs. Worms' Estates, Pussilava, Ceylon.

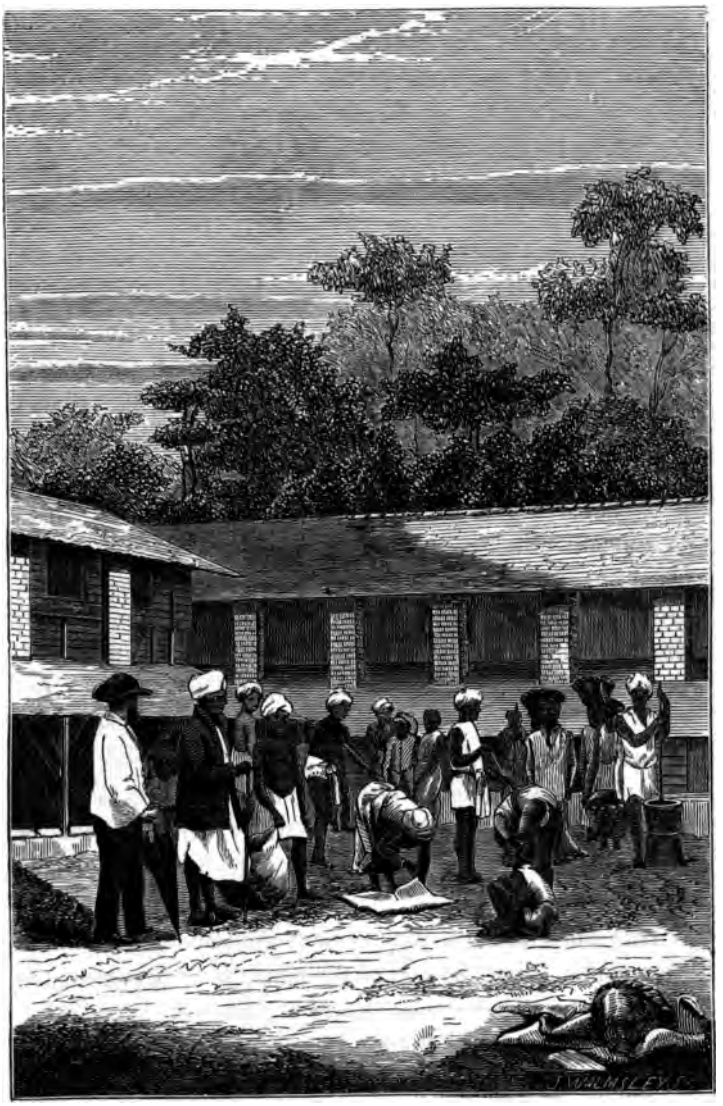
a coffee-store is generally boarded or laid with flat stones or broken macadam, and "chunamed," or, still better, cemented over. The two other floors are upon joists, crossed by reapers two by one and a half inches, upon which coir matting is tightly stretched. The advantage of coir matting is, that the air is drawn down through the coffee, and serves as a ventilator. A still better but more expensive material for the flooring of a store is "wire," prepared in England for the purpose, and I believe now very extensively used in granaries. The first cost would be heavy; but it would last as long as the building, and need not be replaced, which has to be done every three or four years with coir matting. The lower floor of the store might also with advantage be of coir matting or wire gauze, but it must be raised at least two feet from the ground to allow a free current of air underneath, and to admit a cooly boy to sweep the space below and keep it free of weeds and lumber. The sides of the store between the pillars should be boarded for about two and a half feet above each floor, the rest reapered in a slanting position like jalousies; so that while it gives admittance to the air, it at the same time throws off the rain. The two ends may either be boarded in or built up of stone, and should be well lighted with large glass windows. Plenty of air is requisite to keep up the circulating medium, and to prevent the coffee getting heated or damaged. I therefore advocate the jalousie system in preference to that of completely shut-up stores.

A store, one hundred and twenty feet long and thirty wide, with three floors, is sufficient to take in a crop of

9000 bushels parchment—say 2000 cwt. The cost of such a building put up complete, as above described, with stone pillars, sawn timber, and galvanized iron roof, would be from 1000*l.* to 1200*l.* Adjoining the larger building, a rice-store, tool-store, and a room for the storekeeper, should be built. The height between the floors of the store should not be less than six feet. The pulping house should, if possible, be built on a sloping hill-side, the pillars of stone or shingled, supported on sawn timber, and the roof of iron. First, a cherry loft must be provided on the upper floor, below it the platform on which the machinery stands; this should, if possible, be roomy and on the solid, as better able to bear the weight of the machinery, and causing less noise and vibration. The level of the receiving cisterns should be three feet below the pulping floor, and two feet lower again comes the washing cistern; in fact, it should be a series of steps, for the easy flow of coffee from one into the other, aided by water. The receiving or "fermenting" cisterns were formerly built of two-inch planks; but stone is now universally used, the bottom and sides being asphalted or well cemented over to make them water-tight. A large iron door, two or three feet wide, must open out upon the washing cistern to admit the fermented coffee into it to be thoroughly washed. In the centre of the cisterns should be a perforated iron aperture, over a covered drain leading under the receiving cisterns, the object of which is to carry off the water when the pulping process is going on without its interfering with the washing, and also to drain off the foul water from the coffee during the fermenting process.

The fermenting I allude to does not in any way injure the berry, which is fully protected by the parchment skin; the plan is adopted only to heat the coffee sufficiently to make the gummy substance wash off. A very convenient size for fermenting cisterns is twelve feet square; the washing cistern should be thirty feet long by nine broad, and have a slope of four inches. A "tail" cistern should be sunk below it to receive the skins, scums, &c., and be so arranged that the water can escape through a wire grating without letting any coffee-beans through. Spouts must be arranged to let an ample body of fresh water into each of the cisterns; that for the washing cistern should be at the head of it, that the water flowing down should carry the skins with it, leaving the good parchment, which sinks, at the bottom of the cistern. The cherry coffee from the loft is admitted to the machinery by a vertical spouting, leading into the "hopper" or feeding trough. A good stream of water must flow in with the coffee to pass it freely through the pulpers, and prevent its being cut and damaged. Every pulping house should be provided with a draining platform, conveniently placed next to the washing cistern, so that the wet parchment may be heaped upon it. The floor of this draining platform should be either of wire gauze or coir matting, laid over a strong floor of sawn reapers. Coffee may lie for two or three days in this wet state with safety, but even then it is erring on the right side to have it turned over in case of any accidental heating.

On estates where there is an abundant supply of water, a water-wheel should be erected to turn the machinery. Where water is scarce or its supply uncertain, I would



The Barbecue, or Drying Floor, Messrs. Worms' Estates, Pussilava.

recommend the adoption of a small steam-engine; and where neither of these means is feasible, the pulpers must be worked by hand or by a cattle-mill, which I have seen done on one or two estates in Ceylon.

BARBECUE is the name given to the platforms on which the coffee is dried in the sun. They vary in size and shape, as they have to be constructed in accordance with the nature of the ground on which the store stands. The aspect which is exposed longest to the sun is of course the most preferable. Where the ground about the store is level, one large barbecue suffices; but where the ground slopes, they have to be made in terraces supported by retaining walls. The usual mode of construction is to give barbecues a slight inclination to allow the water to run off. Stones, the size of macadam, are broken and spread over the levelled ground as when metalling a road. Over this, lime or chunam is thickly spread and smoothed; the last operation of the masons, when the chunam is dry, being to polish the surface and stop up any cracks. On some estates, the barbecues are painted with coal-tar: the advantage attributed to this plan is, that black is said to attract and retain the heat, and the tar prevents cracks and breakage; while, on the contrary, white throws off the heat, and the glare from it is very trying and injurious to the eyes.

Barbecues laid over with cement would be more durable than chunam, but the cost of the material is at present too great. Flagstones would answer the purpose excellently, laid as in kitchens in England; so would thick squares of glass of the bull's-eye kind; but until the completed rail-

way brings the planter cheap and handy transport, such expensive materials are out of the question. On some estates, the barbecues are not chunamed at all, coir matting or hand-trays being spread upon them, on which the coffee dries very well.

I must not omit to allude to the plan of trays on wheels, which are run under the store during the night or in rainy weather, and run out whenever the sun makes his appearance. This plan of running trays is an excellent one, and I am much surprised it has not been more generally adopted; for it is not only a very clean and inexpensive way of curing, but has this advantage, that coffee can either be wheeled in or out at the shortest notice, and that the coffee, once laid down, remains there till it is fit to be permanently stored, and thus time and labour are saved. Warping of the timber is the sole drawback; but this might be guarded against, and iron rails provided for the wheels to run upon.

I have omitted to mention what is called a "Clerihew store"—a patented process which has found advocates, and is particularly suited for rainy districts. This store is a closed one, and either hot or cold air is drawn through the coffee by fans, which are turned by the water-wheel, and thus the coffee is kept sweet and prevented from heating.

TOOLS AND MACHINERY.

THE tools requisite on a coffee plantation are as follows:

MAMOTIES, for holing, trenching, roads, and heavy earth-works.

STEEL HOES, for weeding and light work.

AXES, for felling timber, cutting logs and roots.

CATTIES, or bill-hooks, for cutting jungle and thorns.

GRASS-KNIVES, for cutting mânâ and other grasses.

HEAVY CROW-BARS, for road-work.

MINERS' TOOLS, do. do.

SPADE-BARS, for holing and trenching.

SPADES, for earth-work.

SHOVELS, for use in pulping house.

SLEDGE-HAMMERS, for road-works and breaking stones.

STONE-CRACKERS' HAMMERS, do. do.

CARPENTERS' and MASONS' TOOLS.

PRUNING SAWS and KNIVES.

CROSS-CUT SAWS and SHINGLE KNIVES, for splitting shingles.

MEASURES, of one, half, and a quarter bushel.

PICK-AXES, for road-works and cutting roots.

MANURE FORKS, for use in nursery, or loosening soil round old trees.

LANTERNS, for store and pulping house.

SCREW-WRENCH and KEYS, for unfastening bolts and screws of machinery.

WOODEN MATTA-PALLAGIES, for washing coffee; and

WOODEN SPADES, for turning over parchment coffee in store.

QUINTANIES, for trenching, road-work, and artificial manuring.

A large stock of picking and dispatching bags, koutti bags, manuring baskets, store baskets, hand-sieves for cistern use, cocoa-leaf sieves for sifting light coffee, ekel brooms, packing needles, twine, nails of sizes, oil for machinery, and lanterns, should always be provided before crop comes on.

It is always prudent to have spare sheets of copper ready punched in case of any accident to the pulpers.

Matting and hand-trays are required for drying coffee upon, in addition to the prepared barbecues. Two or three tarpaulins are also very useful for covering over coffee during the night, or when a sudden shower comes on before there is time to put it into the store.

Where large quantities of grass are needed for stall-feeding cattle, grass-cutting machines may be used with advantage.

THE MACHINERY requisite for separating cherry coffee from the husk are pulpers, which are turned either by hand, water, or steam power, and occasionally by cattle-mills. In Laborie's days, what modern planters now call the "rattle trap" was the only machine known; and it is saying a good thing for its inventor, that with some simple modifications it is still a general favourite. It is now

made with an iron in lieu of a wooden frame, the only wood used in its construction being that portion of the cylinder upon which the perforated or punched brass or copper plate is closely nailed with copper tacks. In the Appendix will be found Laborie's description of what a pulper was seventy or eighty years ago; and I also add a very interesting letter, lately published in the 'Colombo Observer,' which gives a very good description of the pulpers now in use.

Besides the original "rattle trap," or wooden pulper, with sieve attached, we now have "double iron pulpers," combined with crusher, circular sieve, and buckets on the dredging-machine principle, for returning the "tails" to the feeding hopper. This machine—first set up by Mr. A. Brown, engineer to Messrs. Worms, of Rothschild, Pussilava—is, as I have before observed, still the favourite; it, however, requires a very large and unfailing supply of water to drive this machinery by a wheel, which the introduction of steam-power will tend to remedy, for it is not on every estate that a sufficient quantity of water is procurable to work it by that less expensive process. The same principle governs all pulpers—*viz.* the cherry is crushed by a revolving cylinder against the upper chop, whereby the berry is detached from the skin; this or (as in some modern inventions) another revolving barrel draws the skin over another iron bar, placed against the punctured or roughened surface, thus separating the skin from the berry, dragging and causing it to pass behind the machine; while the coffee itself falls forward upon the sieve or into the spout leading to the circular sieve, where it is sifted.

The good coffee falls through into the drain leading into the receiving cisterns; the husks and unpulped berries which come forward are jerked on to the pulping-house floor, picked up by coolies in baskets, and returned to the hopper. Where there are buckets, they fall into the well through which the buckets revolve, and are thus drawn up and fall back into the feeding trough, to be again passed through the machinery. With Laborie's description, and the letter by "An Old File," it is needless for me to enter into any further description than to name the various modern pulpers, and say what my opinion is of them from personal observation, or state the remarks of others which I have heard made upon them.

In addition to the pulpers already alluded to, there are the following: Wall's pulper, Butler's pulper, Walker's disc-pulper, Gordon's breast-pulper, and Brown's vertical pulper. They are, I believe, all patented. The chief object of their inventors has been to do away with a sieve, by pulping the coffee free and clean of skins, and to admit of its being at once passed into the cisterns.

My experience of patent pulpers is, that they work fast, pulp cleanly, and without doing damage—conditionally on their being most accurately set, and the cherry coffee being perfectly ripe and of an even size. But should the least thing go wrong, they cut, squeeze, skin, and damage the berry to a much greater extent than the common pulper.

I agree with "An Old File" that Butler's pulper is the most perfect machine yet invented to pulp coffee without a sieve. I refer my readers to his remarks thereon.

Walker's disc, I believe, answers admirably for low-lying

estates and small native plantations, the coffee at those elevations being of a size suitable to the machine; but on high estates, the cherry being less even, it is apt to squeeze and skin the berry, but this might be remedied by having the grooves cut suitable to the size of the coffee. Mr. Chippindall, of Opalgalla, always spoke in favour of Wall's pulper, and I believe made some alteration in the position of the chop, which caused a marked improvement in the quantity pulped by that machine.

Gordon's breast-pulper works very fast, but it must be most correctly set.

Brown's vertical pulper I have never seen, but have heard it praised. For my own part, I think a crusher, two iron pulpers, and a circular sieve set in an iron frame, driven by a water-wheel of adequate power (fourteen feet diameter), sufficient for the purposes of an estate bearing crops of 2000 to 2500 cwt.; such a machine, correctly set and in good order, should pulp eighty to one hundred imperial bushels an hour, and would get easily through three hundred boxes in five hours. The advantages in favour of the old pulper is its simplicity, the easy mode of setting it, and its not being so liable to get out of order.

Wherever machinery is used, it is always prudent to have a spare hand-pulper in readiness to provide against a break-down, for cherry coffee cannot be kept long without getting heated; and when cherry arrives at the unpulpable state, the only way left is to dry it in the husk, but this is a weary and cumbersome process, and entails additional time, labour, and expense. Mr. Brown, formerly Messrs. Worms' engineer, was, I believe, the first to avail

himself of steam-power for driving pulpers: his example is now being gradually adopted, and will ere long become much more general. In preference to a stationary engine, the boiler of which has to be built in, I would recommend to the notice of planters the portable engines, now extensively used in England for ploughing and thrashing; their adoption would save the expense of building in the boiler, always a very expensive and nice process, which should be supervised by a professional engineer.

The portable engines are on wheels; they would need no protection but a light shed over them, and would stand outside the pulping house, the machinery being driven by a band attached to the large fly-wheel of the engine. The cost of an engine in London is, I believe, 80*l.* to 100*l.* The price of an iron water-wheel complete, and two iron pulpers with circular sieve, would be from 120*l.* to 150*l.*; but more correct information may be easily obtained on application either to London or local engineers.

The pulpers or crushers are fed from the cherry loft. An aperture two inches square is sufficiently large, and if the cherry coffee is well heaped over this hole it will feed the machinery unassisted for a considerable time; there should, however, be a cooly constantly on the watch.

Much saving in labour has of course been effected by the adoption of steam and water power, and the cooly has been saved the very laborious and wearing work of hand-pulping.

Pulping during the day-time is preferable to night-work, but it is customary on estates to work off the coffee as it comes in; so that the pulping-house coolies are sometimes

retained till seven or eight o'clock, for which they are paid at the rate of one penny per hour. In the old days of hand-pulping a tot of arrack was sometimes given in addition or in lieu of the cash payment; but I never adopted this plan, deeming it best not to encourage coolies to drink ardent spirits, though in the case of the "polleus" and "parriahs" such a precaution availed little, the love of drink being inherent.

THE ENEMIES OF THE COFFEE-TREE.

WITH coffee-planters, as with English farmers, there is seldom a season when everything goes right. Thus, if the crop is a good one, there are not sufficient coolies to pick it; or when there is a short crop, there are so many hands that one is puzzled how to employ them. At other times, scarcity and dearness of rice, exorbitant cart-hire, excess of rain or drought—all more or less tend to make the planter anything but a contented man.

In addition to the drawbacks enumerated above, the coffee-tree suffers from the attacks of various creatures of the animal and insect kingdoms. In its youth coffee is attacked by large grubs, which eat round the bark of the plants just above the ground, so that the stems break and the plants generally die off. Ashes and lime are sometimes spread round the tree in hopes of averting this evil, but with no very great success. I am inclined to think that coal-tar applied to the stem would be more efficacious in stopping the ravages of these insects, which are particularly destructive at the lower elevations, where the soil is light, dry, and quartzy.

Rats are at certain periods very destructive, particularly to young plantations, as they bite off the primary branches and leave the young trees like parrot-poles. As the ravages of these jungle rats are periodical, their attacks

upon the coffee plantations are attributed to the dying off, every seven years, of the "nelloo," a forest plant upon which they are believed to feed. A native told me rather a curious story, when I asked him if he could account for the attacks of these animals. He said that the rats feed upon the seeds of the nelloo, which seeds periodically; this makes them blind and forces them to travel downhill, devouring all that comes in their way, until they get into the paddy-fields, ravines, and streams, where they are drowned or killed in large numbers by the natives.

But the coffee-bug, of which there are two species, is by far the greatest enemy the planter has ever had to contend with. As Mr. Neitner, of Ferlands (a very good and acknowledged authority), has scientifically treated this matter, I cannot do better than refer my readers to his able pamphlet, and confine myself to the practical treatment of the subject.

The white bug—an insect so called from its colour—generally makes its appearance on the coffee-trees shortly after the blossom has set, during the prevalent hot weather of February, March, and April. It settles amongst the clusters of newly-formed berries, and gathers round itself a white glutinous substance, the effect of which is to rot away the stems of the young fruit, which fall off, and may be seen thickly strewn on the ground beneath the trees.

The black bug is an insect which attacks the leaves, fruit, and branches of the coffee-bushes, and seems to exist under a small thin shell, shaped somewhat like that of a limpet. The effects are to make the tree assume a black, sooty appearance. This is caused by a thin gauze-like

membrane which covers the leaves, which, if rubbed off, exhibits the green leaf beneath. The black bug has also the effect of diminishing the productiveness of the bushes to a minimum extent, only a few berries being yielded by trees in this condition; or, if it attacks a tree with crop already upon it, it causes a large quantity of the fruit to drop off. Black bug generally makes its appearance in swampy and sheltered nooks, and then spreads to the adjacent fields. The period over which it remains varies, but is generally supposed to be three years. Low-lying estates suffer less from black bug than those at a higher elevation, the cold and prevalent wet weather to which they are subjected making it less easy for them to shake off this dreaded scourge.

The best mode of driving away the black bug is to thatch the ground thickly with mânâ grass. Coal-tar applied to the roots is also a very good remedy, but to render it more efficacious it should be followed by the thatching process. The best mode of applying coal-tar is to scrape the earth gently from the surface roots, and sprinkle half a cocoanut-shell full over them, afterwards carefully replacing the earth round the stem.

Manuring is also good, for anything that will invigorate and give the trees strength to throw off this pest is of service. It is very curious that the mânâ-grass cure was not long ago discovered, but I can now vouch for its efficacy in this district.

In dry and low-lying districts, ants make their nests in the coffee-trees; they are very obnoxious to the coolies, and hinder the work, as their sting is very painful. The

red ant especially may be named: there is a tradition that the Kandian kings used to tie their prisoners, having first smeared their bodies with honey, over the nest of these creatures. Thanks to British rule these barbarities are no longer permitted.

My friend Sausmarez Le Cocq, of Ensalwatte Moorawa Korle, has suggested to me to number buffaloes as amongst the enemies of the coffee-tree: and most truly cattle trespass may be named as one of the annoyances to which planters have to submit. Estates situated near villages, and surrounded by pattena lands, are most subject to the encroachment of these animals.

The natives from time immemorial have been accustomed to let their buffaloes and black cattle graze on the pattenas untended, and in a semi-wild state. They think it very hard that planters should pound these animals when caught trespassing in the coffee. On the other hand, planters are justly annoyed at having their best trees ruined, and the Mauritius grass in ravines eaten and trampled upon; and are loud in their cries for redress. Sometimes a planter loses patience and shoots an animal, which at once sets the natives against him.

The only remedy at present granted by law, is to impound the cattle if caught, and to sue for damages in the police court—an expensive and tedious process. Licences of a month's duration may be taken out for permission to shoot after certain hours, but before they can be obtained the applicant must swear before the magistrate that the buffaloes are dangerous, and cannot be caught.

Government has no doubt found this a very difficult question, and this is why it has never been satisfactorily settled, for it seems impossible to satisfy both parties. Planters cannot in justice be expected to erect miles of fencing, or to cut miles of trenches to protect lands which were originally forest, and in that state not trespassed on by village cattle. At the same time the natives would deem it hard to be compelled to herd, and look after their own cattle, or to house them at night, as is invariably done with the cattle belonging to coffee estates. Let us hope that ere long some law may be framed which may accord to both parties the protection they justly can claim from Government.

If natives could but be induced to look upon the housing of cattle from a remunerative point of view, they might for their own benefit be induced to follow the example set them by Europeans. Planters would purchase the manure so accumulated, or would be willing to hire the cattle, paying a certain monthly fee per head, which I believe has been successfully carried out on a few estates.

THE MALABAR COOLY.

THE Malabar or Tamul cooly is an inhabitant of the southern part of India, known as the Carnatic. Those who resort to Ceylon come from the districts of Tanjore, Trichinopoly, Arandangy, Madura, Ramanadaporum, Palamcottah, and Tinnevelly. A few, speaking a different dialect, come from Travancore and Mysore; the former speak Malleyalum, the latter Cannareese.

Malabars have the same cast of features as Europeans, and vary in complexion from the deepest brown to a light copper-colour. They are generally very light, active, and supple; some of them are handsome, well-made men. Of the women, not a few are graceful and pretty when young, but age soon tells upon them; they then become the veriest of old hags, and are notable for their garrulity, the language of Billingsgate being quite refined compared with what these old crones indulge in; and it is one of the superintendent's hardest tasks to make them keep silence in the field, and stop their quarrelling in the lines.

The coolies who resort to Ceylon are of various castes. Those mostly preferred by planters are the low castes, such as "polleus," "shanars," and "parriahs," as being more accustomed to, and fit for, hard work; but as a class they are more given to drink, spend their money more freely, and are more quarrelsome than the higher classes, whom

their caste forbids to drink arrack or spirits, and who are more cleanly in their habits, better behaved (as fearing to lose caste), who have land of their own on the coast, and are more interested in working regularly and saving their wages to take away with them. Planters have—fortunately for themselves—not yielded to caste prejudice to the extent to which it prevails in India; and although the high-caste men cannot be persuaded to use the same cooking utensils or inhabit the same room, they will nevertheless live under the same roof, stand near each other at muster and in the field, and altogether fraternize to an extent they would not admit of in their own country. I have even known cases of high-caste men cohabiting with low-caste women, for which breach I believe they have sundry penances to perform and gifts to offer in the Ramissaram temple; but they cannot marry a lower-caste woman than themselves without being totally excommunicated and cast out. The fact that coolies to a certain extent give up some of their caste prejudices, when working on the coffee estates, may lead to the hope that, as years pass on and education becomes more general, the absurdity of this custom will become apparent to the people themselves, and so gradually die out.

Tamuls have not earned for themselves the character for gratitude and affection which has hitherto been freely yielded to the African negro, though late events in Jamaica may tend to alter the general opinion in that respect. Tamuls certainly very rarely show proofs of affection or gratitude, though they certainly in a manner attach themselves to some popular masters or favourite estates, but

I believe this is caused more from personal interest than real affection. Amongst themselves they often exhibit much selfishness and even cruelty, turning sick people out of the rooms into the cold night air, and abandoning their fellow-labourers when on the road from or to Ceylon. Happily these cases are becoming more rare, as the better accommodation and supervision, now provided on their route by the Ceylon Government, have tended to reduce these evils. Untruthfulness comes as naturally to a Tamul as mother's milk. No dependence whatever can be placed upon the statements of coolies as a class. If it is best for them to tell the truth they will do so, but if it is to their interest to lie they will do so quite as readily.

The religion of Tamul coolies is, in the main, the worship of a deity named "Muneandy." He is an evil spirit whom they occasionally propitiate by gifts and offerings, and by this means they believe they can keep themselves free from evil. Coolies acknowledge a Supreme Being, but they pay him no special regard, being more careful to propitiate a spirit that can do them evil than ask the blessing of one who can do them good. As regards conversion, very little has been really done, though every credit is due to the Church of England Cooly Mission for their sincere and earnest endeavours for the conversion of the coolies on the coffee plantations; but until a system of education is generally practised all over the south of India, and caste prejudices swept away, very few real and sincere conversions are to be expected. As there is an exception to every rule, so there is to this, and missionaries

will justly point to the district of Tinnevelly as the result of what has been and may yet be accomplished.

As a general rule, superintendents give every encouragement to the catechists of the Cooly Mission, who pay the estates periodical visits, by allowing them to preach to the coolies at morning muster, and by giving them free access to the lines; but as these catechists are few in number and the Mission funds inadequate to provide additional men for this work, much cannot be expected as the result of three or four annual visits. In due time, when funds are more abundant and catechists more plentiful, so that one or two may be appointed to each coffee district, the results may be more satisfactory; but I confess that I see little hope of any large numbers being truly converted while caste prejudices remain as powerful as they are at present.

I now proceed to give the result of my experience in the management of coolies. They may be compared to a lot of school-boys, ever ready to take advantage of the master's laxity in not efficiently looking after them; for they are naturally inclined to get over the day's work as easily as they can, and to talk and idle away the time in the field, unless efficiently supervised and a system of task-work generally adopted.

A method somewhat similar to the patriarchal system is, I think, most suitable for the management of coolies. Indeed, it is common for them to say to the superintendent of the estate they are at work upon: "Now I am in a foreign ('yellenga') country, you are my father and my mother, and must take care of me." Coolies are not

unreasonable beings; they are well aware when they have done wrong, and are quite content to receive the punishment they know is their due. It is an incalculable help to the superintendent to be able to converse fluently with his men; nothing tends more to win their respect and affection, as far as that is worth. The superintendent must be firm and strictly just, and willing to yield when yielding is the safest course to pursue; but he must be master in more than the name, and should endeavour to instil a fear more like that of a father over his children than that of a hard and selfish task-master, whose interests are foreign to, instead of in common with, his men. But he must at the same time be careful not to become too familiar with them. The advantages in favour of a superintendent who can talk the language are numerous. In the first place, he is able to give orders himself and to direct the work without the assistance of an interpreter; he is able to listen to the coolies' complaints, and can act as arbitrator in any serious disputes that may be brought under his notice; by this means much "going to court" is avoided, while the coolies themselves, being fully aware how well the master knows their tricks, are less likely to be troublesome. Thus everything, both in the lines and field, goes on happily and pleasantly.

Several letters have at different times been published in the papers by the well-known and esteemed writer "B.W.," and I may safely hold him up as an example of a good superintendent. His devotion and philanthropy are well known, and no estates in Ceylon are better managed or more plentifully supplied with labour than those under his

management. The best way to punish coolies is to stop their wages, by striking one or more days' work out of the check-roll. They feel the loss of money far more than corporal punishment, which I consider injudicious. A friend has told me that his mode of punishment was to keep the men longer at work, and that he found it answer.

The sanitary condition of coolies, while on the coffee plantations, I believe to be much more satisfactory than in their own country. They are better fed and housed, and have blankets ("cumblies") provided for them; many also purchase coats and other garments for themselves. On their arrival from the coast, fever contracted on the north road frequently breaks out among coolies, which by prompt attention is easily cured. For the treatment of this and other diseases common to the country, a series of "Medical Hints," compiled by the late C. Elliott, M.D., has been published in Ferguson's Ceylon Directory (and which may, I believe, be obtained in the form of a pamphlet), a copy of which should be provided on every estate by its proprietor. Fever, diarrhœa, and dysentery are the most common diseases to which coolies are subject, but they can usually be very satisfactorily treated by superintendents with the aid of the "Medical Hints" referred to.

On the estate on which I resided, I made it a practice of late years to employ one of the kanganies, whose duties were about the store, to take round medicine to the lines for the sick coolies three times a day. Being versed in the native practice, he not only quickly got into the way of knowing and giving the requisite medicines, but the coolies had confidence in him, and were far more willing

to take "master's" medicine when administered by him; and the results were most satisfactory, very few deaths taking place. In addition to this regular treatment, the estate was visited weekly (or more frequently, if necessary) by a native medical practitioner, who had been a pupil of Dr. Green, at Jaffna. He answered the purpose very well for the Pussilava district; and it would be well, in my opinion, if the practice were more generally adopted, and an hospital near the doctor's residence erected in each district, in as central a position as possible.

Though coolies are very fond of bathing, they are not as cleanly about their lines as could be wished; and the scavenger plan I have suggested in another chapter should, I think, be adopted on every estate.

Before concluding this chapter, I must not omit to point out to all new comers that the kanganies and coolies will, when a new master assumes charge, endeavour to gain ascendency over him; but he must be firm and just, and show no personal fear of them. The consequence of this will be, that they may strike and not work for two or three days, but the victory will rest with the master, for they will soon come to their senses when they perceive the material he is made of, and that—to use a vulgar expression—they "cannot come over him."

That coolies are less tractable and more difficult to manage than formerly is an undeniable fact. I attribute it to the advance system and the yearly addition to the already large number of coffee estates, which causes an increased demand for labour, the supply of which becomes proportionately deficient. In fact, coolies are beginning

to learn their value to the planter, and know that without their aid he cannot succeed. The advance system, now (when too late) universally abused, has been an immense evil, as putting planters completely into the hands of the conductors and kanganies, who have fed and fattened upon it; while coolies, who, previous to the custom, were content to quit their homes with the small sum requisite for their travelling expenses, now refuse to move under heavy advances, varying from ten to twenty shillings a head. Other evils subsequently ensue—the kangany often uses this original debt as a cloak for chicanery and extortion—the cooly is dissatisfied and works unwillingly, or, worse than all, runs away. I do, indeed, hope that planters will for once be unanimous, and all adhere to the proposal lately started by the Planters' Association, not to give advances above certain fixed rates. This plan, under present circumstances, is the only one that can be looked to, to effect a partial remedy and put an end to the abuses which, in most cases, are engendered by this baneful custom. As a rule, I feel confident that coolies are well and kindly treated on coffee estates; indeed, it is the planter's interest that they should be so, and, if anything, the fault has lately been to yield too much to the cooly, for fear of driving him to another property. As a consequence of this, the complaint arises of the increased cost of production, and of less work being done by the coolies than in former years. All this is very true, and had prices not risen proportionately with the increase of production, a return to the bad times of 1847–8 would have been the consequence.

Coolies' wages are now nominally eightpence per diem; but with kanganies' wages and the calculation for loss on rice, it is really much nearer tenpence per diem. What the result will be when all the new land that is being opened comes into full bearing, God alone knows. We must look hopefully to the future, and trust that the extension of railways will bring us labourers from more distant parts of India than now resort to Ceylon; and if that source fails us, we must do as Mauritius, the West Indies, and other colonies have set us an example, and import labour from more distant and expensive fields.

ESTIMATES.

UNDER this heading will be found three estimates, made out by three experienced Ceylon planters, who resided in different districts. Of these, one has had over twenty years, the other twenty, and the third ten years' practical knowledge of coffee-planting.

It will be observed that Estimate No. 1 does not set down the original purchase-money of the forest land, and perhaps justly so, because the price may vary from 1*l.* to 5*l.* an acre.

In this estimate the 200 acres are set down as being all felled, holed, and planted in one season. This is a consummation seldom realized in these times of scarcity of labour, except in very favoured districts; and even then it is in great part effected by Cinghalese contract labour. Twenty years ago it was thought nothing wonderful to fell and plant 300 acres in one season, and in 1845 as much as 600 acres were planted on the Delta estate; but such cases are no longer common, and it is now thought a very good season's work to get 100 to 150 acres planted.

The advantage of planting 200 acres the first year is shown by the large maiden crop of 800 cwt., which at once clears off 2600*l.* of the expenditure; whereas, in Estimate No. 3, only half that amount of crop is calculated for. Estimate No. 3 enters more into detail than No. 1;

but the results are very much the same when price of land, commission, &c., are added. Thus, Estimates Nos. 1 and 2 (allowing everything included) make the cost of three years 25*l.* an acre, and No. 3, 27*l.* 10*s.*, which proves the calculators are not very far apart in their estimate of the different items.

We may, therefore, come to the conclusion that a coffee estate, under ordinary circumstances, may be brought into bearing and all buildings erected for from 25*l.* to 30*l.* an acre; and that if all prospers as it should, the capital ought to be repaid in seven years from the commencement of the estate. My unprofessional readers must not, however, understand that I guarantee such a result; nor must they be dazzled with the very satisfactory consequence set forth in Estimate No. 3, for it is very seldom that estimates can be strictly adhered to; and circumstances over which planters have no control constantly happen, bringing down their castles in the air, insomuch that a great many properties, which at one time gave every promise of success, were years and years in repaying the first outlay, while many still remain involved. In addition to what I have said above, I should also point out that though a considerable extent of forest land is yet available, it is far removed from roads and means of communication; neither is there that selection which might have been had twenty or twenty-five years ago. It must also be borne in mind that year by year prices of food, labour, and materials increase, and that therefore the same results cannot be looked for. To myself but one great difficulty is apparent—that labour will not be

sufficient to meet the demands made upon it when the numerous estates lately planted, and which are still being opened, come into full bearing; and I cannot help expressing my anxiety, and questioning the wisdom of those who go on opening land in the face of this uncertainty.

No. 1.—ESTIMATE FOR BRINGING 200 ACRES OF COFFEE LAND INTO BEARING.

First Year.

				£.	s.	d.
Value of land, nominal.						
Felling and clearing 200 acres, at £2. 10s.				500	0	0
Holing, lining, and planting, at £3. 15s.				750	0	0
Plants	£100	0	0			
Tools	100	0	0			
				200	0	0
Lines	200	0	0			
Temporary bungalow	60	0	0			
				260	0	0
Roads	200	0	0			
Drains	300	0	0			
				500	0	0
Suckering	30	0	0			
Weeding	200	0	0			
				230	0	0
Superintendence				350	0	0
				£2790	0	0

Second Year.

Planting, topping, and suckering				100	0	0
Store and Machinery				1200	0	0
Completion and extension of lines	100	0	0			
Permanent bungalow	300	0	0			
				400	0	0
Repairing roads, drains, &c.				100	0	0
Weeding				200	0	0
Superintendence				350	0	0
Sundries				50	0	0
Carried forward				£5190	0	0

THIRD YEAR.

	£.	s.	d.
Brought forward	5190	0	0
Handling	60	0	0
Repairing buildings £50 0 0			
Spouting 500 0 0			
	550	0	0
Repairing roads and drains	100	0	0
Crop expenses—say on 800 cwt., at 10s.	400	0	0
Weeding	200	0	0
Superintendence	350	0	0
Sundries	100	0	0
	£6950	0	0
Less value of 800 cwt. in London, at £3. 5s.	2600	0	0
	£4350	0	0

REMARKS ON ESTIMATE No. 1.

Estimates depend upon so many things—the current rate of labour and contract work; the style of work done; the description of land, whether it be steep, rugged, and rocky; whether the soil be rich and climate forcing; and whether the situation adjoins weedy estates or abandoned cheena, &c.—that it is quite impossible to give an estimate which would not, in some way or other, be open to objection.

The majority of estates can easily be kept clean at 1*l.* per acre per annum, if a regular system of weeding is commenced directly the fields are burnt off. —— is now twenty years old, and has been kept perfectly free from weeds for this long period at the above rate per acre. But a low country estate with very rich soil, and surrounded by weedy cheenas and native gardens, cannot be kept perfectly clean for less than 2*l.* per annum. —— costs 1*l.* 16*s.* per annum.

On some estates, where soil is very fine and small holes answer, of course the cost of planting would be from 1*l.* to 1*l.* 10*s.* less per acre than I have calculated upon in the above, and roads in the same proportion.

No. 2.—ESTIMATE FOR THE BRINGING INTO COFFEE CULTIVATION 200 ACRES OF FOREST LAND.

First Year: *Sept.* 1, 186—, to *Aug.* 31, 186—.	£.	*s.*	*d.*
Purchase of 300 acres of forest land—say at £1 per acre	300	0	0
Government survey fees	50	0	0
Felling, lopping, burning, clearing, cutting pegs, lining, and holing (6 by 5), at £5 per acre; 100 acres	500	0	0
Filling-in holes, planting, and supplying; 100 acres, at £1 per acre	100	0	0
Purchase of 150,000 plants for planting and supplying, at 6*s.* per thousand	45	0	0
Making nursery and purchase of seed	10	0	0
Stone pillar and shingle lines, 60 by 20	70	0	0
Superintendent's bungalow	300	0	0
Conductor's bungalow	30	0	0
Loss on rice	50	0	0
Purchase of tools	30	0	0
Roads, 3 miles	45	0	0
Weeding 100 acres, from March 1 to August 31; six months, at 2*s.* per acre per month	60	0	0
Superintendent	100	0	0
Conductor	50	0	0
Contingencies	50	0	0
General transport	50	0	0
	£1840	0	0

Second Year: *Sept.* 1, 186—, to *Aug.* 31, 186—.			
Felling, lopping, burning, clearing, cutting pegs, lining, and holing; 100 acres, at £5 per acre	500	0	0
Filling-in holes, planting, and supplying, at £1 per acre	100	0	0
Making nurseries and purchase of seed	10	0	0
Stone pillar, one set, and shingle lines, 60 by 20	70	0	0
Roads, 3 miles	45	0	0
Planting grass	30	0	0
Weeding, 1st clearing for 12 months, at 2*s.*	120	0	0
„ 2nd „ 6 „ „	60	0	0
Loss on rice	70	0	0
Purchase of tools	10	0	0
Superintendence	150	0	0
Conductor	50	0	0
Contingencies	50	0	0
General transport	50	0	0
Carried forward	£3155	0	0

THIRD YEAR; *Sept.* 1, 186—, to *Aug.* 31, 186—.

	£.	s.	d.
Brought forward	3155	0	0
Superintendence	200	0	0
Conductor	50	0	0
Weeding 100 acres, at 2*s.* 6*d.*	150	0	0
,, at 2*s.*	120	0	0
Handling	30	0	0
Draining 200 acres, at 15*s.*	150	0	0
Stone pillar and shingle lines	70	0	0
Roads, 3 miles, at £15 .. .. £45 0 0			
Cart-roads 200 0 0			
	245	0	0
Pulping house, store, purchase and putting up of machinery ..	1000	0	0
Iron coffee-spouting	300	0	0
Purchase of tools	20	0	0
Loss on rice	100	0	0
Contingencies	50	0	0
General transport	50	0	0
Picking, pulping, and drying 400 cwt. off 100 acres, *viz.* 4 cwt. at 6*s.*	120	0	0
Transport to Colombo, 1900 bushels, at 1*s.* per bushel	95	0	0
Colombo charges: curing, 4*s.* 6*d.*; export duty, 1*s.* per cwt. = 5*s.* 6*d.*	110	0	0
Total expenditure	£6015	0	0
Loss: 3 years' loss of exchange on £6015, at 6 per cent. ..	360	0	0
Total expenditure	£6375	0	0
Less net value of 400 cwt. in London, at 67*s.* per cwt.	1340	0	0
Estate Dr.	£5035	0	0

Note. — The superintendence in this estimate is calculated as if the property was opened by the manager of an adjoining estate.

No. 3.—ESTIMATED EXPENDITURE TO PLANT 200 ACRES OF LAND WITH COFFEE AND BRING IT INTO BEARING.

	£.	s.	d.	£.	s.	d.
First Year: *September*, 1865.						
Purchase of 300 acres of land, at the nominal value of £1 per acre	300	0	0			
Survey fees on above	41	0	0			
				341	0	0
Nursery or Purchase of plants				50	0	0
***January*, 1866.**						
Superintendence, European, one year	120	0	0			
Allowances	40	0	0			
Native Conductor	50	0	0			
				210	0	0
***March* to *December* 31, 1866.**						
Felling, lopping, and clearing up 100 acres, at 50*s.* per acre ..				250	0	0
Holing 100 acres, at 25*s.* per acre	125	0	0			
Lining „ at 7*s.* „	35	0	0			
Planting „ at 9*s.* „	45	0	0			
Filling-in „ at 9*s.* „	45	0	0			
				250	0	0
Roads, 1 mile, at £50	50	0	0			
„ 2 „ at £15	30	0	0			
				80	0	0
Draining 100 acres, at 15*s.*				75	0	0
Weeding to December; 100 acres, at 20*s.* per annum				73	16	0
Buildings, *viz.*:—						
Superintendent's bungalow (permanent) ..	300	0	0			
Conductor's bungalow	60	0	0			
Stone pillar and shingle lines, 60 by 20 ..	100	0	0			
Rice and tool store	25	0	0			
				485	0	0
General transport				36	0	0
Tools and portable machinery				50	0	0
General contingencies				50	0	0
Loss by rice				50	0	0
Medicines and medical attendance				15	0	0
				£2015	16	0
Loss by exchange on £2000, at 6 per cent.				120	0	0
				£2135	16	0

SECOND YEAR: *January* to *December*, 1867.

	£.	s.	d.	£.	s.	d.
Superintendence, European	150	0	0			
„ Native	50	0	0			
Allowances	36	0	0			
				236	0	0
Felling, lopping, burning, and clearing up; 100 acres, at 50*s.* per acre	250	0	0			
Holing, lining, planting; 100 acres, at 50*s.* per acre	250	0	0			
				500	0	0
Roads, 1 mile, at £50	50	0	0			
„ 2 „ at £15	30	0	0			
				80	0	0
Draining 100 acres, at 9*s.* per acre	..	..	..	75	0	0
Weeding „ at 2*s.* „	120	0	0			
„ „ 9 months, at 1*s.* 8*d.* per acre	73	16	0			
				193	16	0
Permanent buildings, *viz.*:—						
One set lines, 16 by 20	..	..	..	100	0	0
General transport	50	0	0			
Tools and portable machinery	30	0	0			
General contingencies	50	0	0			
Loss by rice	50	0	0			
Medicines and medical attendance	15	0	0			
				195	0	0
				£1379	16	0
Loss by exchange on £1300, at 6 per cent.				78	0	0
				£1457	16	0

THIRD YEAR: *January* to *December*, 1868.

Superintendence, European	200	0	0			
„ Native	60	0	0			
Allowances	36	0	0			
				296	0	0
Topping and handling	25	0	0			
Supplying failures	25	0	0			
				50	0	0
Roads, 1 mile, at £50	50	0	0			
„ „ at £15	15	0	0			
Roads and drains, upkeep of	40	0	0			
				105	0	0
Weeding 200 acres for 12 months, at 2*s.* per acre	..	..	..	240	0	0
Carried forward				£691	0	0

				£.	s.	d.
Brought forward				691	0	0
Buildings, *viz.*:—						
Store, 120 by 30, three floors, iron roof, permanently built on stone pillars	£1000	0	0			
Pulping house, water-wheel, and machinery	500	0	0			
Iron coffee-spouting	250	0	0			
Set of permanent lines, 60 by 20	100	0	0			
				1850	0	0
Crop expenses, *viz.*:—						
Picking, pulping, and curing 400 cwt., at 6*s.* ..	120	0	0			
Transport of 1900 bushels parchment to Colombo, at 1*s.* 3*d.*	118	15	0			
Colombo curing charges on 400 cwt., at 4*s.* 6*d.* ..	90	0	0			
Export duty on 400 cwt., at 1*s.*	20	0	0			
				348	15	0
General transport	75	0	0			
Purchase of tools	30	0	0			
General contingencies	75	0	0			
Loss on rice	75	0	0			
Medicines and medical attendance	20	0	0			
				275	0	0
				£3164	15	0
Loss by exchange on £3100, at 6 per cent.				186	0	0
				£3350	15	0

RECAPITULATION.

First year's expenditure	2135	16	0
Second „	1457	16	0
Third „	3350	15	0
	£6944	7	0
Less value of 400 cwt. in London market, at 67*s.* net per cwt.	1340	0	0
Estate Dr., Jan. 1, 1869	£5604	7	0

WILLIAM SABONADIÈRE.

Remarks on Estimate No. 3.

This estimate has been framed for an old district, where timber is scarce and labour expensive. The average rate of cooly labour has been calculated at ninepence per diem. The price of 1*l.* is the nominal value of the land, that being the common Government upset price for waste lands; but as competition takes place at the kutcherries that price is usually exceeded, and 2*l.* 10*s.* per acre might be a more even average for the present cost of forest lands. Blocks of land do not always consist entirely of forest. Sometimes there is a large quantity of pattena or grass land attached (useful as grazing ground). Sometimes a portion of the land runs up to an elevation at which it is unwise to plant coffee; it is therefore only useful as a reserve for timber, and may in future years serve for tea or cinchona plantations.

The sums put down in this estimate for the construction of buildings and setting up machinery may appear excessive, and may be questioned by planters who have been able to execute the same works at a more moderate cost, but the framer prefers to be rather over than under the mark; and as every succeeding year enhances the value of labour and materials, it is perhaps as well that a liberal margin should be given under this head. For the sake of brevity, the writer has concentrated the entire cost of buildings within the three first years, the result having been the same in the end; but it is often customary to build only the pulping house to take in the maiden crop, it being temporarily arranged for the purpose, and to purchase only one hand-pulper, that being sufficient to pulp off the small crop usually looked for.

The above plan avoids the necessity of throwing the entire cost of buildings into one year, when the crop also is but a small one.

In this estimate, no mention is made of interest of money, which must of course be taken into consideration, and should be added to the total expenditure.

Loss on rice is now a heavy charge on the generality of estates. The nearest properties to Colombo suffer least: those farthest away often lose at the rate of four to five shillings a bushel. This loss is caused by the prevalent custom of providing coolies with rice at a given rate (now eight shillings per bushel), any excess in the price over that figure having to be borne by the estate. It is not deemed expedient to raise the price of rice to the cooly, as it would be compulsory to give him an equivalent increase in wages; it must therefore be hoped that the completion of the railway will give cheaper transport, and so enable that necessary "staff of life" to be landed on the estates at a more moderate rate than at present.

The result of this estimate is to show, that at the expiration of three years an estate of 300 acres—200 of which are planted, 100 acres two and a half years old, and another 100 acres one year and a half old—with all necessary and permanent buildings erected, would, after deducting the value of the maiden crop, represent to its owner (interest on capital excluded) a debt of 5604*l.* 7*s.*, or at the rate of 27*l.* 10*s.* an acre.

Under ordinary circumstances, the next three, or at most four, crops should entirely clear off this incubus; so that taking the planter's year from the 1st of July to the 30th of June, a property commenced in 1865–6 should be clear, at latest, on the 30th June, 1873, or at the rate

of seven years' purchase; and would then be worth, say from 12,000*l.* to 14,000*l.* in the market.

Note.—Since the above remarks were written, the export duty has been abolished. Rates of exchange have been more moderate, and no loss on rice has been sustained since 1868. Still Estimate No. 3 may very well be taken to represent the cost of bringing a first-class estate into bearing, all buildings, machinery, and spouting included.

APPENDIX I.

DESCRIPTION OF THE COFFEE-TREE, BY LABORIE.

The improvement and appropriation to our use of the productions of nature is the general object of culture, with a view both to increase the quantity and ameliorate the quality. But the science of culture is like the science of medicine. In both it is the general and particular object to assist nature, which, in such case, will gladly conspire with our exertions; but if thwarted, at least for a length of time and with rudeness, will be found rebellious. Hence, a proper study of the plant, the object of our care, demands our first attention. We ought to make ourselves familiarly acquainted with its origin, its progress, its decay, its temperament, its disposition —I had almost said its habits and inclinations. In consequence, I beg leave to expatiate on some circumstantial particulars relative to this subject.

The original reproductive sprout of the coffee-tree is in the seed. Thus, the bountiful hand of the Creator has multiplied it almost to infinity. Take a seed, and open its fissure or stigma, you will hardly perceive the sprout; it is, indeed, exceedingly delicate. If the seed is kept long in a state of siccity it withers into sterility, whereas, when it is green, it shoots out with wonderful ease and strength.

Let the seed, with its parchment, be laid only upon a wet soil—you will see it open itself a little. A pedicle peeps out, an extremity of which leans towards the ground. Here two radicals are seeking and soon grasp their nurse. The other extremity rears itself up, loaded with the whole seed. In a short time two follicles, almost round, and of a thin yellow colour, unfold themselves from the very substance of the seed, and shake off the parchment. The stigma or fissure seemed to mark their separation on the flat side of the seed, and on the round side they seemed perfectly blended together; but now they part of themselves. Thus, it is the seed itself which spreads out into these two follicles which turn green by the contact of the air.

From between them a small top rises. Its point is acute, and divides itself into two leaves of lanceolous form. The sapling rises again and again, still in the same manner, bearing its leaves two and two, or axillary, at equal distances, and every pair opposite to each other, above and below.

When the sapling has several leaves, the two original follicles fall. When it is about twelve or fifteen inches high, the boughs begin to make their appearance at the eye, close above the stem of the leaves. When these boughs, which originate from the trunk, and which may be distinguished as primary, have acquired strength, the leaves at their original fall.

The sapling rises, always bearing leaves, and afterwards boughs above them by pairs, or in axillary form and opposite. These boughs lengthen themselves in the same manner and proportion, and as they grow they always end as the trunk,

in a sharp point, which divides itself into two leaves, which also spread out a proper distance, and so on.

In their turn, secondary branches shoot out directly above every leaf of the primary ones. These make their growth as the former, and bear tertiary branches if the tree is luxuriant. Where that goes farther it is always in the same order.

Here a material observation is necessary, as it is, in a great measure, the foundation of the whole system of lopping or pruning.

The vertical sapling or trunk has been shown bearing its boughs, or primary branches, in opposite pairs, so that the inferior ones exhibit the figure of a cross with the superior—thus, the four branches spreading in four different directions; and this is necessary, that the tree be garnished all round without being embarrassed. Exactly from the same principle of avoiding encumbrance, the arrangement of the secondary and tertiary branches is different. They are all placed by pairs on both sides of the mother branches, so that all spread out horizontally, and with a direction, in some measure, towards the circumference. If any should grow upwards or downwards, they would become intricate, and the tree embarrassed. Nature makes no such blunders; and if such happen to be the unintentional effects of art, art must redress them, as we shall see in its place. It must also be observed that, the tree being in its natural state, two branches seldom grow from the same leaf or bud.

. Now, I suppose the tree to be about four or five feet high. The boughs near the ground will extend wider as they are nearer the source of vegetation, so that the shape of the tree is pyramidal. All those branches, of three orders or

more, garnish it richly; but, as all are horizontal from below upwards, all diverging from the centre more or less, all placed either at the four faces of the trunk (and these at distances at least eight or nine inches from each other at the same face) or both sides of the mother branches, the profusion of nature can neither be perplexed nor intricate.

That beautiful economy of nature must be remembered, and the accidental wanderings checked and repressed into that order; for a period will arrive when the hand of man must force nature from her common directions and arrangement. The redress of that wrong is the business of culture, as the article on Pruning will explain.

The coffee-tree is classed among the shrubs. Its natural height will seldom exceed fifteen or eighteen feet. The size of the trunk is proportionable, but being probably improved by culture, it is usually from two to five inches in diameter, in correspondence to the difference of soil. In infancy the primary boughs shoot out near the ground; but when the tree becomes fully grown it is probable they would fall, and the tree, if left to itself, would have the form of all others —that is, a naked trunk and a branchy head.

Confined to the usual height, the coffee-tree is one of the most elegant productions of nature. Its shape is that of a fine bush, pyramidical and luxuriant, without confusion. Its leaves are of a deep green colour, lanceolous, polished, and shining chiefly on the superior surface. Its blossoms, spreading a sweet, pleasing fragrance, are absolutely like small white jessamines, supported by short stems composed of a calix, four follicles, and a pistil, with its stamina lightly tinged with yellow, the whole upon a short stem. If they

happen to be blasted they fall immediately, burnt; but if the infant fruit forms a knot, then the flower falls to the end of the pistil, and remains there suspended, the pistil still adhering to the fruit till both are dried and fall together. The little green fruit grows on until it becomes yellow. As it approaches ripeness, it spreads itself over with red spots and streaks, which widen till the fruit is perfectly ripe, and of deep shining purple colour. Both the flowers and fruit spring forth in large clusters, going off from every leaf or bud and at the diverging of the branches; and in both states, nature is nowhere more profuse and beautiful in the variety of its colours and forms.

The coffee-tree is endowed, in an extraordinary degree, with vegetable life; being cut, it grows again in many sprigs. Its branches, cut and placed in the ground by either of their ends, have been seen to bear roots and leaves indifferently.

I saw one fallen from a height of thirty feet with its clod; it stopped on a road and there bore fruit for several years, and perhaps even now. The bark of the tree is grey, compact, and moderately rough; its wood is white, but hard, knotty, with very little sapwood and central pith. Underground, it has a pivot or perpendicular root three or four feet deep. The roots, at first large, end in an immense bulk of capillary fibres. If the pivot finds the quick-stone, gravel-stone, or clay, the tree will not last long; but it, as well as the roots, find their way through stony ground, and, if there is a good proportion of mould, suffer no inconvenience; nay, the tree may do better, as the stones keep the mould together.

EXTRACT FROM LABORIE'S REMARKS ON PRUNING.

It appears that because the trees have been stopped, and the heights to which the soil and the vegetative power seemed designed to rear them has been circumscribed, an impetuous and overflowing sap breaks out from all quarters. If nothing is done against this exuberance of vegetable juice, the trees in process of time will grow into a maze of entangled boughs, inaccessible to the genial warmth of the sun, and deficient in the ordinary powers of fructification. It is the business of the planter to check the excess of vegetation, and to assuage, so to speak, the wrath of offended nature, by a strict subserviency to her laws and original intentions.

I had carried in my plantation this plain natural idea a step farther, in strong grounds, and more particularly in the cool expositions. I plucked from the main boughs all the two secondary branches, next to the trunk, from above downwards. Thus, I diminished the quantity of wood, which in the centre is more exuberant. I thus formed round the trunk a large opening, through which air might circulate, and the sun penetrate even to the earth. Thus, vegetation was cherished, and moss, which arises from moisture, and is very hurtful, was produced in less abundance. Success had crowned my industry, easy and simple, when the revolt. . . .

God knows what is become of my poor trees, since the eye of their friend has been withheld from watching over them.

This does not entirely exempt the trees from the saw and the pruning knife, chiefly when they grow old; but the work will be short and easy where the preceding precautions have been taken, and it must be performed after every crop.

If a head is spoiled, it must be sawed. If any of the superabundant branches have been left through neglect, these must be cut off.

If a bough has been broken by accident, and if any branches have become spent and withered from too great a load of fruit, these must be pruned. In short, everything that is defective must be completely taken away, but without retrenching anything else.

The pruning of a bough of consequence will make a charm in the tree, if it is not otherwise made up. This may be effected by a kind of device, which I shall endeavour to explain.

A B D represent the bough, which is spoiled at its end. B D must be cut, the sound portion A B being preserved. The object in view is to make the former grow again, so as to furnish a circumference in the same direction, and as much as possible resembling that of the former bough.

For this purpose the bough A B D must be cut immediately above a knot, where two, or at least one, good secondary branch may be found, as in B.

Then cut the secondary branch so as to cut also the tertiary branch, and preserve the opposite tertiary, and then the branch will be in the state described by the Fig. 3. If, instead of tertiary branches, buds only are found, it is the

same thing. Cut off the branch and the posterior bud, and preserve the anterior, which will give out a branch. In both cases the bud or branch will contend with all the sap which was designed for the whole part cut off; the bough will again exhibit the proper figure, for it will reach in its turn the circumference, loaded with secondary and tertiary branches, and the crook will always tend to conform itself to the vacancy.

This ingenious and simple operation of nature, assisted by art, often occurs in full pruning, as well as in the present.

In both, if long branches interfere with the neighbouring trees, they must be shortened as much as is necessary. Moss and other parasitical excrescences must be removed.

Some planters, who have no idea of lopping regularly, content themselves, after the crop, to break the dry branches, but a careful husbandman will not imitate them.

After this operation, nipping may be necessary. When the above plain and easy practice has been neglected, the trees, particularly in strong grounds and cool expositions, grow into impenetrable thickets. Vegetation is entirely attracted to the summit by the air; there a mass of small branches makes a deep cover, which smothers the inferior boughs. These wither and decay if the tree is left long to itself. Then it exhibits the figure of an umbrella, bearing only a few cherries on the upper branches. If the exposition is still cooler, the tree loses its leaves, the end of the branches wither, and upon the whole the tree bears scarcely any fruit.

Great toil and great loss are the consequence of this neglect, for full pruning is the only remedy.

The saw and the crooked knife are the tools employed for this and the former operations. The small English hand-

saw, about two inches broad at the handle, is the best. The blade of the knife ought to be strong, at most an inch broad and five inches long, besides the fork, which must be pointed. The blade, for greater length and for other reasons equally obvious, ought to be of one piece with the handle. The master and the drivers have always lesser crooked clasp-knives in the pockets, to cut what occasionally falls under their eye.

Pruning is generally considered as the most arduous part of this culture. Why so? Because in general men, instead of seeking for a sure and simple principle—the consequences of which are obvious and easily applicable in practice—usually proceed by one routine or other; and as nature, simple and uniform in the principles of her proceedings, is extremely fruitful in sportive deviations when driven by art out of her own ways, routine becomes a difficult and embarrassing line of conduct. But when once observation has discovered the more general and systematic proceedings of nature, it is obvious to common sense and reason that the best means to redress her sportive wanderings and deviations is by conducting her gently to her more usual paths and her original forms. The means of succeeding are easily deduced from the same observation. It is for this reason I have insisted at large upon a natural symmetry of ramification, and upon the causes of deviation from it. In the application, therefore, of this principle, as may be collected from what has been said, it is obvious to common observation that pruning consists (and can, indeed, be allowed only to consist) in cutting off what deviates from natural symmetry, preserving what corresponds with it, and directing the vegetative principle to purposes of order, use, and regeneration.

I will not deny that this demands attention; but it is so far from being extremely difficult, that I had myself above thirty negroes capable of pruning trees, which they had learned by routine. As knowledge of a higher source cannot be expected from people of this description in the beginning, I sent five of them to work for a week at a neighbouring plantation; these succeeded pretty well, and taught to others those crude lessons which they had themselves learnt. Nothing was left to me but to direct their routine into the path of nature, from which, as I had observed, the negroes of my neighbour had not deviated.

It may be objected, and I by no means deny, that the great variety of grounds, of climates, and expositions may occasion differences. These, however, never alter the leading principle—namely, of conducting nature in her deviations back into the usual systematic path. They only affected the modifications more or less, and less than is generally supposed.

The tree is everywhere the same. Its nature, its shape, and temperament are all alike. The differences arise from foreign circumstances, such as soil, climate, and exposition. According to this short and easy system, pruning must be considered as the true medical aid of the coffee-tree; and it must be proportioned, I shall say, rather in the circumstances or local situation, than directed by supposed difference of temperament in the patient. Towards this the negroes must be particularly directed by an uninterrupted watchfulness on the part of the master. I return to the several applications.

But in sultry expositions and good ground, though it may

have been neglected, it will be still sufficient to clear the trees perfectly. First, whatever is rotten, withered, or broken must be taken off, always attending to the method of regeneration. Next, the gormandizing vertical and cross branches, as well as the supernumerary, and those which diverge from natural directions, must be plucked off, or cut if too strong. The spoiled heads must be sawed, but with great economy; the summit and the centre must be particularly laid open, to admit the sun and air. Lastly, if the tree be still too thick, some secondary branches, those which diverge most from natural direction, must be taken out, for the primary ought never to be touched; in this, as well as in the preceding operations, some mechanical rules must be attended to.

I come to the third and last degree of pruning, which must never be employed but in trees which are in cool aspects, and in the situation described.

Trees which require this process are in general so very thick and intricate, chiefly at the top, that the pruner is at a loss where and how to begin. The crown or top must be first cleared, by plucking all the small branches that abound in every direction. Next, crooked large branches, as they are met with, must be cut. Lastly, if the head is rotten it must be sawed, without sacrificing any of what is sound. This economy can never be too strictly attended to.

The whole tree is then easily seen, and what is to be preserved or cut will not escape the pruner's observation.

All the primary boughs which have kept their natural direction must be preserved for this reason, that once cut off they never grow again. However, if they are entirely

broken or spoiled at their rise, they must be lopped off notwithstanding. It is the same if they have taken a wrong or cross direction at their origin; but here, reserve and economy are necessary. If there is a single knot sound and well directed, and still more if there are two or four, these must be cautiously preserved. If the farthest knot be a secondary branch it must be treated. If it has not, it must be still left, for it will bear several twigs, the best of which may be chosen in the next operation to make up the main bough. Thus, all the boughs must be examined from above downwards, and treated as required.

Lastly, where the situation is exceedingly cool, and the trees are decayed into barrenness from the great overload of wood, all the boughs must be stripped of their secondary branches, both with a view to renew the first bearing ones, and to give a stronger direction to the sap; as also, if the extremities of the boughs are withered (as happens in the trees stripped of their leaves from severity of cold), or if they interfere with the neighbouring trees, they must be pruned and shortened.

As the operation of pruning ought, in all cases, to be made with economy, it is obvious that still more economy is necessary in rectifying the disorders of those trees which have lost their inferior branches, and are distinguished by the correct appellation of umbrellas; such are actually very deficient in wood, and pruning will diminish it still more.

I tried to replace those inferior boughs, by suffering a gormandizer sucker or two to shoot up as near the ground as possible, which I stopped under the umbrella. I hoped that these might have produced fine boughs; but whether

it was that the mother-trunk engrossed all the substance, or that the umbrella growing thick, smothered the suckers, these never answered my expectation. In cases where the tree was low I have suffered one to shoot up, which I stopped when it had four or six boughs. This succeeded only a little better; and those trials have satisfied me, that the best method (particularly where the umbrella is small) is to cut the tree close by the ground.

I now come to the manual dexterity of pruning in general.

1st.—In order to saw the trunk at any part, the saw must be managed with one hand and the trunk held fast with the other, both for the purpose of preventing the tree from being shaken too much, and to facilitate the working of the saw. The trunk must be cut sloping from above downwards, the oval surface of the cut facing towards the north, and very much inclined; in which case the sun will strike less forcibly upon it, and rain will more readily pass over, for if it enters into large cracks or fissures, it will hurt the tree extremely.

2nd.—The larger boughs, which cannot be conveniently cut with the knife, must be sawed and held fast in the manner above described. But in these cases, the saw should never be used where the knife can be employed. If a very large bough is gently bent down, and the cut made with an even quick stroke upwards, the power of the knife is surprisingly great.

3rd.—As the saw tears and notches the bark around the edges of the cut, both wood and bark must be dressed and pared with the knife. After this, the bark grows better, and the wound cicatrizes more rapidly round the cut.

4th.—In order to cut a branch, the branch must be held firm with one hand, and with the other the knife applied forwards and drawn steadily and quickly. If the cut is not performed at a first stroke, the stroke must be repeated in the same manner, still bending the bough gently, but being careful not to split it. Should this happen, the whole damaged part must be taken off; should the hand shake the business will not be well done, and the knife is apt to be notched, if its temper is too hard. The defect of the temper, however, is remedied by dipping the knives, for a short time, in boiling water.

5th.—In all cases it is necessary to cut very close. Thus, where a secondary branch is cut, let it be done very close to the mother-bough, more particularly behind the cut; and if it is wished to prevent the shoots from rising up in crowds, cut a little of the bark of the mother-bough round the cut.

When the tree is completely pruned, the moss and other parasitical excrescences are scratched from the tree with a wooden knife, taking care not to injure the bark.

A common negro can hardly prune, every day, more than thirty of those thick and overgrown trees; from which the tediousness of lopping, where several thousands require this operation, may be conceived. As the prunings are made, the bough must be cut in pieces and spread upon the ground, so as to occasion little incumbrance.

For the better performance of the work, care must be taken that the knives and saws be sharp, which must be effected by means of a grinding-stone and triangular file. After the business of pruning is over, the instruments must be collected together, rubbed with tallow, and kept for another year.

Where the choice is left, March, April, or May are the best seasons for pruning; the trees requiring a relief after the crop, which they find fully from the vegetation of the summer. It may, however, be performed in any season of the year, so that some planters appoint for this purpose alone a certain proportion of negroes, who continue the employment the year round, unless in the short times of full blossom. In general, however, the rapidity of crop admits of no other work being done at that time, the intervals being sometimes even too short to allow of weeding.

Upon the whole, when any branch requires to be cut, neither blossom nor fruit is of consideration, however unpleasing the havoc may be. Besides, the trees in general would be exhausted, or sink under the loads of fruit, if all their flowers came forward. If the fruit is ripe, the pruners begin to work two or three days before the reapers, who pick the cherries from the branches as they lie down upon the ground, and are still fresh.

A PAPER ON PRUNING, BY A MEMBER OF THE PLANTERS' ASSOCIATION.

PRUNING may be said to begin when the tree is topped, and can only be successfully carried out by carefully following up the two operations of hand and knife pruning. The topping of the tree, as is well known, were it allowed to remain, would very soon form the tree into an entangled mass, not to be easily regulated afterwards, unless by cutting the tree to pieces; and which, in some measure, assisted to wear out many a good old estate, in those days when it was a planter's boast to have "lots of wood." In olden times, I have seen a green shapeless mass, that you could not push your hand into, held up as a pattern of what a tree should be. To prevent this, coffee should be handled within a few months after topping, and before it has blossomed. However pleasing it may be to have a large virgin crop, it is more desirable to train and strengthen the trees for their first full crop; as also more profitable in the end, than if they had been allowed to overbear and check their strength when young.

To ensure a regular and strong tree, then, handling must be resorted to early. In doing so, take off all the branches that are within six inches of the stem, and make an opening of one foot in circumference in the centre of the tree. This, besides strengthening the primaries, will admit the sun and

air to penetrate, both of which are beneficial to the growth of the tree, as well as the ripening of crop. Next, run along the primaries and single out the secondaries, leaving no pairs but one secondary only at each joint, on either side of the primary alternately. This, I know, is thought very unnecessary by a large class of planters, but if they will only study the tree itself, they will find that although nature throws out the secondaries in pairs, almost invariably one is stronger than the other; and by a little care the strong ones can be left, and the weak ones taken off. It is better to look to the strength of the wood than quantity of it. As secondaries left on too near the stem tend to weaken the primaries, so do they when left in pairs, cramping, as it were, that expansion which takes place under the treatment I advise. To those who would wish to leave everything on for the virgin crop I would say, that I have known coffee trained under the above system give a virgin crop of 7 cwt. per acre.

To handle a tree well, it will be seen that it requires a great deal of care and attention, and should be done only with picked hands. Some, I know, differ from me, and think that anybody can prune. Perhaps they can pull off a quantity of wood, if that can be called pruning, but that is not always what should come off. In some instances, so little care is taken with what I consider the most important operation in coffee-culture, that all hands, including men, women, and children, are put on to handle at times when the weather is too bad to do anything else. Careful handling ensures, more than anything else, equal crops, instead of a large and then a small one. A properly-handled tree should never have more bearing wood than it can bring the fruit of to maturity, and

grow wood for next year. If too much be left, then all the strength of the tree is required to ripen the crop, and no young wood, or very little, is made; hence a short crop the following year. It is a mistaken idea to say, "I had a short crop last year, and so must leave plenty of wood this year;" or, "I must prune heavy this year, as my trees bore heavily this year." Of course you must, because your trees have overborne and have no young wood, but this is only following up a wrong system. The practice of handling, which I have endeavoured to explain, will ensure a strong tree, a good bearing tree, and one that will bear nearly equal crops year after year.

Now for knife-pruning. From what I have already said, it will be apparent that this process is made laborious, or otherwise, as the handling has been attended to. If this has been well done, that will be comparatively easy, and you will not have to think twice before you cut; only the wood that has borne has to be taken off, and there will be a sufficiency of young to take its place. With badly-handled trees it is very different, and becomes a puzzle to know what to cut and what to leave; in fact, you are inclined to cut it all to pieces, and call in the assistance of nature to reform your trees for you. I would not advise this cutting to pieces, even when a tree has overborne, but would rather prune it as lightly as possible, even at the risk of its being called "shocking pruning;" leaving as much old wood as is requisite to make young wood, and taking care of it next time. It is only badly-handled trees that are difficult to prune; and it is the handling, not the knife-pruning, that regulates the crops. It is also more exhausting to a tree to be allowed to run wild,

overbear itself, be cut to pieces, and grow up again to have the same treatment repeated, than it is to bear a good average crop yearly.

To the class of planters who say, "never cut a primary," I would add, "till it requires it." Generally speaking, primaries require cutting after the first full crop; not all, but the few of the lower ones that have become long and straggling, and are better to be shortened back to the first good secondary, which will then take the lead. A primary that is reduced, it may be, to a pair of yellow leaves at the point I should not cut—it will push out in time. If it is cut off short—say within two joints of the stem—and the circulation of sap thus suddenly checked in the hot months of January and February, the chances are ten to one it will die; and hence a scarcity of primaries so often seen. Leave it, if even it be dead at the point; it is more likely to recover sooner than if cut short. If coolies, who are otherwise most excellent pruners, are once allowed to cut primaries, they sometimes commit great mistakes by cutting close back to the stem, thus depriving the tree of its primaries altogether. In contradistinction to the "never cutting a primary" system, a theory prevails, the technical term of which I am ignorant, of nipping off the points of the primaries (to give them a set upwards, it is said), and thus keep the secondaries up from the ground. I do not think it has the desired effect, and would not recommend it for this reason, that I would never cut a primary till it requires it.

I have been induced to write the above few remarks on the subject of pruning, not so much with the expectation of giving as receiving instruction, by rousing a spirit of emulation

among Members of the Association, calling forth the experience of the body on this and other leading topics of coffee-culture, by which alone perfection is to be attained.

In offering the result of my experience to the Chairman and Members of the Planters' Association,

I beg to subscribe myself,

Their obedient servant,

W.

CENTRAL PROVINCE,
June, 1869.

COFFEE-PRUNING.

(From the 'COLOMBO OBSERVER' of June 17, 1861.)

THE natural coffee-plant differs as much from the artificial one as the wild crab-tree of the dingles from the apple trained on the south face of a garden wall. The natural coffee-plant differs in appearance with every variety of soil, climate, shade, or exposure; but in all its various forms its development is towards the strongest light, its ramifications never extend beyond stems and primary branches, and it is never exhausted by overbearing.

When nature is so provident for her own, why is it that the planter, with care, toil, and expense, imposes and maintains an artificial form on his plant?

The answer to this question is threefold: the artificial form suffers less from wind in exposed situations; the harvesting of the crops is rendered more convenient and less costly; and, other things being equal, the yield of the artificial plant is greater; though it is possible that this latter circumstance may be one of those things that everybody believes, while no one has ever been known fairly to bring it to the test of experiment.

The first operation in forming an artificial plant is to cut or pinch off the top of the stem. This is an act that declares a war with nature that admits of neither peace nor truce. The enemy immediately throws up, from under the highest pair of branches left, two or more supplementary stems, and

renews them as often as they are removed. The vigorous prosecution of the contest in this direction forces the sap back into the primary branches, and carries them out to an equal length of three feet from the stem. The demand on the resources of the plant for the elongation of the primaries ceasing, causes the sap to expend itself in the formation of secondaries, and in the management of these consist the art and science of coffee-pruning.

Nature arranges the primary branches of the coffee-plant with the most perfect equality in the distribution of light. Each succeeding pair takes a direction a few degrees from a right angle with those immediately below them; so that if there are twenty pairs, no two of them will be in the same vertical plane. This arrangement gives each primary branch a fair space and a fair proportion of light; but when the vertical development is stopped, the planter limits all his hopes to a space about three feet in depth by six feet in diameter; and as wood only bears one crop, there would very soon be no room for young wood unless the old was removed, because the secondaries, after yielding their crop, would produce tertiaries, these again quaderaries, and so till the whole became a complicated mass of twigs, covered with a verdant shell. The production of healthy bearing-wood takes place only where there is light and space; therefore, in managing the secondaries, the first thing is to strip the primaries of all that grows on them within nine or ten inches of the stem. This lets light into the centre of the plant, and carries the bearing wood well out, where it has more space than it would have nearer the stem. The next thing is to reduce the shoots, where they are doublets or triplets, to the one that has the

direction of growth nearest to an angle of forty-five degrees with the primary, and to the same horizontal plane; then equalize the numbers on each side of the primary, and finally, make the numbers on each primary equal. If the average crop of the land and the wood necessary to bear it be known, it will be easy to settle the number of secondaries to be retained on each primary; but if the planter is uncertain on those points, and has any fear of an exhausting crop, he will go over the plant before the flowering season and cut out to such an extent as will remove all danger of overbearing; because, if the first crop on the secondaries be an exhausting one, the plant is thrown into a bad habit of bearing a light and a heavy crop in alternate years, and this habit will certainly continue till the planter can assume magnanimity enough to reduce the bearing wood to such an extent as to enable the plant to yield an average crop and wood enough for another average crop within the year.

As soon as the first crop has been gathered from the secondaries, every one that has borne to the extent of becoming fit to produce tertiary branches should be cut out; indeed, if there is not an absolute deficiency of wood for the next crop, every secondary that has yielded crop on part of its length should come out. The operation is very simple and the work light, if no secondary is left to become older than two years. As soon after the pruning as the succession of young wood has shown the direction it takes, it should be thinned and regulated as in the foregoing season, so that there may be as little waste wood as possible. There is often much injury done by deferring this operation, both to the current crop and the following one, by the removal of a large quantity

of leaf at a time when the demand on the resources of the plant is daily increasing, and by allowing the most vigorous and rapid growth of the season to be frittered on a multitude of useless shoots, instead of directing it into the development of the proper number of well-arranged and well-directed branches. When a good system is once established it is easy to carry it on—the operations of one season are exactly those of another. The same description of wood has to be removed in the same manner and same season; and though there will be cases for the exercise of the judgment at all times, they will annually diminish in number and importance.

It is a simple enough thing to cut or pinch off the top of a coffee-plant; yet there are good and bad seasons for doing it, as well as good and bad ways. The stem and primary branches are the only permanent parts of the plant, and the only parts on which an original error will be permanently injurious. The stems should be firm and upright, and primary branches strong, equal among themselves, and standing firm at right angles with the stem. Nature has made no provision for renewing a primary that has been lost, consequently, the place it should occupy on the stem remains vacant, and so much space for disposing the bearing wood is lost. The case is very much the same if any of the primary branches be much weakened in proportion to others on the same plant; they never regain the ground once lost, and consequently never throw out into the space they alone can occupy their due proportion of secondaries. The most common cause of the loss, or weakening of the primaries, is an exhausting maiden crop—maiden being that which is borne on the primaries. The effect of an exhausting crop on

any coffee-branch is the contraction of the sap-vessels and the loss of the leaves. This extends so far that it will die and drop off, or it may be only so much that it will be thrown back in its growth, while such as have not suffered to the same extent leave it behind so far that it never recovers the lost ground. The loss of a primary branch is a loss that can never be remedied, and the same quantity of bearing wood can never be so conveniently arranged on the plant where any of them are wanting: a heavy maiden crop should therefore be avoided by all means. If the plant be topped at the beginning of or during the flowering season, the sap forced back from vertical development will rather be expended in the formation of blossom and fruit than in strengthening and enlarging the wood; the topping should therefore be performed after the flowering season is over. It is better to grow wood to be cut off and thrown away than to weaken and deform the plant by premature bearing. If the stem be topped immediately above the highest permanent pair of branches, there is some danger of splitting when the branches become heavy. This danger will be avoided by letting the stem run one joint above the highest branches left, and taking off the pair attached to it within the first pair of leaves. By this means the top of the stem will be strengthened, and as the suckers always spring from the highest buds left on the stem, their removal will be facilitated.

In cutting out the secondaries after crop, the cut should be made exactly at the junction with the primary, so that no stump may be left to turn the succeeding shoots out of their natural direction, or carry disease into the plant. For some time after pruning, the plant is full of sap and seeks an outlet

in every direction, expanding every bud and barking over every wound that happens to be in the line of the bark, but if a pointed stump be left, that must rot off before the bark can close over the spot; and in the mean time the hands of the labourers are cut by the sharp points, unless they exercise a degree of caution by no means favourable to the rapid progress of the work.

The quantity of wood to be left for an average crop depends entirely on the soil, climate, and situation of the particular spot. No rule can be laid down that is universally applicable as to the number of secondaries on each primary, but everyone may soon ascertain the point for himself by observation. At the end of the crop season, the plant should have an equal number of one and two year old secondary branches, the former to bear next crop and the latter to be cut out. If it is found that there are more of the former than the latter, it is certain that the past crop was less than an average one, and if all the young wood be left, the next will be above the average; if, on the other hand, the older wood predominates, the past crop has been a large, and the next will be a deficient one. The crops of each succeeding year will be equal when the old wood cut out and the young wood ready to blossom are equal, in number if not in length, at the time of pruning.

To have entered into all the details would have extended this article to a length for which my readers would probably not have thanked me. I think, however, that all necessary to understanding the system has been said, and so I bid the subject farewell, most likely for ever.

W. L.

MR. MOIR ON ESTATE EXPENDITURE.

CHILMARK, SALISBURY,
20th November, 1865.

DEAR SIR,

The subject of increased expenditure on estates is of such vital consequence to all interested, that no apology is necessary from anyone to take part in the discussion the Planters' Association has called forth by the offer of a prize for the best Essay on Reduction of Estate Expenditure. I hope the call will be well and ably responded to, and I feel sure that you will afford liberal space in your columns to any who prefer addressing you to striving for the prize. I have read Mr. Wall's letter, addressed to Mr. Rose, and published in the 'Overland Observer.' In offering a few remarks, I shall follow that letter as far as it will admit.

I am of opinion, with Mr. Wall, that the cooly has not participated in the increased average pay in the same proportion as kanganies. This alone points to the needlessness of the rise. As most kanganies have risen from the cooly ranks, it is unnecessary to pay them so disproportionately the moment they are promoted to kangany rank. The cause of this evil, as of most others—tending of late to an alarmingly increased expenditure—can to a certain extent be traced to the absence of combination among planters for the common good, coupled with a spirit of rivalry, and a recklessness of

expenditure* that did not exist in earlier coffee-planting. Any attempt to decide upon and agree to a scale of rates for a district is ignored, each individual evincing a determination to act independently of, rather than in concert with, his neighbour; one thinking he has a *spécialité* in any estate difficult to work, another has a bad road, another better men; and in each case a higher rate is the usual result. Others, failing to perceive the particular *spécialité*, follow; and so, up and up things go. No system, and no apparent responsibility.

In a worse degree does this apply to cart-hire, tavellams, and the pay of artificers, than to kanganies and coolies.

I am not forgetful of the natural laws of supply and demand, but I think rates are not seldom unnecessarily raised in the way I have described.

Conductors I dislike even the name of, and consider them necessary only when a superintendent has charge of more than one property, and his personal supervision is divided. Doubtless they were introduced with the era of coffee-planting made easy, and in too many instances are employed to do what the superintendent should do himself. It came to be thought a trouble, as well as *infra dig.*, to attend morning muster and to working details; and to such an extent was this carried, that anyone wishing to attend to his duties was pointed to and styled a kangany. All apparent responsibility was here again at fault, and conductors became general. In many instances ignorant of work, it is no wonder that work was both costly and badly done.

* An old friend who has lately visited Ceylon writes: "Extravagance has become a fearful rage."

Would planters now combine and agree to some average rates, they would do much to prevent further increase, though unable to effect much reduction. Reduction is more practicable by careful economical management—getting a day's work for a day's pay, checking extravagance, and working with a view to profitable returns—than the lowering of existing rates, unless where they are excessive, as in the case of twenty-five per cent. to kanganies. These might at once be safely reduced to a uniform rate of, say ten or twelve per cent. in the wages of their gangs; and where they are employed without a gang, a slight addition to the pay of a good workman would be ample.

Conductors dispensed with altogether except in cases as instanced, and when employed to be charged to superintendence. European assistants are a great difficulty, and often a great source of trouble and disappointment. That they must be employed by some is certain, or where shall our future managers come from? But those so doing do not always meet with the consideration they should.

It is well known, that for some considerable time after the arrival of a new hand on an estate he is worse than useless. The coolies, taking advantage of his inexperience, seem to take an especial pleasure in doing everything knowingly wrong, and where the young hand is left to himself, appear to be working hard in doing perhaps a fourth of a day's work. It is not to the interest of any employer to engage a young man for a shorter term than three years. In that time he may reasonably expect to be remunerated for the uselessness of the first portion by the usefulness of the last. The term used to be five years: I think three fairer; and any

young person ought to serve this gladly, if he will take into consideration the position he will attain then over those who, failing to fulfil their engagements, have sought promotion earlier. Were this kept in view, there would not be that hesitation to employ fresh hands that exists.

Employers have here also the remedy in their own hands, by refusing to employ anyone who has not honourably fulfilled his engagement.

In connection with too rapid promotion is one great source of increased expenditure. Persons are put in charge before they understand either the working of an estate or the management of coolies. The coolies, seeing this, at once become dictators, and settle both how much work they will do and what they shall be paid. There is a too prevalent idea that anyone can manage a coffee estate. The increased expenditure goes to prove the error—experience and ability are as necessary there as anywhere. It should not be within the province of superintendents to raise rates without a reference to their principals. The large agency houses* are especially to blame in this—that they leave every superintendent too much to do as he pleases, and as if without any control. This, I think, arises from a want of system and insufficiency of inspection. To carry out an efficient supervision more experienced visitors are required, to supersede the present system of one person travelling thirty to forty miles a day, and visiting a half-dozen or more estates. Have

* Agency charges open up a subject which can be left for adjustment to agents and their constituents. It is suggestive of note, how far their interests can be divided consistent with mutual advantages. For instance, the larger the disbursements the better are the agents' commissions. In other words, the agent gains by increased expenditure, the proprietor suffers.

fewer reports and more personal inspection—the inspectors really knowing what is being done, not interfering unnecessarily where not required, but guiding and controlling the inexperienced, consulting with all what to do, and seeing what is done—working by method, instead of confusion.

Thus would a check be put to what Mr. Wall fears, that "the coolies will soon be masters."

Contracts given indiscriminately are not to be encouraged, because superintendents are inclined sometimes to contract for what might be performed by the estate force, and hence all such contracts become increased expenditure. Weeding by contract I consider advantageous, as it can be both cheaper and better done than the superintendent can do it; it relieves him of a great drag on his time, and permits him to bestow more of his attention upon other works. I don't mean that I would give a contract to any man, or that any contractor can be left without proper oversight; but this will occupy a short space of the superintendent's time, compared with what would be requisite did he not contract. It is no more necessary to overpay a contractor than it is to pay a cooly for an inadequate day's work. Hence, if opportunity of loitering be withheld, there is no danger of a bad example. It is to the interest of contractors to weed clean, and they know it. I once had occasion to complain of a contractor being a day or two behind time (it was his first month), and his reply was, "Ah, sir, I am taking out all the kellingas (bulbous roots), and next month will be easy!" What day-labourer, I wonder, ever thought of making next month easy!

The rest of Mr. Wall's letter is taken up with the supply of coolies, which I think has kept fair pace with the demand;

and I can see no reason why we should not continue masters, which is the true way to keep down expenditure. Do away with middle-men, in the shape of conductors and head kanganies, whose interest it is to magnify their own importance with, and at the cost of, both master and men. Let the communication between superintendents and their coolies be as direct and easy as possible, and ask the latter which they prefer.

I am yours faithfully,

PETER MOIR.

ON THE MANURING OF COFFEE ESTATES.

To THE MEMBERS OF THE PLANTERS' ASSOCIATION.

GENTLEMEN, KANDY, *March* 14, 1857.

In addressing you on the important subject of the manuring of coffee estates, it is not my intention to propound any new theories, or to assume to myself the office of a teacher. I will simply lay before you the results of my experience, and would beg, in return, to have the benefit of yours. The subject is one of daily-increasing importance as the estates become older, and exhibit, more and more plainly, the symptoms of decay. It divides itself into three separate branches of inquiry, *viz.*:—

1st. What are our available resources for the purpose of manuring?

2nd. What amount of beneficial effect does each manure yield?

3rd. At what cost may that effect be obtained?

A complete answer to each of these questions would form a treatise, and comprise the whole art of manuring, as applied to coffee estates in Ceylon. Much more knowledge than I possess would be required to write such a work; but if each planter would contribute to the general stock the information he has acquired by his own observation and

experience, we should soon be in possession of a complete exposition of the subject, and one which would be a certain guide to all who choose to consult it.

The greatest obstacle we have to encounter, in pursuing our inquiries, is to ascertain approximately the amount of benefit produced by the application of manures. It is sufficiently difficult, in most cases, to find out the cost of procuring and applying the various manures; but that task is easy when compared with the trouble of proving clearly the nature and value of the benefit we derive from them. In almost every instance, the application of manure has been found to produce a perceptible improvement in the appearance of the bushes or in the amount of the crops; but I am not aware of a single instance in which the value of that benefit, or that increase of crop, has been reduced to figures. Even if we knew the exact increase of crop on the manured bushes, allowance must still be made for the effect of season, the influence of more frequent weedings, and other operations which usually accompany the use of manure. These considerations must be duly weighed before we can ascertain what share of the increase may be attributed to the manure itself.

The English farmer knows, or may learn, what is the most suitable and economical manure for the soil he has to work and the crop he wishes to produce. He knows to what extent his crops may be increased by certain tillage, and the cost at which it is procurable. In this he enjoys an immense advantage over us. It is one, however, for which he is much more indebted to accumulated experiences than to the aid of science. If we would emulate his success we

must imitate his example, observe more closely, calculate more carefully, and impart to each other more freely the results of our experiments.

The cost of manuring may be learned with more ease and certainty than its beneficial effect; indeed, as regards such manures as poonac, bones, &c., the computation of cost is exceedingly simple. The principal difficulty, unfortunately, occurs in regard to that most important of all manures, cattle-dung, the cost of which varies very much, according to circumstances. Some estates, situated on highroads, may obtain immense supplies of dung from the natives' sheds, for the mere cost of carting away; whilst other estates have to procure it by maintaining a costly stock of cattle, which have to be fed on grass, raised at a great expense on forest land felled for the purpose. Under circumstances so widely different, it is quite possible that the same style of manuring which pays handsomely on one estate might be attended by a ruinous cost on another. Hence the importance of knowing, with some degree of certainty, the value and cost of cattle manure, under all the different circumstances of our estates, lest, as has sometimes happened, we should unwittingly be paying for it far more than it is worth.

Our available manures are:

Cattle-dung.	Lime.
Bones.	Burnt Clay.
Poonac.	Charcoal.
Guano.	Pulp.
Superphosphates.	Prunings.
Salts.	Mânâ Grass.
Wood Ashes.	Composts.

CATTLE-DUNG.—It would be mere waste of time to descant on the virtue of this manure, its value being universally acknowledged.

Effect.—I believe that a cooly-load—that is, an ordinary basketful of cattle manure—applied to each tree in the usual way, gives an increase of crop varying from two to five hundredweight per acre, according to soil and climate; and its effect lasts from two to four years.

I have found that the disturbance of the soil, in making holes to receive the manure, has a very beneficial effect on the coffee-bushes; and in one instance, where my stock of manure was not sufficient for the land that had been holed, the part that had received no manure appeared to improve, for a few months, as much as that in which the manure had been applied.

Cost.—The cost may be classified under the heads of "Capital" and "Current Expenditure."

The capital consists of the following items:—

1st. The cost or value of land for grass.
2nd. The cost of planting it.
3rd. The cattle-sheds.
4th. The carts, grass-cutting machines, and tools.
5th. The purchase of the stock.
6th. The roads required for carting out the manure.

The current expenditure should be set against the current receipts, in a regular debtor and creditor account, which will include the following items, *viz.*:—

Dr.	Cr.
1. To Interest on Capital Account.	1. By increase of Stock Calves.
2. Maintenance of Grass-land.	2. Coolies' Wages and Carriage saved by the employment of the cattle for the purpose of transport.
3. Repair of Sheds, Roads, and Machinery, &c.	3. Fattened Cattle sold.
4. Loss of Stock by deaths and depreciation.	
5. Cattle-tending—that is, wages of cattle-keepers, drivers, grass-cutters, &c.	The balance will show the net actual cost of applying . . . baskets-ful of manure to . . . acres of land.
6. Medicines, Tubs, Ropes, Salts, &c.	
7. Application of the Dung—*viz.* making holes, carriage by coolies, filling up holes, &c.	

There is the strongest inducement for gentlemen interested in coffee cultivation to classify their expenditure on cattle-manuring as above, and to have the account of it strictly and regularly kept. I have already stated that the circumstances of estates differ very widely, and I have good reason to believe that their influence on the cost of cattle-manuring has not hitherto been generally appreciated. By the kindness of friends, I have seen many statements of expenditure under this important head; but hitherto, not one that was complete. In some the capital items were altogether left out, and in others omissions of almost equal importance occurred; and this not from any wish on their part to deceive or make a false statement, but from oversight and for want of a regular and systematic method of keeping the manuring account.

In filling up the foregoing form of account, each planter would leave blank such of the items as he does not need to incur, and would fill up those only which compose his actual expenditure.

Before concluding this part of my subject, I would suggest that many of us have hitherto used our coolies too much as beasts of burden, and allowed our cattle to live in indolence. I am persuaded that much might be done to economize cooly labour and cheapen cattle-manure by the judicious employment of our cattle.

I think the usual mode of applying cattle-dung is erroneous in principle. It is admitted that it has much to recommend it for its convenience; but those planters whose estates are thoroughly drained, and have therefore no need to fear from surface wash, would find great advantage in spreading their manure, and digging it into the soil.

BONES I have used extensively and successfully. If any reliance may be placed on chemical indications, bones ought to be a most valuable manure for coffee, as their chief constituent—phosphate of lime—enters largely into the composition of the coffee-bean.

Effect.—The effect of bones, unless they were fresh and full of animal matter, is not so perceptible in foliage as in fruit. The two most striking instances of the utility of this manure which have come within the range of my experience, were in two very different localities and soils. In both, the coffee-bushes used to become yellow as the beans began to fill up. The points of the branches failed, blacked, and died, with withered fruit on them. I applied bones, because I thought these effects were caused by the want of phosphates in the soil, and in both cases the evil was completely cured. The effect lasted for six years. I think the increase of crop produced by the application of half a measure of bones to each tree—that is, five hundredweight per acre—is about

two hundredweight per acre per annum on an average. It was, no doubt, much greater in the cases above mentioned.

Cost.—The price of bones in Colombo is generally about 3*s.* 6*d.* per hundredweight. They may be cheaply broken up to a suitable size—say one-inch pieces—by machinery, or reduced to powder by the aid of high-pressure steam, for about threepence per hundredweight.

The cost of application is very inconsiderable, as their bulk is small and they are easy of carriage. For these reasons they are usually employed in outlying and far distant parts of estates, where heavy manures would not be suitable. In such situations the cost of manuring would be about 45*s.* per acre—namely:—

Ten men to cut small trenches to receive the bones	at 8*d.*=14*s.* 8*d.*
Twelve men to carry and supply them and fill up the holes	
Five cwt. of bones, at 6*s.* on the estate	30*s.*

Poonac.—The effect of this manure on the foliage and growth of the coffee-bush is very surprising; but I have not found it contribute proportionately to increase the crop, nor is its effect very enduring. It is particularly valuable for bringing forward supplies, and for reviving old trees that have suffered from long neglect. In such cases, a year or more of time may be saved by its use.

Cost.—The cost is rather more than that of bones, as a larger quantity is usually applied; but the mode of application is much the same, and the advantage of portability is also nearly equal.

GUANO.—I have not employed this manure extensively, nor have I found encouragement to do so. I tried fine Peruvian guano in a liquid form, applied to the surface of the soil, which was loosened for the purpose of absorbing it. It was put under the bushes, but not near the stem, and afterwards the ground was strewn over lightly with weeds and prunings.

Effect.—The only perceptible result was a freshening of the foliage, which soon disappeared. I applied it at the rate of three hundredweight per acre, in rather dry weather, when there were only occasional light showers. I observed no increase of crop.

Cost.—The guano which I used cost about 12*s.* per hundredweight on the estate = 36*s.* per acre; but the expense of applying it in the liquid form was such as to preclude the possibility of adopting that method, otherwise than for experiment.

SUPERPHOSPHATE.—I have neither tried this manure nor seen it used by others; but I believe there are some members of the Association who could give us information, both as to its effect and its cost.

SALINE MANURES.—We have already an essay on the use and virtues of common salt as a manure, written by a well-known and much-respected member. I have had no experience of its use.

THE SALTS OF AMMONIA are very valuable, but their solubility, and the strong affinity for water they, as well as common salt, possess, make them particularly liable to be carried down below the reach of the roots, or swept over the soil by heavy rain, before they have had time to be absorbed.

Effect.—I cannot give you any information as to the amount of benefit to be obtained by the use of these salts, but I am of opinion that it is quite inconsiderable, when compared with their very heavy cost.

Cost of sal-ammoniac in Colombo is 35*s.* to 40*s.* per hundredweight. The waste and expense of application make its use extremely costly.

A much less volatile salt of ammonia—the sulphate—which would be more valuable as a manure and much cheaper, may be made by pouring sulphuric acid into the tanks where the urine of the cattle is kept.

Wood Ashes I have used with marked advantage. This manure possesses the advantage of being both cheap and abundant. As we use the ashes, they contain much soluble alkaline matter, which, in England, is almost always previously abstracted for the manufacture of soap. For this reason ours are particularly valuable, and cannot fail, when judiciously used, to give very beneficial results.

Effect.—I cannot state in figures the increase of crop obtainable by their use, but their composition is such as to assure even the most sceptical of their possessing a high value. Besides their fertilizing influence, due to the ingredients of which they are composed, they possess an active quality, resembling that of lime, for which they are a valuable substitute.

Cost.—Their cost depends much upon the skill employed in making them. Large timber, besides being heavy to cut and carry, contains but a small quantity of ash; whilst small twigs, which are much more easily procurable, yield a much greater proportion. In burning for ashes a strong

blaze should be avoided, as the draught it causes will carry away a great part of the ashes. A smouldering fire is every way to be preferred. I have manufactured wood ashes largely by contract at sixpence, and even as low as fourpence-halfpenny per bushel—that is, sifted ashes.

If used as a substitute for lime, they should be dug into the soil whilst they are fresh, and should not be left exposed on the surface. They should be applied in about the same quantity as lime.

BURNT CLAY has conferred a name on one of our best planters, from whose pen I hope you may soon hear of its virtues, much more clearly and accurately than I could describe them.

CHARCOAL I have used in various ways, in pulp-pits and manure-stacks, and as a filter for separating the mucilage from pulp-water, as it flows from the washing cistern.

Effect.—Its effect depends on its property of fixing ammonia, and will therefore vary very much, according to the circumstances under which it is employed. It is a great economizer of manure, and, as such, has a value peculiar to itself. It cannot fail to be economical and advantageous, when obtained at the moderate cost at which it is procurable in this country, and when used judiciously.

Cost.—The pioneers receive fourpence per bushel for making it, including the cutting as well as the burning of the timber.

It deserves much more attention than it has yet received from coffee-planters.

PULP is not very valuable nor very effective, but it costs nothing or next to nothing.

To make the most of it, pulp ought not to be left imbedded in a mass by the action of the water which conveys it to the pit, but should be stacked in layers with weeds and litter, and afterwards applied whilst decomposing.

PRUNINGS are a useful manure, and they not only cost nothing, but, if left unapplied, are so great a nuisance in stopping up drains, that it would almost pay to bury them, in order to put them out of the way. Their application involves no carriage, as they are dug in close to the spot where they lie. As it frequently happens that at pruning-time the coolies are anxious to return to their country, it would be found convenient to have the holes opened before crop-time, when labour is abundant.

The cost of burying prunings varies very much on different estates, according to the luxuriance of the bushes. The proportion of men burying to those pruning is about one to three on an average.

MÂNÂ GRASS is most useful, both as bedding for cattle and a litter to be applied on the surface of the soil. When used for the former purpose, its chief advantages are its abundance, and the facility with which it may be cut and carried. For the latter purpose I have employed it very extensively, and with widely different results. When applied to free soils that abound in vegetable matter, as those of Hunasgeria, it is scarcely of any use except to keep down weeds or to kill running grass; but on the cold, wet soil of Ambegamoa its effect is almost magical, exceeding that of a heavy dose of cattle-manure. I have applied it to a cold, heavy, yellow soil, in which coffee-bushes could scarcely exist, and where their scraggy branches had only a few small yellow

leaves on them, and the effect was most surprising. Not only were the trees soon clothed with fine dark green foliage, but even the soil appeared to be changed, and, to the depth of three or four inches, became friable and dry. How this change was accomplished, whether by the acids resulting from the decomposition of the grass, or by the protection afforded to the soil, I do not pretend to say, but I can speak confidently to the fact.

Effect.—The increase of crop obtained through the agency of this manure, in the instance above alluded to, was at least five hundredweight per acre.

Cost.—The cost of this method of manuring is much less felt on a weedy estate than on a clean one, because on the former it almost supersedes the necessity for weeding. The principal item of cost is the carriage of the grass. I have, therefore, restricted the use of mânâ grass to places within one hundred trees of the spot where the grass is grown. Under this system the cost of a heavy littering, in which each tree has a very heavy cooly-load of grass, is 35*s.* per acre. One such heavy littering, and two light ones of about 20*s.* per acre each, are sufficient for a year—that is, about 75*s.* per acre per annum for weeding and manuring. I am of opinion, that after two or three years of this treatment, the land would be able to bear several successive crops without requiring the assistance of litter.

The effect of surface littering is much increased by the digging up of the soil, previous to the application of the mânâ grass.

Composts have the disadvantage of requiring a great deal of extra carriage, the materials having to be first collected

together for mixture, and afterwards in most cases the advantage derived from the mixture is very trifling. Composts are very little in favour amongst practical farmers, who hold that the ingredients of which they are made up may be bought much more economically, and applied much more conveniently in a separate form.

Besides our manures, there are various other means by which our soils may be improved and economized, and which are deserving the attention of planters—such, for instance, as:—

Draining.	Terracing.
Digging.	Irrigation.
Open Trenching.	

Draining.—I have no hesitation in saying that surface draining is the most profitable operation in coffee cultivation. It not only directly accomplishes a most important object in preventing the washing away of soil by heavy rains, but it also prepares the way for modes of cultivation which would otherwise be impracticable.

It is surprising to see the indifference with which planters witness the loss of thousands of tons of their finest soil by the wash of heavy rains; and whilst they use the most strenuous efforts to improve their soil, they scarcely do anything to prevent its being carried away. True economy suggests that, whatever we may do to improve it, we ought at least to preserve the soil we have. Draining, if systematically and judiciously carried out, is an effectual preventive of wash, and may be done at 15*s.* to 20*s.* per acre, according to the nature of the ground. Scarcely any amount of rock needs to prevent the effectual draining of a field of coffee, if a right

principle be followed; neither will it be found necessary to alter the gradient for such obstacles. The best gradient I believe to be one in sixteen. All drains should be made to discharge themselves into the ellas, or natural streams. It is important to have them wide and flat-bottomed, that they may not be stopped up by stones; and they must be kept in order, which will cost about 3*s.* to 4*s.* per acre per annum.

The saving effected by drains is almost incredible. Let any sceptic satisfy himself of the quantity of soil that may be so saved, by taking a gallon of muddy water out of one of his streams during a heavy shower, letting it stand a few hours, and then drying and weighing the sediment. Then let him compute the number of gallons of water that have flowed along the stream in that state of muddiness, and he will find that several hundreds of tons of soil are not unfrequently carried off his estate by a single shower.

I have heard it objected against surface drains that they are liable to be stopped up and to cause great damage, but this objection has little or no force. Drains, when made, must be kept in order. The topping of a coffee-tree causes a dozen suckers to shoot out to supply the place of the amputated limb, and these have all to be removed; yet no one considers their appearance as an argument against topping the trees.

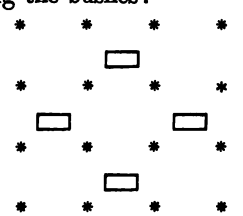
Digging is a most important operation, which can only be carried out safely and effectively on land that is well drained. It sets the roots free to find nourishment in the soil, and at the same time it helps to prevent wash by making the ground more absorbent.

Effect.—I have known the most striking and satisfactory results from digging. It stands to reason that hard soils, in

which the roots of the coffee-bushes are bound, must be much benefited by an operation which sets the roots free and makes the soil easily penetrable. A small field of coffee, which had been twice manured with very little effect, was made luxuriant by digging. The manure till then had been accessible to only a few of the roots, but the digging set all the roots at liberty to roam in search of nourishment.

The cost of this operation varies according to the nature of the soil, but on an average it is about 20*s.* per acre—that is, when done thoroughly to a depth of ten inches.

Open Trenching consists of making trenches, and leaving them open to receive wash, weeds, prunings, leaves, decayed wood, &c. The soil that is taken out of the trenches should be spread under the trees, to cover any denuded roots there may be. The trenches will fill up more or less quickly according to circumstances, and when filled fresh ones should be opened. They form reservoirs for much valuable matter, which would otherwise be dispersed and lost. The shape I prefer is 4 to 5 feet long, 15 to 18 inches deep, and 12 to 15 inches broad; but these dimensions are subject to modification, according to the steepness of the land and the character of soil. The trenches should always be made longitudinally across the face of the hill, and not vertically, or up and down. I usually make one such trench to each alternate bush thus, the dots representing the bushes:—



The cost of open trenching depends on the nature of the soil and the size of the trenches; but, on an average, they will cost, when made of the dimensions above recommended, about 20*s.* per acre in old land, where the large roots are decayed.

In considering the cost of open trenches, it should not be forgotten that they afford a very convenient means of burying weeds and prunings, and save the cost of those operations altogether. Moreover, they effect a considerable saving by detaining stray leaves, &c., and preventing their rolling into and choking the drains.

Draining, digging, and open trenching, if done carefully and consecutively, will entirely prevent the loss of soil by wash, and will form a most efficient and economical basis for all future manuring operations.

TERRACING has been tried, I believe, extensively and with the most satisfactory results by one of our members, who I hope will favour us with an account of his operations.

IRRIGATION I mention only to express a hope that the gentleman who has carried it out so extensively may soon give us the result of his experience of it.

I conclude by expressing my sincere hope that these brief observations may prove useful and acceptable.

I am, Gentlemen,

Your most obedient servant,

GEORGE WALL.

LABORIE'S DESCRIPTION OF A PULPER.

It is the first operation to strip the seed of its outer skin, leaving it clad with the parchment; and this must not be postponed, because the cherries, when heaped together, are disposed to run speedily into fermentation; in consequence of which the pulp may, in twenty-four hours, impart a yellow-brown tinge to the seed.

This is called to grate ("grayer," in the Creole-French idiom), because it is performed by a grater-mill, of which I shall try to give, as far as I can, a clear and full description.

First, the cherry coffee is laid upon a floor above the mill, from which it falls, by little and little, into a hopper. This being either sufficiently inclined or put in motion by the mill, drops the coffee into a grater. The structure of the mill is as follows:—

It is supported by a strong wooden frame, three feet high, six in length, and about two in breadth. The principal pieces are a roller and grater, two moveable pieces or chops, a wire grate, and a leaping frame.

The roller is supported, at the fall of the hopper, by an iron axle-tree running through its centre, which turns rapidly by means of two handles upon two copper poles, fixed upon the sides of the great frame. The wooden roller is commonly fourteen inches in diameter, and about eighteen

in length. If it is large, as in water-mills, the diameter is less.

The middle sixteen inches of the roller are carefully covered with a strong plate of copper, pierced as a grater with a strong bodkin, so that every hole has, on the outside, three or four sharp points or asperities: the grater being accurately nailed upon the roller, all the asperities are turned outwards.

Moreover, five strong wooden pegs are fixed at equal distances, at each end of the roller, round the axle-tree.

The moveable pieces or chops are two pieces of wood; one is superior, the other inferior. They are fixed in the great frame or support by their ends, which are square; and by means of wedges, they (the chops) may be placed somewhat nearer to or farther from the roller. The middle part of the chop, opposite to the grater, is cut in a sloping direction; and their edges, near the roller, are armed with a band of steel, about a line thick and nine or ten broad, between the points.

Now the sloping surface of the superior chop falls towards the roller; that of the inferior falls, on the contrary, backwards, and upon the wire grate placed under it. The edge of the superior slope is placed at such exact distance from the roller that the cherries are bruised, without injury to the parchment; the seeds are suffered to pass, and finding their way through the interstices between the points of the grater, the skins and seeds then meet with the edge of the inferior slope too, which is so close with the grater that the seeds cannot pass. They must, of course, fall back through the sloping declivity upon the wire grate or sieve; but the skins,

which have been flattened, are besides entangled by the asperities of the grater, pass between it and the inferior chop, and fall into a gutter behind the mill.*

All the pieces before mentioned must be of mahogany, or other wood, of the best quality. The wire sieve is stretched upon a square long frame, and the holes are of such dimensions as to let the naked seeds pass. It is much inclined, and hangs by the crooks at the great frame and by the rods at another similar frame—namely, the leaping frame, which hangs also by its middle from the stirrup, and from the great frame of the mill. By means of the two arms of the leaping frame, which are stretched out on both sides of the roller, the wire-grate sieve is put into brisk motion by the pegs fixed to the roller, by which means the arms alternately sink and rise.

Thus the seeds fall through the holes of the sieve into a gutter under the mill, the slope of which causes them to glide into the adjoining basin, where they will soak and be washed. The cherries which happen not to have been bruised, being too big to pass through the sieve, are tossed about till they fall down at the back end of the mill into a box, from which they are taken and put again into the hopper.

The grater-mill is liable to inconveniences. If some of the points of the grater are sharper than the others, they bruise the parchment and the seed, which will leave a black mark. If anything hard, as a small stone, happens to crush down any of the points, the cherries that meet them will not be bruised; or, if they have been bruised, they will pass out

* These skins, kept and rotten, are the best possible manure.

with the skins behind, and consequently be lost. This must be prevented by great watchfulness on the part of the negroes; and when it does happen, the grater must be instantly mended or changed.

It is also evident that the chops must be exactly placed at the proper point. If the upper one is too near the grater, the seeds will be injured; if too far, the cherries will pass out unpeeled. If the upper one is too far the seeds will pass out; but this can hardly be too near, provided it does not injure the points of the grater.

It is further necessary that a thread of water trickle constantly upon the grater, to assist the coffee in passing more readily.

Eleven negroes are required for the service of a mill: eight to turn—four and four alternately—one to be upon the floor to feed the hopper, one to carry away the skins, and another to carry back the unpeeled cherries into the hopper. This hard work is performed in the evening, when the negroes return from the field, but they like it because it is rewarded with a small glass of rum.

A good hand-mill, such as that above described, may pass thirty-three barrels of cherries in an hour. But I shall speak afterwards of the mill or water-machines, which have been very usefully and ingeniously employed in the manufacture.

ON COFFEE-PULPERS.

To the Editor of the 'Colombo Observer.'

Dear Mr. Editor, Kandy, *November* 4, 1865.

It is a time-honoured custom at this season of the year to have a discussion in your columns relative to the merits of the various coffee-pulpers in use, but this year everyone seems so absorbed in League and Anti-League movements as to have forgotten all about pulper grievances. I have just thought of them, and beg to open the question, trusting that those interested will take up the subject and keep it alive until thoroughly ventilated. Of late years many improvements have been made to our pulpers, but there is still room for more improvements, both in principle and detail; and if planters of experience could be induced to sit down and record on paper the advantages and disadvantages of the various machines they have taken in crop with—giving particulars of the system of feeding, quantity pulped per hour, percentage of cut coffee, description of machine, and any contrivance invented to facilitate work—they would not only instruct the griffin, but might receive a wrinkle in return from some brother-planter, and at the same time give hints to the engineer for the construction of his new machinery.

We have now the combined crusher and pulper, with buckets and circular sieve (commonly known as Brown's double pulper), the rattle-trap, Butler's pulper, Walker's disc

pulper, Wall's pulper, Brown's vertical pulper, and Gordon's breast; all different in design and management, but the same in principle. The cherry is crushed by a revolving cylinder against a piece of iron or other substance, whereby the berry is detached from the skin; then this or another cylinder draws the skin over an iron bar placed against its roughened surface, thus separating the skin from the berry, on the principle that a mouse will go where a rat can't enter; and the question of which is the best pulper resolves itself (according to our present enlightenment) into the most effectual arrangement of crusher for detaching the berry from the skin without injuring the berry, and the best arrangement of the iron bar and surface of cylinder to separate the skin from the berry, without giving it a touch in the passing.

The double pulper is the favourite machine, but it requires a large amount of power to drive it, and a large supply of water to work it after it is driven; and on estates short of water this is a serious objection. The introduction of steam-power remedies this to a certain extent, but it would be a great advantage to obtain the same results from a less cumbersome machine, requiring less water and more easily driven. I find the double pulper work best with a good deep upper chop, say about three inches deep and nearly straight, the top of the lower chop to be filed flat about one-eighth of an inch. The speed of the cylinder should be about one hundred revolutions per minute, but the working of the machine depends a good deal upon the action of the sieve; and it is a question whether a long crank with a slow regular motion, or a short crank with a quick and rather jerky motion, is the best. So far as my experience goes, I prefer

the latter for getting through the work. The great desideratum is to get rid of the sieve and buckets altogether, as they are not only heavy to drive, but subject to derangement, and therefore inconvenient and expensive.

The Butler's pulper is, in my opinion, the most perfect machine yet invented to pulp coffee without a sieve; but unfortunately it is not appreciated as it deserves. The cylinders are allowed to wear blunt, the edges of the chops to be ground away; and because some trace of the grooves on the small cylinder remains, the owner is surprised that it will not take the tails away or squashes the berry against the worn-out chop, gets disgusted with it, and throws it on one side. To make a Butler work well, the grooves of the small cylinder must be brought up to a sharp edge on the periphery, the chop filed square across and sharp at the edges—they cannot be made too sharp; then adjust the distance between the cylinders to the size of the cherry, so that the berry will be squeezed out of the skin without being injured; then screw up the chop until just clear of both cylinders. Wherever I have seen these conditions complied with, this pulper has given every satisfaction. There may be room for many improvements in the details of the machine, but it must be borne in mind it remains just as Mr. Butler left it when he died—a fatherless pulper, which no one was interested in or particularly cared for.

Mr. Walker's disc pulper is the next machine for pulping coffee without sieve or buckets, and where the coffee is fairly ripe has given, I believe, splendid results; but dry and green berries are apt to get skinned or torn to pieces. The latest design of this pulper has a crusher attached, and it will be

interesting to know the results of this addition to the machine, which cannot fail to be an improvement. I am not aware of any peculiarity in setting this machine, beyond seeing that the discs run true, that the lower plate of the chop is straight, the depth of the groove suitable for the coffee, and above all that the chops are fairly screwed down to the plate, so that the coffee may not press them away from the surface of the discs. The manager of a large estate in Kotmalie contrived a disc with grooved sides, but has not, so far as I know, made the results of this and other improvements public.

Wall's pulper is the best we have for working off tails; and, connected with a good crusher and sieve (as at Opalgalla), is equal if not superior to the double pulper and crusher, seeing no buckets are required. Still there is the sieve, and the machine is just as unwieldy as the double pulper and crusher.

I have not seen Mr. Brown's pulper at work, and cannot say anything about it; but the last of the category—*viz.* Gordon's breast—is the most extraordinary machine of all. I have known it pulp at the rate of one hundred bushels per hour, and not cut more than about half per cent.; and another planter, with a similar machine, could only get through about thirty bushels per hour, and cutting then about seven per cent.

The iron cylinder is a great improvement in this pulper, as there is great difficulty in keeping a wooden cylinder to fit the breast; and it is much easier to fit the breast to the rings cast on the rims of the cylinder.

Yours faithfully,

AN OLD FILE.

COFFEE STATISTICS.

In the ten months ended 31st of October, 1865, 107¼ million pounds of coffee were imported into the United Kingdom. In the corresponding period of last year, the quantity was not so large by 14¾ million pounds. Of the total imports, Ceylon contributed 68 million pounds, other British possessions 18½ million pounds, Brazil 9¼ million pounds, Central America 4¼ million pounds, and all other foreign countries 7¼ million pounds. The quantity on which duty was paid in the first ten months of this year amounted to 25¾ million pounds, which is a diminution, in comparison with last year's returns for the same period, of 772,869 lbs. A gradual decline in the consumption of coffee has taken place within the last four or five years, and is attributable in part to the greater demand for chicory, and in part to the increased liking for tea. Of chicory it may be observed, that last year 99,564 cwt. were entered for duty, whereas in 1862 the amount was only 9883 cwt. notwithstanding that the rate of duty had increased in the interval from 12*s.* to 12*s.* 6*d.* per cwt. The quantity of coffee exported from this country in the same months of this year was 82 million pounds, or nearly 17 million pounds in excess of the shipments for the like period in 1864; Holland, France, Hanse Towns, Russia, Prussia, Belgium, Italy, Austria, and Turkey having been the principal customers. In the bonding receptacles, the stock on the 31st October last was 30¼ million pounds, or about four million pounds less than on the same day in 1864.

PLANTERS' ASSOCIATION.

Report of Sub-committee on Manuring Questions.

THE Sub-committee appointed in October, 1868, to consider "the Manure Question" beg now to come forward with an account of their labours, and though the result of their inquiries may not be so satisfactory as might have been expected, yet they trust that their efforts have not been in vain, and that these preliminary inquiries will be the means of drawing attention to so important a subject, and induce those engaged in manuring operations to keep more careful records of their work than seems to have been the case hitherto.

Your Sub-committee issued in October, 1868, to the members of Committee, for circulation in their respective districts, a series of questions bearing on the different points on which information was sought. Of these lists of questions 152 were printed and circulated, but it is a matter of regret that the Sub-committee have only been favoured with 25 answers from the following districts:—

Ambegamoa	3
Badulla	1
Dumbera	3
Hantana	4
Hewahette	1

Kadugannawe	1
Kotmalie	2
Kornegalle	2
Knuckles	2
Pussilava	4
Saffragam	1
Uda Pussilava	1

The reason for this your Sub-committee are led to believe arises not so much from an unwillingness to give information, though it is the case in some instances, as from inability to give accurate information for want of proper records.

That manuring operations have been carried on extensively for a number of years there is no possible doubt, but from various causes till very recently no authentic records seem to have been kept of the nature of manures applied, the cost of same, and relative effects, and the Committee are therefore met with difficulties at the outset in arriving at conclusions for want of sufficient data.

Description of Manure applied.—The manures generally applied as collected from the reports sent in seem to be the following:—

1. Cattle-manure.
2. Pig-manure.
3. Poonac and Bones (in proportion of 2 to 1 in weight).
4. Bones and Guano.
5. Pulp.
6. Pulp and Line (Line Manure or Lime?).
7. Cattle-manure and Pulp.

8. Bones and Pulp.
9. Bones, Pulp, and Guano.
10. Eureka.
11. Guano: Peruvian, Bolivian, Bird Island, and Phospho.
12. Sombreorum.
13. Fish.
14. Ashes.
15. Animal Charcoal.
16. Phosphoric Potash.
17. Sal-ammoniac and Poonac.
18. Sulphate of Ammonia.
19. Dissolved Bones and Swamp Soil.
20. Cuera.
21. Composts, Leechman's.
22. Do. Cattle-manure, Bones, Pulp, Coffee-husk, Mânâ Grass.
23. Do. Vegetable Matter saturated with diluted Sulphate of Ammonia.
24. Do. Poonac (1 cwt.), Bone-dust ($\frac{3}{4}$ do.), Bolivian Guano ($\frac{1}{4}$ do.).
25. Do. Cattle-manure, Pulp and Mânâ Grass, and Rubbish.
26. Do. Pulp, Line Manure, and Mud from Drains.
27. Do. Poonac ($\frac{5}{8}$), Bones ($\frac{3}{8}$), Guano ($\frac{1}{3}$).

Application. — The mode of application seems to be to place the bulky manures in holes varying from $1\frac{1}{2}$ feet × $1\frac{1}{2}$ feet to 2 feet × 2 feet in the square, and in depth from 6 inches to 18 inches; and about 6 to 18 inches from the stem of the tree; the artificial manures being placed in smaller

holes of less depth. On one estate the plan seems to have succeeded of placing a large quantity of pulp (5 baskets) in a hole cut in the space between every four trees, at a cost of 9*l.* per acre and a yield of 18 (?)

Quantities.—The quantities of several manures seem to be as follows:—

Phosphoric Potash, ½ lb. to a tree; Bone-dust and Poonac, ¾ lb. to 1 lb. per tree.
Leechman's, ¾ lb. to 1 lb. per tree.
Cattle-dung, 1 basketful to 3 baskets (30 lbs.).
Sombreorum, 4 to 7 oz.
Bones, ¾ lb. to 1 lb.
Cuera, ¾ lb. to a tree.
Composts (*viz.*) Pulp, Lime, and Ravine Soil; ⅓ lb. Lime, 1 bus. Pulp, 1 bus. Ravine Soil.
Do. Dissolved Bones (1 lb.) and Swamp Soil (1 basket).
Do. Bolivian Guano (½ lb.).
Do. Cattle-manure (1 basket), Guano (3 oz.).

Cost.—It seems from the reports that the cost of cattle-manure, including application, varies from 4*l.* 1*s.* 6*d.* to 10*l.* 10*s.* per acre according to facilities for grazing of cattle, transport of bedding and manure, and other circumstances. Of other manures the cost as near as can be gathered from the report is as follows:—

Artificial Manures, 6*l.* 2*s.* per acre.
Bones and Poonac, 5*l.* 10*s.* to 8*l.* per acre.
Leechman's, 7*l.* 10*s.* per acre.
Sombreorum, 3*l.* to 6*l.* 10*s.* per acre.
Bone-dust and Ashes, 10*l.* to 12*l.* per acre.

Poonac, Bone-dust, and Bolivian Guano, 7*l.* 2*s.* per acre.

Poonac, Bone-dust, and Guano (No. 27), 6*l.* 15*s.* 3*d.* per acre.

Pulp, 1*l.* 16*s.* 6*d.* to 2*l.* 10*s.* per acre.

Effect.—Of the relative effects of the manures the following seems to be the result deducible from the majority of these reports :—

1. The cattle-manure is *par excellence* the best and most lasting, the effects remaining over two or three years.

2. Next in order comes bones and poonac, which are said to be good from one to two years.

3. Guano *alone* is considered too stimulating and not lasting, but in mixtures (in small quantities) with bones and poonac seems to have a very beneficial effect.

4. Several of the writers speak very favourably of the application of pulp ; one indeed going so far as to put it on a par with cattle-manure.

The Sub-committee would beg now to make the following suggestions with regard to mode and time of application of manures.

First that all lands, except such as have little or no slope, should in the first instance be carefully drained ; that bulky manures should be placed in holes of not less size than 2 feet × 1 foot, and not exceeding 1 foot in depth, and at a distance of from 9 to 18 inches from the stem of the tree. That artificial manures should be in semicircular holes above the tree, and not exceeding six inches in depth, and the manure should be well mixed with the soil previous to being covered. That the best time of application of cattle-manure and pulp, which are longer in taking effect than some of the artificial

manures, should be as soon after crop as possible; whereas artificial manures can be kept for a latter period of the year, till the rainy season commences.

To those gentlemen who have taken the trouble to furnish detailed statements of the cost of the different kinds of manure and their application, the Sub-committee have to return thanks, and especially to Mr. Corbet for a valuable set of tables showing the cost of manures.

Yet with a great deal of valuable information before them, it seems to the Sub-committee very clear that the Reports sent in for the most part show a great paucity of results. Very few planters appear ever to have accurately tested these. This could only be done by setting aside certain rows of coffee, of an average field, for each kind of manure—if running up from the bottom to the top of a hill so much the better, as the effects would be more observable. On either side of these manured rows should be left as many unmanured, so that the contrast would be visible.

These manured rows ought to be picked separately from the rest of the estate. A distinct account should be kept of the produce of each set, and samples of the coffee put aside, so as to enable the manager to judge as well of the quality as the quantity.

In order to carry out the above suggestions, and to turn them to practical account, your Sub-committee are of opinion that planters should be invited to co-operate with the Committee, and that one or two gentlemen in each district should be appointed to collect reliable information, based on future experiments, and submit the results quarterly to the general Committee, till the full effects of manures are fairly tested.

CORRESPONDENCE.

To the Secretary Planters' Association.

Dear Sir, Kandy, 18th *September*, 1869.

Herewith I send you letter from Mr. Cruwell accompanied by a translation of parts of a letter received from Baron Liebig. It contains much valuable information, and I would suggest its publication in the papers without loss of time.

Yours faithfully,

(Signed) G. Denis B. Harrison.

The treatise on "Phosphorite" is in German, and therefore I do not send it.

To the Secretary Planters' Association.

Dear Sir, Laymas, 10*th September*, 1869.

I enclose translation of a letter received by last mail from Baron J. Von Liebig, in which he said he will be most anxious and glad to analyze varieties of samples of coffee and soils for you, if you will only send them to him.

The essence of the treatise on "Phosphorite" is this, that the thing we want is bone-dust, superphosphates; and phosphorite is phosphoric acid;—which in phosphorite, only costs one penny the pound, whereas in the others it costs from four to seven pence the pound.

The author also recommends it as more expedient in the forming of composts on farms.

I remain,

Yours faithfully,

(Signed) G. A. CRUWELL.

DEAR SIR,

The sombreorum is a mixture of alkaline salts and steamed bone-dust; there is about 30 per cent. bone-dust in it, 22 per cent. chloride of potassium and sulphate of potash, nitrate of soda 5¼ per cent. Steamed bone-dust costs in *Cologne* 7*l.* 10*s.* per ton; sulphate of potash, 12*l.* (with 80 per cent. sulphate of potash, 12*l.*); chloride of potassium costs 9*l.*; nitrate of soda, 18*l.* You will be able to calculate the real cost of sombreorum from this.

I received a short time ago, from Scotland, a manure for analysis on behalf of a planter in the colonies, resembling the character of sombreorum. It contained 26 per cent. alkaline salts, 20 per cent. natron (common salt), 21½ per cent. phosphate of lime.

I am an enemy to the use of mixed manures, and think it better to manure with artificial manures singly. Soils rich in alkaline salts want phosphate; others in which lime or quartz predominates, chiefly potassa. Since soils vary *ad infinitum*, one and the same mixture for all does not suit. I have analyzed the ashes of the two coffees you sent me, and their chief ingredients are potash and phosphoric acid.

Ceylon coffee yields 5 per cent. ash, in which are 55 per cent. potash, and 11 per cent. phosphoric acid. You may calculate herefrom how much of these stuffs is carried away by each crop from the soil.

The proportion to be returned would be after the first crop a tenth part of that taken away by the crop; and in each of the following years the same as that taken away.

In Germany they manure now a great deal with *phosphorites* instead of with *superphosphates*, but they take three times the weight of superphosphate; instead of 100 superphosphate they give 300 phosphorite; costing less than superphosphate. The soil from this kind of manuring gains much in phosphoric acid. For perennial plants I hold this kind of manuring particularly good and desirable, avoiding ammoniacal salts and *nitrates*—these ingredients are in my opinion injurious to perennial plants. In Singapore they have had some sad experience to that effect with their nutmeg trees.

I don't know whether coffee-trees are pruned in the same manner as our fruit-trees and vines are every year? I am of opinion that this is very important, for nothing has such a great influence on the quality of fruit as a scientific pruning of the branches.

It is true that *Caffeine* varies in the berries, although the price of coffee may not always be in proportion to the caffeine in the beans; but the latter appears to me to be the surest criterion or standard of the quality of the bean, keeping in view the great influence a good manipulation of the berry and careful curing have upon the taste of the decoction; and thus

the low prices paid for Brazil coffee are explained by the careless and wretched curing this coffee receives.

Herewith a price current of artificial manures, all under control of Government and guaranteed: also a treatise on "Phosphorite."

I remain, &c.,

(Signed) J. Von Liebig.

SOMBREORUM: LIEBIG'S OPINIONS.

To the Editor of the 'Ceylon Observer.'

Dear Sir,

In publishing Liebig's letter to Mr. Cruwell on Sombreorum, you said I would have something to say upon it. Indeed I had—but was too modest to call that great man to question. I am able now to let him speak, in the enclosed, for himself. In that letter he said the coffee manure he had analyzed for a Scotch planter in the colonies was composed of one-third of common salt. He now acknowledges that his operator transposed the figures representing respectively chloride of sodium and chloride of potassium, and that he has paid the penalty of this important mistake by dismissal from the Baron's service! In sombreorum, chloride of potassium would represent *gold*, and chloride of sodium *coppers!* There is no chloride of sodium whatever in the prescription used for sombreorum, but it (common salt) results in an analysis, chiefly from impurity of ingredients which cannot be helped. In the Baron's first analysis he placed

Chloride of sodium at	20,407
And chloride of potassium	2,962

But in the second amended analysis, thus—

Potassium—20·46
Sodium — 2·80

The correspondence with the Baron speaks for itself. I send you copies for publication, omitting the figures of analysis, which I reserve as private property, and also the originals for your satisfaction—but you will please return me these, and consider them private and confidential.

Every batch of sombreorum manufactured is tested by analysis by Professor Brazier, and a better guarantee the public could not have—as this gentleman personally conducts the operations, while, I presume, such men as Liebig, Anderson, Voelcker, Gardiner, &c., get their assistants to do it, with all the risks.

Liebig's objection to "mixed" elements forming a compound manure I do not understand. The chief merit of sombreorum in my estimation consists in its being a mixture of the elements, and in their due proportion, which analyses and experiments prove to be required for the best development of coffee-bearing wood and fruit. There is no more "*mixed*" manure used than in cattle-dung, the ash of which is so nearly identical with sombreorum.

Another Professor —— made the same mistake in transposing the figures as the Baron's assistant did, and he as handsomely afterwards acknowledged the error. After his first analysis he said such a mixture could be sold for 8*l.* (eight pounds) per ton; but after the amended analysis he said it could not be manufactured (genuine) for less than 12*l.* 10*s.* (twelve pounds ten) per ton. I am glad to have it in my power to state this, because 12*l.* 10*s.* is the price which *Messrs. Miller & Co., Sandilands, Aberdeen,* charge for what is sold under my trade-mark—and because I am informed that an imitation sombreorum is about to be supplied both from

Newcastle and from Leith. It cannot be supplied at less price except by substituting inferior-priced ingredients. Perhaps no commodity is more open to adulteration than artificial manure, but the public are free to judge and act for themselves (see a late 'Gardener's Chronicle').

Dr. *Anderson*, of Glasgow, the greatest authority in Scotland, being Agri-chemist for the Royal Agri-Society, calls sombreorum a very valuable mixture for the coffee-tree.

Professor *Voelcker* may be considered the greatest authority in England, and he says "The sample of manure analyzed by me is a highly compound and intrinsically valuable fertilizer."

Dr. Griffin, of Herepath's School of Chemistry, Bristol, in a compendious report, says "we can only arrive at an opinion as to the value of a manure for any given crop by comparing its competition with the mineral ingredients contained in the ashes of that particular plant, comparing the amounts given, in the ash, of phosphoric acid, potash, lime, chloride, magnesia, sulphuric acid, iron, &c., &c., with those found in the grey powder" [sombreorum]. "I consider that the latter would form a very appropriate and valuable dressing for a coffee plantation. There are, however, two points to be noted. The leaves and woody tissues of a plant require their special pabulum as essentially as the fruit, and even if its character be similar the *proportions* may vary considerably. Now in this case, as I am not aware that any part of the coffee-plant except its berry has been analyzed, we have not complete data to go upon. It would be well worth the while of coffee-growers to have a full and careful analysis made of the entire plant," &c.

Dr. Griffin when he wrote this was not aware that I had

these analyses to the number of over a hundred, taken in all the past ten years, with the view precisely which he indicates of ascertaining what the requirements were not only for fruit, but for coffee in all its circumstances—and I have had the great advantage of being able to work my own experiments on my own estates.

Dr. Gardiner, of Berner's College, says of sombreorum, "It must be a good manure indeed for coffee—no doubt about that at all." If I be not misinformed this testimony comes from the gentleman to whom Lord Talbot applied to get an artificial manure compounded for exhausted coffee estates in Jamaica, who said his chief difficulty lay in his want of practical knowledge of the culture, and the impossibility of his conducting experiments.

My own belief in sombreorum continues unbounded. In cases wherever it may have been used without effect, I cannot think otherwise than that it is a question solely of the mode of application. So be that the roots get at it, and it to the roots, I cannot believe but there will be effects. But these may not be in a succulent appearance, such as is produced by stimulating manure. It is essentially an alkaline dressing, requiring to be melted into the soil, in contact with the coffee-roots, and requiring time for absorption and digestion, by the growth of the plant, under the action of the sun.

Yours faithfully,

R. B. TYTLER.

2nd December, 1869.

From —— to Baron Justus Von Liebig.

SIR, *28th June*, 1869.

I am requested on account of a planter in one of our colonies, to send you a sample of a highly compound manure for analysis. This I have put up in two small bags, and dispatched per parcel post, to your address.

Enclosed you have banker's draft, payable in London, in name of fee. If this is insufficient, please advise when you send me your report.

It may be well for me to say that my friend seems to expect you will find nitrate of potash present in addition to usual manurial ingredients of phosphoric acid, lime, magnesia, &c.

Yours faithfully,

X. X. X.

From Baron J. Von Liebig to ——.

DEAR SIR, MUNICH, *8th August*, 1869.

I send you enclosed the analysis of the two samples of manure I have received from you. The manure is as you perceive a mixture of common salt, potash-salt, with bone-dust, and a little sulphuric acid. The amount of nitric acid is very small.

I could not say that this manure may not be useful in many cases, but I should rather prefer the ingredients unmixed. The quality of the soil is so different and variable, and so ought to be the manure: on lime soil, poor in potash, the

potash salts in manure may be useful and efficacious, and not at all on gneiss or felspar soil. The same manure may prove efficacious in one case and fail in others. Phosphates are always good manures.

The fee you send me is quite sufficient.

Believe me, yours truly,

(Signed) Js. LIEBIG.

From —— to Baron Von Liebig.

SIR, *27th August*, 1869.

I had your favour of the 8th with analysis of the compound manure. I have had an opportunity since of comparing it with one made of the same material (taken indeed from the same jar) by Jas. S. Brazier, Professor of Chemistry in Aberdeen University. There are some striking differences betwixt them, so great indeed as to make me think it possible there may have been some error made in transcribing your report.

Professor Brazier (who has frequent work of the kind) did the analysis himself, and feels confident of his accuracy.

He found only 5·51 *chloride of sodium*, "common salt," present, but a total of 20·71 *potassium*, which he saw reason to apportion as follows:—

Chloride of potassium Sulphate of potash Nitrate of potash	Blank.

He says the nitric acid of the nitrate was distinct from the nitrogen of the organic matter, which he makes very like to your own, *viz.* 0·93.

Before sending out your report to my friend will you kindly refer again to your notes, and see if you have not inadvertently transposed your entries of chloride of sodium and chloride of potassium. This seems to me a possible occurrence, and its rectification now may prevent much disappointment and annoyance, or if your notes have been destroyed, perhaps you have still some of the manure beside you, and a reference to that will at once determine whether there is not considerably more *potash* present than you have recorded in the analysis sent me.

I am,

X. X. X.

From Baron J. Von Liebig to ——.

SIR, MUNICH, 10*th October*, 1869.

The new analysis of the manure in the second little bag you sent me has given very different numbers to that of the first.

(The figures tabulated here are reserved as private property.)

Professor Brazier's analysis is perfectly correct, and I am unable to account for the difference. The analysis above is made by *another* of my assistants, the other one is dismissed.

I have still some of the manure which has been analyzed by my former assistant; it will be analyzed again, and I shall inform you of the result if there is any notable difference.

Believe me, yours truly,

(Signed) J. LIEBIG.

From Messrs. Miller & Co., Sandilands, Aberdeen, to Mr. R. B. Tytler, Kandy, Ceylon.

[EXTRACT.]

"The sample sent him was drawn from Mr. Gibbon's shipment, and identical with that examined by Voelcker in April, and by Brazier in June, and copies of whose analysis you have already got. You will see that his *second* analysis comes very near to Professor Brazier; but bear in mind that the *second bag* he refers to was EXACTLY the same as the other, and taken out of the same jar. The sample was put up in two bags because, while we wished him to have a pound at least to operate upon, in case of accident, the Post-office limited the weight of each parcel to 8 oz. only. Liebig says he has dismissed the assistant who did the first analysis, which, if true, shows considerable dissatisfaction. Yet that analysis is not much further wrong than ——'s first, or ——'s first was. Indeed the whole of our correspondence on this subject shows that very little reliance could be placed on reports, where highly compound manures, such as *sombreorum* are concerned, unless the chemist has been informed beforehand of its composition, as Brazier was, and of what therefore he ought to

look for. It has shaken our faith more than ever in great names, and will induce us to place reliance on the like of Brazier rather, who can do the work himself, and commands sufficient time for the purpose."

(True copies)

R. B. TYTLER.

2*nd December*, 1869.

LETTER TO PLANTERS' ASSOCIATION.

To the Secretary of the Planters' Association,
Kandy.

Planters' Association, Dambetenne,
3rd June, 1869.

Dear Sir,

By last mail I received the accompanying letter from Professor Liebig, who sent me also a sample of *caffeine*, which I enclose for your and the Committee's inspection.

In the same ratio as *quinine* is the chief extract of the bark of the cinchona tree, caffeine is that of coffee, and on the greater or lesser presence of this substance in the fruit the quality of coffee depends. I am promised decisive information on this subject after the various samples of coffee I sent to the Baron have reached him for analysis.

Caffeine, being of the *alkaloid*, it is perfectly subject to be introduced where wanting, and as phosphor is the chief agent producing fruit, we must look to phosphoric acid to give us quality. Without phosphor, either in the animal or vegetable kingdom, the formation of *albumen* is impossible, so necessary for the creation of fruit, and this we find most in the seeds of all plants, but above all in bones.

Phosphoric acids are plentiful in vegetable plants and animals, less so in the mineral kingdom, and very scarce in most soils.

The Baron says:—"Superphosphate of lime is an excellent manure, but for bushes like coffee I would prefer *steamed bone-dust;* it contains double the quantity of phosphoric acid to what superphosphate does, and is not dearer. Bone-dust acts slower than superphosphate, but its effects are more lasting.

"As 100 parts of the ash of coffee-bean contains—

Phosphoric Acid	13·59
Potash	52·94
Magnesia	10·90
Soda	14·76
Lime	4·33
Oxide of Iron	0·66
Chlor.	1·22

you can form an idea why the *ageratum* (goatweed) must be so injurious to the coffee, or so beneficial if you return its ashes. The components of which ash these weeds receive are articles of food for your coffee-trees, and have for them the same value that meat and bread have to the human being, or hay and oats to the horse. That which is in the goatweed is wanting in the coffee, both cannot be allowed to thrive side by side; and your interest tells you to sacrifice the *ageratum.*

"Compared to the latter the ashes of the *andropagon* (mânâ grass) which you have sent me are valueless. It contains—

81½	per cent.	Silica,
2	„	Chloride Potassa,
3	„	Potash,

and other immaterial matter. I may here mention that coffee growing in quartzy soil and lime bottoms contains double the quantity of caffeine to what coffee grown in gneiss soils does: in the usual Ceylon soils gneiss predominates. In soils where either quartz or lime is predominating, manuring with phosphoric substances would be less wanted.

"Believe me, yours faithfully,

(Signed) "G. A. CRUWELL."

CATTLE DISEASE, AND ITS TREATMENT.

A MEDICAL friend now in England sends us the following very valuable communication. It shows the correctness of what we have always insisted on, that the lower animals are liable to disease and amenable to treatment, very much in the same way that the human being is. Tonics are just as valuable in the one case as in the other, and those who think that the cultivation of the quinine-yielding plants may be overdone, would do well to think of the lower animals as well as of man. The grand difficulty however in India with the animals as with the natives is what a shrewd doctor in Bengal has indicated as the main source of a fever which has desolated the Valley of the Ganges—*innutrition*. Men or animals badly or insufficiently fed are in a chronic state of debility, and present the most favourable conditions for being affected by malaria, and the most unfavourable, from want of stamina, for successful medical treatment. The great point in Ceylon will be to impress upon the natives the importance of housing and feeding their cattle better than they do. While we are encouraging a more extensive growth of grain, we ought not to neglect the cultivation of ordinary grasses. As yet guinea grass is the only cultivated grass in Ceylon, if we except an occasional patch of clover in Newera Ellia. We cannot help thinking that many of the varieties which are receiving attention in Australia might be successfully grown even on our

lowland plains. These and many other connected questions will, we suppose, be fully discussed in the report which the Cattle Commissioners have submitted to Government, and which has been described to us as elaborate and interesting. In printing that report, we submit that the following very valuable contribution to our knowledge of the nature and treatment of cattle disease should not be lost sight of:—

"You are no doubt aware that the cattle murrain (foot and mouth disease) is very prevalent in England at the present time, and consequently a great deal of attention is directed to the malady by those competent to institute inquiries on such a subject. In the Greenwich district only, upwards of 300 cases have been recorded, and the disease is rapidly increasing in different parts of England, and it has been recognized even among pigs. So great is the alarm felt in respect of its contagious character that a Contagious Disease (Cattle) Bill has been recently enacted, to enforce the necessary amount of segregation. In Yorkshire attempts have been made to stamp the disease out by at once slaughtering all affected cattle.

"A trip to Essex enabled me to observe the *English* murrain. It is in every respect the Indian cattle disease, perhaps in not so severe a form as is sometimes observed in India, and the treatment adopted here *with success* consists in the application to the hoofs of a thick creamy solution of chloride of lime and a strong *unguent* of borax and honey to the mouth and tongue, together with tonics of steel internally (the green sulphate is very cheap and abundant in the bazaars), careful housing and good nourishing drinks. (I think rice congee would be a good substitute for barley gruel which is

used here.) Care is also taken that the affected animal does not lick the lime paste from off the hoofs.

"This treatment is both simple and rational, and therefore scientific. The first stage of ulceration of the mouth in cattle in Ceylon is, as in those affected in England, decidedly of an *apthous* character, an aggravated form of *apthæ* that is frequently observed in children, and for which the "honey of borax" is almost the household remedy everywhere. The same remedy and with a like success (only a stronger preparation) is used in the case of affected cattle.

"As the 'hoof and mouth disease' is very prevalent occasionally in Ceylon, perhaps a hint in the 'Observer' respecting its *successful* treatment here would be of service to our friends, European and native, who are obliged to have cattle in numbers.

"Medical men in England have warned the people against the use of milk from cattle affected with this disease, particularly for young children.

H. D.

MANURE AND GENERAL AGENCY.

THE difficulty of obtaining a genuine artificial compound manure, even in "England," is great, and necessitates, on the part of the purchaser, careful and constant scientific attention to prevent imposition. In the colonies, where there is little or no scientific chemical element, purchasers are dependent entirely on the manufacturers. The public need not be reminded what that means. Spurious manures (and other articles*) are to a very great extent (as evidenced by recent published analysis) exported for colonial consumption from England. It is with the view of placing the colonial purchaser of artificial manures especially on an equally advantageous footing as the English farmer, as regards facilities for detecting and providing against imposition, that I have been requested to offer my services to the "Ceylon" planting and mercantile community. The means I propose adopting to meet the difficulty are stated below, but I shall be glad to consider any suggestion from Ceylon friends, to improve the efficiency of the system indicated. There are various manures made in England not known to the public in Ceylon, some being comparatively cheap.

1st. Dr. Voelcker, Consulting Chemist to the Royal Agricultural Society of England, and one of the best authorities

* *Vide* 'Times' of 23rd February, 1870: "Articles are deliberately got up for them" (meaning the colonies).

in Europe, has undertaken to analyze all soils and manures sent him by me. The charges are—

Analysis of a sample of artificial manure, according to the kind of analysis required, from 2*l.* 2*s.* to 5*l.* 5*s.* per sample.

Full analysis of a soil, and report on manures best adapted for that particular soil, 10*l.* 10*s.*

In case a number of soils are sent for analysis and report, the fee will be 5*l.* 5*s.* for the analysis of each sample of soil, and 10*l.* 10*s.* for the report on the lot.

2nd. I have arranged with certain large manufacturers of artificial manures, to make and *guarantee the quality* of artificial manure on any required analysis. The nature of the guarantee is such that if within twenty-one days from delivery of a consignment it is certified by any competent approved authority that said manure is inferior in any material point to that guaranteed, the manure will be returned on the manufacturer's hands, or a money equivalent paid.

3rd. I am prepared to obtain from Dr. Voelcker the analysis of soils for constituents only, free of charge, except actual outgoings, such as fee for analysis and postages. I am also prepared to get the best scientific opinion on the manures best adapted for certain soils, which have been submitted for analysis, charging only as before stated.

4th. My charge will be 2½ per cent. on gross amount of account. No order will be undertaken for a smaller quantity than ten tons, and satisfactory references will be required, or a cash credit deposit.

I am also prepared to do general business on commission,

especially in wine, spirit, and beer, being connected with that trade, charging 2½ per cent. on gross amount of account, or special agreements may be made. Knowing the requirements of the island so well, from long residence there, I hope I may meet with support from the Ceylon community. The guarantee for my integrity and competence must be the identity of my interests with that of my clients, besides my Ceylon experience.

ROBERT SIMPSON.

2, DANES INN, STRAND, LONDON.

PRICES OF VARIOUS MANURES.

	£.	s.	d.
1. Concentrated Fish Manure	6	0	0
2. Superphosphate of Lime	6	0	0
3. Blood Manure	6	0	0
4. Special Manure (highly concentrated, prepared according to the requirements of each crop)	8	0	0
5. Kainit* (German Potash Salts)—			
In quantities of not less than 100 tons ..	2	7	0
Smaller quantities	2	12	0

(Free in the Thames. Bags or casks charged net price.)

* These Salts should be mixed with Superphosphate of Bone-dust. In combination with Phosphotic Manures, is very valuable for all crops grown in light soils.

ANALYSIS.

1. Moisture	16·450
Soluble Organic Matter	10·765
Insoluble „ „	23·112
Chloride	2·226
Soluble Phosphate of Lime	19·580
Insoluble	20·630
Sulphate of Lime	6·850
Silica	·150
Loss	·242
	100·00

Nitrogen, 5·62 per cent.; Ammonia, 6·80.

By W. T. Rickards, F.C.S.

5. Moisture (loss at 212° F.)	3·36
Water of Combination	10·88
*Sulphate of Potash	24·43
Sulphate of Lime	2·72
Sulphate of Magnesia	13·22
Chloride of Magnesium	14·33
Chloride of Sodium	30·35
Insoluble Silicious Matter	0·71
	100·00

* Containing Potash, 13·20.

24½ per cent. of Sulphate of Potash, 13 per cent. of Sulphate of Magnesium; the remainder consists of Common Salt and Chloride of Magnesium.

By Dr. Augustus Voelcker, R.A.S.

6. No. 2 Concentrated Manure	£9 0 0	6. Organic Matter and Salts of Ammonia .. .. 35·75 Biphosphate of Lime .. .. 10·85 Equal to Soluble Phosphate, 17·00. Phosphate of Lime .. .. 5·80 Hydrated Sulphate of Lime .. .. 21·50 Alkaline Salts .. .. 4·25 Insoluble Matter .. .. 5·85 Moisture .. .. 16·00 100·00 Nitrogen, 3·29—equal to Ammonia 4·00, or Crystallized Sulphate of Ammonia, 16·00.
7. Bone Manure	8 0 0	7. Organic Matter and Salts of Ammonia .. .. 20·70 Biphosphate of Lime .. .. 13·09 Equal to Soluble Phosphate, 20·35. Phosphate of Lime .. .. 4·09 Hydrated Sulphate of Lime .. .. 32·47 Alkaline Salts .. .. 4·71 Silica and Insoluble Matter .. .. 7·96 Moisture .. .. 15·98 100·00 1 per cent. Ammonia—equal to nearly 4 per cent. of Crystallized Sulphate of Ammonia.
8. Superphosphate	6 0 0	
9. Native Guano (A B C process)	4 0 0	9. Water .. .. 14·1 *Organic Matter .. .. 22·4 Phosphate of Lime .. .. 9·6 Earthy and Alkaline Salts .. .. 11·2 Silicates .. .. 42·7 100·0 * Nitrogen = Ammonia, 4·2.
This Manure can be concentrated.		

APPENDIX II.

THE COFFEE DISTRICTS OF CEYLON.

SUMMARY of the PLANTED and TOTAL EXTENT of LAND in private hands in each of the COFFEE DISTRICTS of CEYLON; the number of separate Properties; of Estates opened and worked; and of Superintendents employed on each. Corrected up to 31st July, 1870.

NAME OF DISTRICT.	Total Extent of Land in private hands.	Extent Planted in Coffee.	No. of separate Properties in District.	No. of Estates now opened and worked.
	Acres.	Acres.		
Allagalla	4,618	2,092	13	12
Ambegamoa	20,879	7,090	31	26
Badulla and Passera	14,323	9,265	57	52
Dickoya, including Maskeliya Valley	20,950	6,599	44	36
Dimboola Upper	10,843	4,060	23	30
Dimboola Lower	15,385	5,420	38	31
Dolosbagie	19,842	8,707	53	44
Doombera	7,100	3,519	18	18
Hantanne	10,836	5,384	39	39
Happootella	20,130	11,690	58	56
Hewahette Upper	9,120	2,436	11	11
Hewahette Lower	11,021	6,075	28	21
Hunasgeria	9,200	6,951	27	26
Kaduganawa	11,369	5,620	41	37
Kaigalle	933	482	6	5
Kallibokka	8,129	4,641	18	18
Knuckles	6,100	4,037	21	19
Carried forward	200,778	94,068	526	481

SUMMARY, &c.—*continued.*

NAME OF DISTRICT.	Total Extent of Land in private hands.	Extent Planted in Coffee.	No. of separate Properties in District.	No. of Estates now opened and worked.
	Acres.	Acres.		
Brought forward	200,778	94,068	526	481
Kornegalle	12,968	5,073	51	40
Kotmalie	12,348	8,245	30	28
Matelle East	23,267	11,839	67	65
Matelle West	13,362	7,533	43	43
Maturatta	7,508	3,684	17	16
Madoolsema and Hewa-Ellia	11,925	3,273	30	20
Medemahanewera	8,582	3,464	28	23
Moorowa Corle	9,664	2,554	22	19
Nilambe	9,650	5,089	26	26
Nitre Cave	4,268	743	14	7
Pussilava	16,783	9,941	40	40
Rambodde and Poondhooloya ..	9,202	4,824	26	25
Rangalla	6,038	4,042	16	16
Saffragam	12,003	4,981	38	34
Wallapanne Upper or Uda Pussilava	9,838	3,934	20	17
Wallapanne Lower	1,751	580	4	3
Yacdessa	10,948	2,600	19	11
Total (34 Districts)	380,883	176,467	1017	914

REVENUE AND EXPENDITURE OF CEYLON,

FROM 1840 TO 1869.

THE following Table will show the progress Ceylon has made since the commencement of coffee-planting:—

Year.	Revenue.	Expenditure.
	£.	£.
1840	331,200	355,298
1845	454,146	448,242
1850	415,667	390,425
1855	476,273	405,610
1860	767,100	705,440
1863	952,790	738,194
1864	867,728	843,291
1865	978,492	838,193
1866	962,873	917,669
1867	969,936	927,932
1868	925,266	974,950
1869	946,000	881,000*

NOTE.—The falling off of the revenue in 1864, as compared with 1863, was owing to the failure of the pearl fishery.

* Not yet officially returned.

SHIPMENTS OF CEYLON COFFEE.

Coffee Exports from Ceylon in the Seasons ending October 10, from 1849 to 1869; distinguishing Plantation from Ordinary or Native, and excluding all Coffee not the produce of Ceylon; with Total Value and Average Prices per Cwt.

Year ending Oct. 10.	Plantation.			Native.			Total.		
	Quantity.	Value.	Average per Cwt.	Quantity.	Value.	Average per Cwt.	Quantity.	Value.	Average per Cwt.
	cwt.	£.	£. s. d.	cwt.	£.	£. s. d.	cwt.	£.	£. s. d.
1849	210,187	343,083	1 12 7½	127,339	113,580	0 17 10	337,526	456,663	1 7 0½
1850	219,137	483,350	2 4 1¼	103,623	173,768	1 13 6½	322,760	657,118	2 0 8½
1851	197,644	444,666	2 4 11	90,267	147,750	1 12 8¾	287,911	591,816	2 1 1¼
1852	255,386	534,446	2 1 10	152,621	217,415	1 8 5¾	408,007	751,861	1 16 10¼
1853	209,838	455,232	2 3 4½	113,156	182,363	1 12 2¾	322,994	637,595	2 0 1
1854	303,908	669,803	2 4 0¾	130,178	232,948	1 15 9¼	434,086	902,751	2 1 7
1855	316,373	697,046	2 4 0¾	166,832	275,416	1 13 0	483,205	972,462	2 0 3
1856	325,438	749,308	2 6 0½	113,161	222,272	1 19 3¼	438,599	971,580	2 4 3½
1857	368,047	943,416	2 11 3	161,395	353,320	2 3 9¼	529,442	1,296,736	2 3 11¾
1858	384,164	1,033,917	2 13 9¾	172,227	343,810	1 19 11	556,391	1,377,727	2 9 6¼
1859	406,898	1,098,625	2 14 0	194,697	389,394	2 0 0	601,595	1,488,019	2 9 5½
1860	468,826	1,265,832	2 14 0	166,236	332,472	2 0 0	635,062	1,598,304	2 3 8
1861	483,321	1,304,968	2 14 0	130,169	260,338	2 0 0	613,490	1,565,306	2 11 0
1862	476,824	1,287,426	2 14 0	123,722	247,444	2 0 0	600,546	1,534,870	2 11 0
1863	649,194	1,752,823	2 14 0	158,151	316,302	2 0 0	807,345	2,069,125	2 11 6
1864	574,476	1,551,085	2 14 0	82,104	164,208	2 0 0	656,580	1,715,293	2 12 3
1865	714,259	1,928,499	2 14 0	214,806	429,612	2 0 0	929,065	2,358,111	2 10 9
1866	676,448	1,826,410	2 14 0	210,314	420,628	2 0 0	886,762	2,247,038	2 10 9
1867	720,174	1,944,470	2 14 0	148,099	296,198	2 0 0	868,273	2,240,668	2 11 7
1868	788,737	2,129,590	2 14 0	218,584	437,168	2 0 0	1,007,321	2,566,758	2 11 0
1869	835,686	2,256,352	2 14 0	168,822	337,644	2 0 0	1,004,508	2,593,996	2 11 7
Total for 21 Years.	9,584,965	24,700,347	2 9 6¼	3,146,503	5,894,050	1 16 11½	12,731,468	30,594,397	2 5 8½

INDEX.

APPENDIX I.

APPENDIX II.

LONDON: PRINTED BY W. CLOWES AND SONS, STAMFORD STREET AND CHARING CROSS.