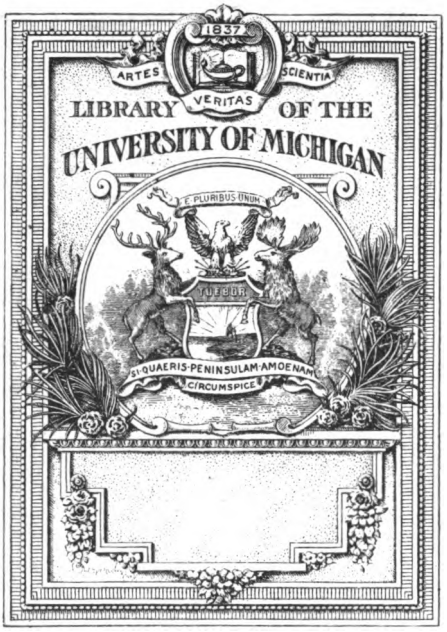

SECOND EDITION.

TEA CULTIVATION IN CEYLON.

By C. Spearman Armstrong.

PAPER READ AT A MEETING

OF THE

DIMBULA PLANTERS' ASSOCIATION,

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By. C. Spearman Armstrong.

[The following is a reprint of a paper read by Mr. Armstrong at a meeting of the Dimbula Planters' Association, on the 31st August 1883, with a few additions on October 30th, 1884.]

MR. Chairman and Gentlemen, I have to thank you for inviting me to attend today, and am glad to give you my experience of the cultivation of Tea in Ceylon, and I trust that the facts and figures I shall have the pleasure to lay before you, will imbue not only yourselves in this district, but all of us, who have hitherto doubted—and we are now very few—with courage, to turn any unremunerative coffee fields we may possess into paying fields of tea, and in thus doing, I would still advise good bearing patches, which are to be found in every estate, to be kept as coffee, even if only aggregating 50 acres. Two hundred acres of tea will allow of this being kept in a high state of cultivation, without any increase in the labor force, as there are often times when one is glad to have some other product that would employ one's labor, or a portion of it, for a few days, to the advantage of the tea. And the return from small patches of coffee worked in this way, are almost nett profit; or on the other hand, 25 acres even of tea may be worked to advantage with coffee. Do not let us, therefore, run into the other extreme, but let us keep all the coffee we can, where elevation and soil are suitable, and cultivate it highly with the aid tea will give us. Let our endeavour be to have as many products as our situation or elevation will allow us to grow. Bad fields of coffee we may have, but bad coffee estates, as a whole, I deny. As, at a meeting like this, time will not permit me to enter thoroughly into every detail connected with tea, I have endeavoured to curtail my remarks as much as possible. The more so, as your knowledge of coffee planting will fill up any gaps. I consider our knowledge of coffee cultivation goes very far to aid us in that of tea, and, with our trained labor, most apt at picking up anything new, to aid us, we can place our tea in the market cheaper than any other tea-producing country in the world.

My remarks today have more especial reference to the cultivation of tea in what may be termed our coffee zone, in fact, to the practicability of tea taking the place, in some instances, of coffee, or of its being planted in forest land adjoining our coffee estates, and which we have thought too high for coffee.

Throughout this paper I refer to Assam-Hybrid tea only.

At what elevations will tea grow at, in Ceylon, to pay? From almost sea-level to over 6,000 ft. provided soil and aspect are suitable.

SOIL.—Should be fairly good—the richer the better—deep and friable, loam well mixed with sand; a shallow quartzy soil is not good. Tea will not flush readily in this although it may grow to a fair sized bush. A sub-soil, well mixed with sand, or grit, without showing a very good surface soil, will, although giving a slower growth at first, turn out a better paying soil than one with a rich surface and clearly defined clayey subsoil without an admixture of sand; the more we pluck, the deeper the roots must go, and we must have room for them. The higher our elevation the richer should our soil be, to make up for climate.

CLIMATE—That which is best for coffee, will I believe, *for a permanency*, be found to be the best for tea. The beau ideal of a tea climate is Avisawella, Yatiyantota and the lower portions of Morawakorale, also portions of Ambagamuwa; but they have not our coffee zone subsoil, as a whole; and our zone will I think, make up, in its deeper soil, for the want of extreme heat with moisture, which prevails in these districts, where, however, tea will rapidly make a fortune for its lucky proprietors.

The higher the elevation, the less rainfall is required, and *vice versa*, light showers alternating with sun, if we could order them so, would give us 1,000 lb. per acre at 5,000 ft. elevation. At the higher elevations, continued rain at the height of the monsoon has the same effect in checking the flush, for the time being, as a long continuance of sun has in the lowcountry. Perhaps a good thing; for, with us the bush has no wintering, and the only rest that of a 10 lb. plucking, instead of a 24 lb.

SITE AND LAY OF LAND.—Gently undulating land, for choice, is the best; but I have tea on steep land, doing as well as that on fairly flat undulating land. In fact, any land that is most suitable for coffee is most suitable for tea. In our new districts especially, we find our fields at the higher elevations making wood freely, but, even at the best of times, not giving much fruit; where we have coffee making most wood, there will our tea do best. In my experience I have had poor thin coffee pointed out to me as being suitable, *only for tea*. I say no; if we are to expect tea to pay, we must not pick out our thinnest, weakest,—because washed, coffee, as being the most suitable site, but our free-growing leafy coffee, that from either a bad aspect with good soil (and we often see this) or from too high an elevation, has always persistently run to wood, which we call leaf in tea; with such coffee there need be no hesitation in at once planting it up with tea. Again, we have coffee that in the good old days has borne heavily, but that has now ceased to bear (temporarily or not, is beyond human ken) if we except occasional patches. *If the soil has not suffered from wash* no matter what the coffee may have borne in the past, tea can take its place and flourish, as it has that in the soil to give it a start, and it can seek for nourishment far deeper than the coffee has ever reached. To sum up on this most important point, do not let us waste time and money on a coffee estate trying to grow tea, where we have found coffee will not make

wood, though we may do so where our coffee, although now bad, has been good, in point of crop, provided the soil has not suffered from wash. Ridges and washed faces will be more profitably planted with aoes which we may grow with other products with profit, or mana-grass to keep out the weeds, than with tea. These remarks do not apply to Lower Ambagamuwa Yakdessa, &c., where tea is *flourishing*, but where coffee would not exist, but to our true coffee districts.

Land at 4,000 feet to 5,500 feet that has failed in cinchona, provided soil and climate are suitable, will grow good tea. I have now tea 3½ years old on land that I planted up four times with cinchona (both officinalis and succirubra),—and that failed completely, although no expense was spared in the opening and planting of it, —doing as well as could be wished. Again, I have tea doing well on abandoned coffee land that was cleared and planted 7½ years ago with cinchona—which died out at 3 to 4 years. Elevation, in both instances, 5,000 feet and over. I have tea also doing well in land that was under cinchona for ten years.

Although tea does well, remarkably well, up to 5,600 feet in my own experience—and I have had figures shown me, proving that tea, at over 6,200 feet gave, at 4 × 4, 400 lb. per acre at 6 years old,—it does not follow that all and any land, at these elevations, will give the same results. The higher we go the better our soil must be. We must be rather dry than wet, not absolutely without rain for any length of time—but this we need not fear near our mountain tops—and the more shelter from the monsoon winds do we require. I will treat further down of the yield per acre from tea at the lowest to the highest elevations, and will now enter on *seed*, *nurseries*, *opening*, *and planting of tea*, *its cultivation*, *and manufacture*.

Seed.—The greatest care must be taken to ascertain that the seed you obtain is from the highest class hybrid,—but let it be hybrid and not indigenous, or too near it, as this jât will not give us the yield in Ceylon that hybrid does—as with a poor jat, neither care in the manufacture nor cultivation can make a good liquoring tea, or give profitable yield. Making allowances for poor plants, accidents, bad plants, and the having ample plants over for supplies, I calculate on one maund of 82 lb. for 6 acres planted 4 × 4; a maund of locally grown gives from 27,000 to 33,000 seed, according to the time that is allowed to elapse in weighing after husking; the sooner the seed is in the ground after gathering the better.

Nurseries.—Choose the site as near a stream as possible, for the sake of water. Let the land be as flat as possible, make your beds 5 ft. × 20 ft. with 18-inch walks (which act as drains) between them. If you are going to plant out at six months from seed, sow your seed 2 in. apart every way. I find a very useful little tool for this is one I made many years ago for pricking out cinchona—a flat board, with handle on the top and pegs—50—underneath, any required distance apart, press the board, the pegs being underneath, on to your prepared bed and you have it marked

out in fifties to the distances apart you wish to sow your seed. If you are going to plant them out at 1 to 2 years 4in. × 2in. or, if space will admit, 4in. × 4in. apart; sow 1½ inches deep, if no shade. If your plants are to be forced to save a season, manure your beds, sow 2in. × 2in. apart and 1 inch deep, shade with flat tats of jungle stuff 18in. to 2 ft. above the bed, and water freely twice a day or with ferns stuck *upright* in the ground, this brings tea seed up more evenly and is advisable. You may begin to remove the shade by degree, as soon as the wood at the collar of the plant hardens. Unless it is necessary for you to save the season, do *not* manure, nor pick out too good soil, as plants grown in better soil than it is intended to plant them out in, suffer a check from their first start in the clearing. Give your nurseries time; do not dig your beds more than 6 in. to 9in. deep, or the tap root, always unmanageable, will run deeper than ever. Every tea garden must keep up a nursery for supplies, which is a work we have to attend to every year. Stumps are best for supplies, and should be at the least two years old: even up to four, a permanent nursery can be kept up in *poor* soil sown 3in. × 3in. and the strongest plants taken out for supplies.

LINING.—In fairly good soil, 4 feet × 4 feet is the best distance, in poorer soil 4 feet × 3 feet, on weak soil or exposed faces 3 feet × 3 feet; ordinary Coffee soil will stand 4 × 4. It is better to err in planting wide than too close, as the bush should get sunlight all round, plucking surface is thus doubled. It is as well to have 4 feet between the lines, as each line is almost a thoroughfare, from the number of times the pluckers have to move along it, as well as weeding contractors, in the course of the year, and the proper growth of the laterals is in a great measure stopped if the pluckers have to *force* their way through too much; and in any ordinary fair soil, at a nearer distance than 4 feet between the lines, no light or air can get at the soil or through the bushes themselves, and they become towards the middle of the season an entangled mass of unhealthy wood. Therefore although 4 × 4 does not suit the coffee lines in any way if the tea is to be planted through it, to eventually the extraction of the coffee, (when tea is one year old) it is better to spend a little more money in lining than to try and suit your lining to your coffee, lined, presumably, 6 feet × 6 feet.

HOLING.—If for plants at 6 months or 1 year from seed, in coffee or in new land, 9 in. × 9 in. will do well. If for stumps, in coffee or new land, 18 in. × 18 in. In loose soil, in Coffee, dibbling with the Alavango is quite sufficient as the removal of coffee later works up the soil sufficiently. If seed or germinated seed is to be sown at stake, *in coffee*, loosen the soil with the ordinary fork; this is better than holing; as we are all aware, the coffee roots soon find their way into and fill a hole in which the good surface soil has been scraped, to, in this case, the detriment of the seed: the same holds good with regard to manuring a young seedling which I have heard advocated in coffee.

PLANTS AND PLANTING.—The best plants are those at 6 months from seed, as they do not suffer the same check that a 1-year-old plant does, and equal it in growth at 12 months from planting out; have not such unmanageable tap roots, and stand sun better; will do with shallower holes, cost less to plant, and have a better hold of the ground at 12 months. The best of all are 2 to 4 years old stumps, the roots of which at this age are woody, will stand being broken, in fact cannot be raised from the nursery (which should be in poor soil) without breaking them. They should be stumped, as with coffee, at 6 inches, and have roots that will comfortably fit into an 18 inch hole, which they require. In fair soil a stump can be topped at 3 feet in a year, and regularly plucked at 18 months onwards, giving a fine spreading bush.

SEED IN SITU has its advocates. Its advantages are cheapness in sowing out, and the good hold it gets of the ground, an advantage in windy sites. Its disadvantages are: on any *large* scale, greater first-outlay in seed, as from two to three seeds are required at each stake, the liability of its being smothered (as a seed) by wash, insect enemies, weeders (more especially among coffee) scraping off, unawares, the young shoot as it comes above ground, being trodden on by workers among coffee; many failures, therefore an extra cost in supplying, showing an uneven field; or again, three seeds all coming up at one stake and the cost of removing two, but which of course come in useful for supplies, Also a great loss of growth for the first year in coffee by being shaded by it. If you have no insect enemies, notably the black grub, which nips off the young shoot just above the ground, and it is desired to sow in situ, germinate the seed first and then one seed will suffice at each stake, and, although great care must be taken in sowing, I have found that even if the root germ is broken or wounded it throws out a bunch of rootlets and no harm happens.

STAKING.—This is not generally thought necessary. However I consider it *most important*; and wherever we have enough wind to have made it necessary to stake our coffee, it is there necessary to stake our tea, up to 2 years old certainly, and sometimes even up to to 3 years of age—a stake driven straight through the middle of the bush without tying will do at 2 to 3 years; at 1 or 1½ years, it must be tied. Aloe tape is best for this.

TOPPING.—First topping should be done at from 15 months, on aspects affected by the S. W. winds, to 18 months—3 feet is the best height, or at lower elevations or on exposed ridges 2 ft. 6 in. to even 2 ft. In topping the cooly has a stick of the desired height which he should place in the middle of the bush; the only care necessary is to see he does not gather up a bunch of branches in his hand to cut at one operation, but cuts each singly as it grows; the result will be a perfectly flat surface across the centre of the bush, with many young laterals round the bush untouched, which will soon reach the level to which we have topped; when they and the topped part begin to run up, all should be nipped back to the second leaf below the bud, to keep as flat

a surface as possible, giving, say at 6 months later or at 2 years of age, a bush with a fairly flat surface which will have reached 3 feet 6 in. to 4 feet in height, This very slight plucking after topping must be carefully done, only plucking those shoots that show an inclination to climb, so to speak; the plucking, with the topping, is necessary to force the lower laterals up, and keep your bush down and so form *surface*, otherwise the bush will grow up somewhat in the shape of a poplar, and surface be lost for years. This plucking comes in useful in teaching your labour plucking and manufacture, and will eventually pay its cost in increased diameter of bush, and, therefore increased yield. [Since the above was penned I have been trying another mode of treatment with young plants, with very good results, and I recommend this plan in preference to my former one. When our plants reach 3 ft. about, send round boys with a 30″ stick and nip off all buds above this, being careful not to touch laterals below this height. When we find our bush getting fairly shrubby, say at 18 months, cut across with the pruning knife at 18,″ and when flush has reach above 30″ nip off all buds at this height or above it. Our next topping with the knife, say at 2 to 2½ years, will be at 24″ or at 30″, above 4000 ft. elevation. Topping yearly at 2 eyes above that of the previous year, till our bushes reach 36″ ft. to 39″ when cut down again to 24″ or 30″.]

PRUNING.—This is a most important work, and in Ceylon must not be too severe, yearly, more especially if your bushes are topped early. It should take place from June to August, in any part of Ceylon, perhaps July is the best month. There are 3 ways of pruning:—1st, with a flat surface: 2nd saucer shape, *i. e.* hollowing out the centre; and 3rd, hacking down the bush. This last is murder, so I will pass it by without further remark. Saucer-shape pruning does well for a time, but inclines to too matted a growth in the centre of the bush, which leads to too heavy a pruning yearly, more costly, and bad eventually for the bush. I have no doubt myself that pruning with a flat surface is best, so I will only treat of this mode.

When our branches *after* topping have reached up to, say, 3 ft. 6in to 4ft, having been kept down to this by plucking at 2 to 2½ years of age, according to whether the planting was done in the N. E. or S. W. (I am referring to tea at from 3.000ft elevation upwards), they should be again cut to a level surface at 3ft 3in, or if topped lower, as explained above, 3 in. above the topping. Any thin whippy branches trailing on the ground should be cut off close to the stems with a clean cut; and this is all for this year. Next pruning season, when our bushes will be 3 to 3½ years old, they should be first topped to 3ft, or 2ft 6 in., according to elevation of garden, with a flat surface, all cross wood (*i. e.* branches, growing *through* the bush) and all white barked whippy branches wherever growing, should then be cut off with a clean cut close to the main stem or branch, and growth encouraged outwards and upwards. No laterals should be cut back, except those growing into

the bush which, as I have said, are to be entirely removed, but every branch should be topped or nipped back whether it has reached up to the limit of growth allowed, viz., 3ft. or 2ft. 6in. or not. Thus we have given our bushes their first real pruning, and have got them into shape, which with very little pruning they will keep for 4 years. Our procedure yearly for 4 years is then as follows, always keeping a flat surface:—1st year, our bush being 4 to 4½ years old, top at 3ft. 3 in.; 2nd year, at 3ft. 6 in.; 3rd year, at 3ft. 9 in.; 4th year to between 3ft. 6 in. and 3ft. 9in.; or if topped at 2ft. 6in., or 24" as advised under *Topping* new method, rising 3in. yearly, keeping as much *red* wood as we can and removing each year thin white barked whippy branches, and cutting out all crow's feet from the surface, caused by plucking, leaving not more than a single fork on each branch at the surface; 5th year, cut down to 3ft., or 2ft. 6in at lower elevations, or just below the original cut, and proceed as before. Thus, low topping and heavy pruning is best done every 5th year. At our higher elevations, say from 3,500ft upwards, we can top our bushes far higher than at the lower elevations, and so get increased surface; the flush does not run up from the bush in the same manner it does lower down; our limit here, however, should be at the outside 3ft. 9in.

Exceptions.—Some bushes sulk, either from overplucking or from bad wood, or from some other cause. These should have the knife freely, either by being cut down to 18in. or by removing, with the aid of the saw, one or two of the main stems in the centre, cutting down the outer growth as well, to 2ft or 18 inches, the centre thus opened out will send up a new growth. These bushes should not be plucked till they are well up, say to 3ft. when they can be plucked and then topped with the knife to 2ft. 6in.

PLUCKING.—This again is a most important work and requires close supervision. As a rule, plucking can be begun at 30 to 40 days after light pruning,—I am speaking of coffee-zone teas, be it remembered,—and should not be begun till the bud with opened leaf attached, and half the next leaf, can be plucked at one operation *leaving on* one, or sometimes two, fully formed leaves to carry on the young shoot. The shoulder of the half leaf plucked remains on and protects the eye at its base which in its turn throws out a shoot. Shoots, according to elevation, will measure 6in to 9in. long *before* the first plucking, after pruning, takes place. In after plucking, a good deal depends on the number of leaves on the shoot. If, with the bud and its partially opened leaf, we have four full leaves, then I should pluck at the second leaf down, (leaving on the shoulder of this leaf, which protects its bud, and will probably give red leaf if removed), at one operation, half and again the 3rd leaf at another operation, leaving one fully formed young leaf on the shoot. Towards the end of the season, when the bushes are well up, I would act as above, only plucking at the 3rd leaf, leaving its shoulder on the stem, and thus removing at one operation a half leaf and the shoot consisting of two leaves and the bud. One simple rule in plucking is, to avoid having a bare shoot

without a single leaf to help it on. As in most things a practical less on is best in plucking. As for the number of days in which it is necessary to go round the garden, I learn at a low elevation, it is considered necessary, according to the time of year, to get round in 7 to 10, up to 12 days at the longest. At high elevations, I have found in my *best* months, I should get round in 10 to 12 days to keep pace with my flush, and again, in 15 to, in the very cold weather, December to January, 20 days. I do not think any hard and fast rule should be laid down, at any elevation, as to time. It is for the manager to watch his flush, and wait on it, *just* long enough but no longer and not to rush violently round his estate in a given number of days, which *must* lead to over-plucking, which means a reduction in yield sooner or later, although perhaps higher prices, for the time being; the benefit of this is also in a way nullified by a smaller out-turn.

My average runs this season from (in my worst month,) 10 lb. up to 29 lb. of leaf per cooly, including children. Some of my best pluckers have brought in from 36 to 47 lb.; ordinary months, I average from 20 to 26 lb. My plucking last season 1881-82 cost 5 3-5ths cents per lb. of tea. This season it will cost 6 cents. Leaf should be weighed in twice daily, at midday and at knocking off time; it is best plucked into the ordinary cooty sack, and emptied into cane or bamboo baskets of the following dimensions, to avoid any chance of tight packing:—18in. high, 18 inches across bottom, by 1 feet across top. Cane baskets cost me 62 cents each, bamboo 25 cents to 37 cents, but cane are the cheapest in the long run, and nearer the cane country than I am would probably run from 37 to 50 cents each. Leaf must not be pressed down in either cooty sack or basket. Each basket is best kept by its owner in the line he is working in, the cooty sack should be repeatedly emptied into it to avoid any risk of fermentation. As soon as weighing-in begins, leaf should be removed without delay to the withering shelves. Both baskets and cooty sacks should be taken in after the last delivery, or the cooly may use them to carry bazaar stuffs which may taint the leaf, and in any case they get smoked in his lines. *Bangy* tips, *i. e.* a hardening of the bud and stoppage of growth. should always be plucked, if the single leaf of which it consists is soft, it can be utilized, if not, it should be thrown away. It is as well to take the opportunity of any small plucking to nip off all bangy, the next eye will then nearly always throw out a free running shoot.

WITHERING.—The most simple and best shelves for this are formed of a framework of reepers, covered with sacking,—6 feet long and 3 feet 4 inches wide, the reepers forming this should be 2½ inches wide by 1 inch thick; it takes 1½ sacks to cover this, or Jute-Hessian forms a good cover. It is most convenient to have 12 of these shelves hanging at 6 inches one above the other. The reeper forming the front and back of the frame should project 1½ inches; the projections are rounded off, and at the back are let into holes cut in an upright post to fit them; in front, the projecting ends serve to hold up the shelves by fitting into

knotted loops 6 inches apart, in ropes suspended from the roof. When it is desired to empty them, it is done by simply pulling out the ropes at each end, when the shelves hang flat down on their hinges, throwing their contents on the floor; the upper shelves are reached by the coolies who lay out the leaf to wither, by 3 legged stools 3 feet high. Leaf should be spread as thin as possible and turned over once during withering—a shelf of above dimensions 6 feet × 3 feet 4 inches, holds, very thinly spread, 2 lb. of leaf, or at a pinch it will wither safely up to 4 lb., but not more. Say we put on 3 lb. in full plucking time, we require about 6 feet per lb. of leaf. I have now adopted a cheaper method than above, dispensing with the frame work of reepers, as thus: nail 12 reepers at 6 inches apart across uprights, on to these reepers nail 6 feet lengths of Jute-Hessian, leaving a space of 6 inches between each length. Hem the sides and front of the Hessian, run a ¼ inch rope through the front hem, with ends say 9 inch longer than our shelf, pull these ends through a notched upright say 2 inch in front of the width of our shelf, and we have our shelves ready stretched for our leaf. The advantage of this style of shelf is its cheapness, and the advantage of being able to roll up every other one when full space is not required, thus allowing more light to our leaf. The notched uprights should be 6 inches wide by 2 inches thick, and notched thus:

The rope of the right hand shelf passing through the notch on the left and that of the left hand shelf through the notch on the right.

Leaf is properly withered, if, when held tight in the hand, it does not crackle, and keeps the shape into which you have pressed it; properly withered leaf is best told by touch, feeling like a silk pocket handkerchief, which experience gives us after a time. Leaf to give a good make, that is twist and colour of infusion—copper colour—should be well withered, soft to the touch, not dry or crisp; under-withered leaf will not give a malty liquor, and the larger leaves (souchong) break in rolling, probably lessening the value of your broken pekoe, nor is the make so good as with well-withered leaf.

ROLLING.—Rather overdo this than under-roll; when leaf is properly rolled, it shows a good even twist, is soft, and gummy to the touch, any liquor that exudes during the process of rolling should be mopped up by the leaf, now called *roll*. In hand rolling it saves tip, if, when the rolling is half finished, the leaf is sifted through a No. 4, that which remains in the sieve is rolled separately, that which comes through *lightly*, finished off. A man can take 2 lb. of withered leaf to roll at one time, and it takes him 20 minutes to finish it. If rolling by machinery, and it is wished to make a "tippy" Tea, sift through a No. 4 before withering, withering each kind of leaf separately. There is no real advantage in this further than a pretty looking Tea.

FERMENTATION.—After your leaf is sufficiently rolled, break up the roll well, so as to have no lumps in it and place it lightly

in saucer-shaped baskets of bamboo, or cane 18 inches wide by 6in. deep; these again to be placed inside a sack to ferment. Each basket holds about 12 lb. of roll—no actual time can be laid down for fermentation, as it all depends upon the day or time of year. In cold weather at 5,600 feet, I have waited for 6½ hours for it to ferment, although my house has been kept at 90°. Again, at low elevations, I have seen roll properly fermented in 20 minutes from rolling. As far as time is concerned, at high elevations in ordinary weather, I find it takes from 1½ to 3 hours. Machine-rolled ferments quicker than hand, an advantage in favor of machine. Roll is properly fermented when it shows at a *first* glance a bright new copper color. We must not in making this test, examine the roll too carefully, as, if we do, we will find almost as many green as copper-colored leaves; the *first* glance on taking up a handful must decide us. As a rule, we should ferment up to our pekoe-souchong and let the rest take care of itself, if in doubt, underferment rather than overferment; over-fermentation may cause the tea to be altogether sour, and in any case gives a dark-colored flat liquor, with dark dead-looking infusion.

For the first two or three rounds after pruning, our leaf will not give us a very bright infusion, and there is no use waiting on the fermentation to try and get it; all comes right as the wood matures.

Having arrived at a proper state of fermentation we should hand-roll lightly again, even if machinery is used. Coolies employed in the factory, firing, withering, &c., &c., are sufficient to do this. It is necessary, as it inclines the roll, opened more or less by fermentation, to take its twist again as it is being fired, and it also ensures the whole being thoroughly well separated, before being placed in the firing trays.

In Firing over Charcoal.—The bottom of the tray which is covered with 24 to 26 brass mesh should be 21 inches from the fire-grate which is again 9 inches above the level of the floor, or the stoves are from the level of the floor to the top 30 inches high 3 feet wide, at the top inside measurement, sloping to 1 ft. 2 inches at the grate, which rests on ledges 1 inch wide, making below grate to floor level 1 ft. wide. There should be an opening in front of each grate 6 inches wide by 9 inches high for creating a draught to keep the charcoal alive. It takes 40 minutes to complete the firing of each tray of roll, as thus:—

Each tray 3 feet square inside measurement will hold 5 lb. of roll, which when fired equals about 2 lb. of tea. The tray should be constantly removed from the stove, and the contents well turned (on no account should any turning or fingering be allowed when the tray is over the fire, as dust drops through, burns, and smokes the tea at once) after about 15 minutes drying, being constantly turned the while, the partially fired roll should be sifted through a No. 8 sieve; that which remains in the sieve is again placed over the stoves, being, as before, constantly taken off and turned, and in 15 minutes is ready to be again sifted, this time through a No. 6. It then takes 10 minutes to finish off, being

constantly turned the while. The siftings are left on the table till all tea are finished firing: these represent broken teas, broken pekoe, pekoe No. 2. and dust; and are finished off over the hot stoves by the expiring fires—this takes about 10 minutes. Experience alone can tell us when teas are properly fired, they should feel crisp to to the touch, and when bent resume their shape. As each tray is fired off, the tea should be put into a bin, for the purpose, and exposed on the tables as little as possible.

TASTING.—The first thing the next morning as sorting begins, the "make" of the previous day or night should be infused and tasted carefully; we then know what to do with it, as we should keep our classes of different values (or grades) separately, a good break may be spoiled by having one or two days' inferior make mixed with it. Accidents sometimes happen also, such as over-fermentation, if there is much night work, and this can only be detected by infusing the leaf; burning also. No tea should be packed away therefore (mixed with the bulk) till it is tasted, and faults, if any, discovered, to be rectified in the future.

SORTING.—This is best done by women—one woman to every 100 lb. of tea. Red and large flat leaf is first picked out, and the tea is then passed through a No. 7 or 8 sieve, according to the size of leaf,—*i. e.*, tea of any particular day. That which comes through is next put into a No. 10 or 12—the higher the elevation the smaller and more wiry the make—that which remains in the No. 7 or 8 must be *lightly* broken through by hand; and what still remains in (very little) is congou and black fannings; that broken through is broken tea and broken souchong, which is mixed after removing the dust and broken tea, with the pekoe souchong pure. (remaining in No. 10 or 12,) and the mixture classed as pekoe souchong. We then have left to deal with pekoe, broken pekoe, broken tea and dust,—all of which has been passed through a No. 10 or 12—to extract, as shown, our pekoe souchong. This we *again place* in No. 10 or 12, *lightly* sifting it, to remove broken pekoe, broken tea and dust, leaving the pekoe in the sieve. We then with an ordinary rice winnower ("sholagoo"), remove broken tea and dust from the broken pekoe, the broken pekoe remaining in the winnower; the broken tea and dust we then put into No. 24, passing the dust through. To separate tea dust from pekoe dust, we can use either muslin or the winnower again. We have now sorted our teas into the following classes:—1. Pekoe. 2. Pekoe souchong. 3. Congou (and fannings with large unrolled leaves). 4. Broken pekoe. 5. Broken tea. Tea dust and pekoe dust I do not count as a make, nor yet fannings; the latter may, in most instances, unless the plucking has got ahead of you, be mixed, after breaking, with the broken tea. Fannings we break through a Reid's breaking machine, turning out a reddish make about twice the size of our broken tea, which, if poor in liquor, we ship separately as fannings; or, if showing a fair liquor and not too much red leaf, mix with our broken teas. Of congou, fannings, and the dust, we have a very, very small percentage each day. The numbers of

sieves we require are as follows:—No. 4 for sifting green leaf in rolling by hand, to give more "tips." No. 5 useful sometimes when plucking has got ahead of you; Nos. 6, 7, 8, 10, 12 (14 for fine pekoes) and 24.

PACKING.—As, according to the new rules, bulking on the gardens is now accepted in London and our tea saved from being all turned out, provided tares run pretty equal, I recommend each class of tea to be packed as soon as sufficient can be bulked to make 25 half chests of 50 lb. each. These should measure 15 × 16 × 16, and tare, on an average, 18 lb. including lead, do not require hooping, and represent one cooly load. As soon as we have packed all our teas to complete that particular break or shipment, (which ought not to be under 5,000 lb. nett I think, and the more the better), we may add our dust, fannings, and congou which will only amount to a half chest or so of each. These teas will run from 5d. per lb. to 10½d. and are as well shipped, if a half chest can be made up, with each break from which they have been made. I find a half chest takes 3½ lb. of lead and 1¼ oz. of solder—or cost of half chest with lead-lining, &c. ready packed cents 3·500 per lb. of tea. Whilst on this subject, I think it would be of great advantage to us all if we could arrange to use one uniform package, and no package can be more convenient for us than the half chest as above—the majority of us have to transport our chests to the main road on coolies' heads—this half chest represents just a full cooly load. Whereas a chest takes two coolies to carry it, has to be hooped—a costly work—and there is all the worry of rope which is constantly stolen, and poles, to carry it; therefore, the saving in draft in London (under ½-a-lb. of tea) and the slight difference in its favor in cost, in the first instance, is more than counter-balanced by the cost of hooping and transport, with the accessories of poles and rope. I trust, therefore, that those interested in tea in Ceylon, will from this year,—our first great start almost,—arrange to use one uniform package which shall be peculiar to Ceylon, and become known as the *Ceylon chest*. This for the bulk of our teas, but we may also pack occasional breaks in boxes; these should weigh under 28 lb. gross and thus save draft, say 10 to 15 lb. nett. Any especially fine make could be shipped in these, forming a small break, and will often fetch fancy prices. Brokers at home accept both half chests and boxes, so there is no innovation here. A cooly can pack carefully, 15,—shall I call them Ceylon-chests?—in a day.

I take the following table and remarks from Nemo Nomad's letter to the *Ceylon Observer* of 6th October 1884.

	160 to 199 lb	130 to 159 lb.	80 to 129 lb.	60 to 79 lb.	45 to 59 lb.	35 to 44 lb.	17 to 34 lb.	Not exceeding 16 lb.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.
Landing and housing rate ...	3 6	2 7	2 1	1 9½	1 7	1 3	9½	5
Management rate ...	4 4	3 3	2 7	2 1	1 9½	1 4	10½	6
Bulking and taring ...	2 10	2 4	1 11	1 5	1 5	0 11	11	9
Rent per week	0 1	0 0¾	0 0½	0 0½	0 0½	0 0½	0½	0½

Note that landing and housing rate is charged when goods are sold privately; management when goods are sold publicly. Both are not charged. The private wharehouses have been gradually eating into the business of the London and St. Katherine Dock Co., by returning certain percentages to the merchant. The charges from full rates were reduced by this competition to 35 per cent allowed. Suddenly and lately, the Dock Co., to put an end to further opposition and crush the private warehouses, are allowing 50 per cent; and the privateers, not to be outdone, have responded with 55 per cent. When this big leap was made, the private people tried to come to an arrangement with the Dock Co. against the common enemy, the planter, but all advances are so far made in vain. The Dock Co. are very bitter and are determined to maintain the low rates. I heard of one warehouse which last year showed a profit of £3,000 and is now barely covering expenses. Let planters take note, however, that at present they should receive back at least 50 per cent, and I will endeavour to advise any change."

I now come to yield and cost per lb. f. o. b. at Colombo.

YIELD.—In my own experience, at 4,700 to 5,600 feet elevation, with fair soil, ordinarily featured land, as our hill country goes, fairly steep, I find the yield has been as follows, aud I do not consider I am yet in full bearing:—

At 2½ to 3½	years old	165 lb. tea per acre.
3½ to 4½	,,	292 ,, ,, ,,
4½ to 5½	,,	262 ... ... Pruned heavily in July last season,—season ends in Sept.—to shape bushes, which explains shortness of yield.
5½ to 6½	,,	450
6½ to 7½	,,	year finishes end of Sept., 700 lb. per acre will be exceeded all round.

Bushes from the first have been under plncked.

Again I have yield given me at an elevation of 1,800 to 2,500 feet.

Average age	3 years	224 lb. per acre.
	4 ,,	380 lb. ,,
	5 ,,	315 lb. ,,

And please note, on this garden of over 200 acres in extent, there was a considerable loss of leaf, from allowing large areas to grow up during these three seasons, for seed, from which little, if any, leaf was plucked; had the full acreage been plucked, the average would have reached 100 lb. more per acre.

Again, I have given me figures of an estate, at an average of 2,500, feet elevation, 400 lb. per acre at 3½ to 4½ years old.

Another estate, at an average of 500 feet, gives for the first *six months* of this year, January to June, being in June 4 years old, 400 lb. per acre, the estimate to December is 600 lb. per acre; and will probably be exceeded. Again, an estate from 100 to 400 feet, showing an average age all round of 4 years, gives 430 lb. per acre. This estate is widely planted 5 × 6 and 5 × 5, and had it been 4 × 4 would have given a larger yield, as bushes do *not* cover the ground, but 430 lb. at 4 years is good enough, you will allow.

I have again many instances of estates, up to 3000 feet, giving 400 to 600 per acre up to 5 years of age; and at 4,000 to 5,000 feet, from 360 to 420 lb. per acre.

We have all heard of Gallebodde and its 800 lbs. odd per acre; also of the older portion of Dunedin with its 730 lb per acre; a portion of one of my ffields 3 acres in extent has given me at 7½ years 1,200 lb. per acre at 5,500 ft. elevation, well sheltered with fine soil—an exceptional field, I will allow. These figures are fairly representative of tea in Ceylon at this date, and not *one* of the estates mentioned is in full bearing. What *will* the yield be when we are in full bearing, from 8 years of age upwards? We shall want lots of withering room, gentlemen, so be prepared in time.

Young as we are, and in the face of these yields at 6 years of age and upwards I feel perfectly safe in estimating an *average* yield of 400 lb. per acre from tea in the coffee zone and above it, say from 2,500 to 5,700 ft. in sheltered situations, and in saying 5,700 ft. I do not wish it to be understood I draw the limit even here, but the figures I have had given me above this elevation viz. at 6,300 ft are only from a very small area under tea, which however gave at 6 years old 400 lb. per acre at 4 × 4. For lowcountry teas, that is teas at from 2,500 down to sea level, at 6 years old and upwards, I shall be very much surprised indeed if they do not show an *average* yield of 600 lb. per acre. These estimates gentlemen, may seem excessive, looking at the average yields from Assam and India generally, but compare our yield in this our very infancy with that in India and you will find we can even now show an average, from estates at 3½ years old up to 6 which will more than double theirs. [30th October 1884.—N.B. The yields of this season have proved this estimate to be under the mark, as we have to chronicle yields of from 600 up to 900 lb. per acre all round at high, low and medium elevations, and in the face of a bad season, from insufficient rain, throughout the island.] Inclemency of weather does not affect us in the same way in which it does our Indian fathers, as we have 11 months in which we pluck. If one month is too wet we benefit all the more when the sun shines again, as we have lots of time; if we have a spell of dry weather, on the other hand, this again is sure to be followed by rain, when we at once make up any loss.

COST PER LB. F. O. B.—I have to thank many friends for furnishing me with cost F. O. B. at Colombo and choose the following which are representative of all and may be relied on. In all cases, the tea was manufactured without the aid of machinery of any kind.

450 lb. per acre cost	36 cts. F. O. B.	
700 „ „ „	30 cts. F. O. B.	Including cost of upkeep of young tea not in bearing.
400 „ „ „	40 cts. F. O. B.	
430 „ „ „	29 cts. F. O. B.	

If we take the average of the above 4 estates we have, say 495 lb. per acre, hand-made, costing 34 cents F. O. B. at Colombo; London charges including freight are under 2½d; but for all practical purposes let us say 2½d, the above teas at an average price of 1s 2½d, and this is not a high average, leaves us 1s nett, or at 1s 8d per rupee, 60 cents; a profit of 26 cents per lb. at 495 lb. per acre, say R128·70 profit per acre.

Whilst I am on the subject of yield I trust we in Ceylon will talk of *lb.* per acre and not *maunds*; our tea is sold by the lb. what then can we have to do with maunds?

With regard to plucking and manufacture I find its actual cost is as follows, without machinery :—

Plucking (including baskets and cooty sacks)	cents 7·000
Withering, rolling, firing	cents 6·500
Sorting, refiring, packing (in half-chests) including lead solder and chests	cents 4·000
Total ... cents	17·5000

The rest of the works depend upon circumstances, and in many instances can be done cheaper with regard to some of the items than I now show. Take for example a garden of 150 acres, bearing at 400 lb. per acre :

	cents.
Supt., including Factory overseer, at R20 per acre, cost per lb. of tea	5·000
Weeding at 87 cents per acre R10·44 per acre per annum	2·610
An ordinary pruning at R6 per acre	1·500
Nurseries R225	·375
Supplying at R4·50 per acre	1·125
Roads and drains at R3 per acre	·750
Tools, say R150	·250
Transport of Tea from estate f. o. b.	2·200
General Transport	·400
House and tappal coolies, medicines, stationery, contingencies, and export duty and medical aid	1·540
Upkeep of building at R450 per annum	·750
Manuring 30 acres per annum at R100=R3,000	5·000
Total estate expenditure per lb.	21·500
Add cost of plucking and manufacture as above	17·500
Total cost 400 lb. per acre f. o. b. at per lb. tea *hand*-made	39 cents.

Value of 400 lb. tea at 60 cents per lb. *nett*	R240
Less cost as above at 39 cents per lb.	156
Nett profit per acre	R84

Or if no manuring is done R104 per acre profit. Manure of course eventually pays for itself by *increased* yield.

I believe the above to be a liberal estimate, it is at all events one higher than I should allow for the working of my own garden, which is in perfect order, R150 per acre for 400 lb. tea is liberal enough, without machinery. [October 1884.—Further experience with machinery has shown me 30 cents per lb. at 400 lb. per acre is a liberal allowance f.o.b.] I will now show my experience of the benefit machinery gives us.—On a coffee estate with *water wheel already erected* a Jackson's universal roller should be purchased, for even only 25 acres of tea, as I think the folloing figures will prove. I take 400 lb of tea per diem as my standard, as the following machinery works up to it, and this machinery is sufficient for a garden of 150 acres giving up to 500 lb per acre.

One Jackson's Universal Roller fixed ready for working	R1,200
One Davidson's Sirocco	1,300
To drive the roller a 16 to 18 feet water wheel will do, or if no water power a 2½ H. P. engine costing say on estate	1,500
A second Sirocco is most useful and if means allow of it should be purchased, so I will add it, although not absolutely necessary	1,300
	5,300
Add a sorting macine at a cost of say	950
	R6,250

If the garden is to be increased in area it is better and cheaper to purchase at the first Jackson's larger roller called the "Excelsior" exactly the same as his "Universal" only working up to 8,000 lb. of leaf per diem, instead of 2,000 lb. and costing at the garden about R2,250. This with 4 Siroccos will work up to a 300 acre garden, and requires 6 H. P. to drive it.

Working, however, with our "Universal" at 400 lb. of Tea per diem, costs us as follows:—

	Cents.
Plucking per lb. tea	7·00
Withering. Rolling 1,600 lb. leaf=400 lb. tea at 5 *coolies*, say	·41
Firing ditto at 3 coolies *including* firewood, say	·25
Sorting *by hand*, refiring, packing in half-chests, including chests, &c. &c.	3·50
Total cost of plucking, and manufacture by machinery	11·16

or a saving per lb. of tea of cents 6·34 as against hand-rolling and charcoal firing. I have not as yet worked a sorting machine, but I believe, with two coolies to attend to it, (driven by water or steam,) a Jackson's or Ansell's will sort into four classes at the rate of 400 lb. per hour, Let us for example, take 5 coolies per 1,000 lb. including the picking out of red leaf, its cost is exactly half that of hand-sorting or cents 0·165 as against cents 0·33 per lb. or say we have *a saving of 6½ cents per lb, of tea*, with all machinery complete. This at 400 lb. per acre yield represents a saving of R26 per acre or brings up profits as per former estimate to R100 per acre, or, if no manuring is done, on a young garden, to R130 per acre. From these figures you can work out the profits at any yield per acre; cost of manufacture is always the same, except when machinery is used, when the nearer we work up to its full power, the cheaper are we able to manufacture our teas, as there is then no loss in cooly labor at machinery; cost of the other works is increased or lessened in proportion as the yield is lower or higher. In further reference to machinery, in making any quantity of tea per diem, the machine roller will turn out a better make than can be obtained by hand-rolling. One or two picked coolies might roll better; but when we have from 20 to 80 coolies to attend to, machine rolled tea will carry off the palm. Sirocco fired teas, as I have myself tested, are brisker and fuller than charcoal fired teas. I find my Sirocco @ 2750 will fire off 100 lb. of roll per hour, equal to about 45 lb. of tea; my "Universal" rolls the equivalent of 200 lb. of green (unwithered)

leaf per hour or 150 lb. of withered leaf in 75 minutes, taking in 37 lb. at a fill which it rolls in 20 minutes, and we have to allow 5 minutes for emptying and refilling. If on a coffee estate you have not sufficient power already erected to drive the "Excelsior" roller (6 H. P.) I can for *fine* leaf recommend Kinmond's Centrifugal, one of which rollers I also have. This requires only the same power as the "Universal," but will roll off 5,000 lb. of green leaf per diem, instead of only 2,000; its cost is about R1,700 on the garden. It will not roll coarse leaf well, so with one of these rollers you must keep up with your flush, its great advantage is its cheapness, as compared with the cross action for amount of work it does, with the small power it takes to work it, (2½ H. P.) and with good leaf, the large amount of tip it turns out, although, where it can be worked, I prefer the large cross action (Jackson's) "Excelsior." To compare labour required to make 400 lb. of tea by hand and charcoal, with the number of coolies required to make the same with the Universal and Sirocco, I find the following:—

By hand-Withering 1,600 lb. leaf	2	coolies
Rolling do ...	4	
Firing and charcoal ...	16	
Total for 400 lb. tea ...	5	
By machine-withering 1.600 lb. leaf	2	coolies
Rolling do	3	
Firing &c.	3	
Total ...	8	

Saving in labour at 400 lb of tea .. 50 coolies. This really represents a saving 4·125 cents per lb. or the roll saves 37 coolies and the Sirocco 13 coolies at 400 lb. tea. To aid in working the Sirocco, I make any labour not carrying in leaf, carry in a log of firewood every evening, which one cooly can cut up for the Sirocco.

Since the above was written we have 3 hand rollers to choose from. First I would place Jackson's hand roller which takes 40 lb. of withered leaf at a fill and takes 25 minutes to roll with 4 coolies, costing R375 at Kandy. Next Kerr's roller, quite as good for work but not quite so good as a Machine, 50 lb. of withered leaf at a fill, 6 coolies, 25 minutes, cost R350 at Colombo. And last Thompson's "Challenge," 80 lb. withered leaf at a fill, 6 coolies, 20 minutes. The two former are to be preferred, although the latter does more work.

In Driers, besides others, new, we have the improved Sirocco No. 3, which is said to be equal to 90 lb. of made Tea per hour, or just double the work of the old No. 1; this new one costs £90, f.o.b., or only £5 more than the old pattern.

In Sifters, we have Gore's new patent. with his separator, to remove broken Teas. This can be made equal to any capacity. Its cost, sufficient for any ordinary Factory, is R390; it can be driven by hand or power, and I prefer it to any other. The sieves are removed at will, and a finer or coarser mesh can be substituted at a moment's notice.

Thus rolling by hand should on no account be attempted, nor yet sorting by hand; choolah firing will also before this year is out be a thing of the past with the cheap "American fruit drier" to fire our teas with, cheaper than choolahs, and consuming wood instead of charcoal.

THE FACTORY should be roomy and have as much light as possible. All green leaf, whether withering or being rolled, should

be shut off from the firing, sorting, packing and store-room, or it collects dust, etc. Even with a Sirocco, we should be provided with stoves, ready for charcoal firing, in case of accident. Cleanliness must prevail from rafter to floor Our coffee stores, when too large for our crop, as at present, can be at a small expense turned into a suitable factory, a portion being walled off for our coffee crop.

LAND can be opened, not including purchase of course, at the following rates per acre for the first year :—Jungle R80, patana R50, and coffee R35 to R50. Coffee should be uprooted when tea is at 1 to 1½ years old, unless it has on it sufficient crop to make it worth while leaving in. Tea at three years of age will prevent coffee giving sufficient crop to pay, and eventually kill it out, so the two cannot be grown side by side. Coffee, when uprooted may be stacked with advantage for firewood or charcoal. We can grow *among* our tea to advantage, according to elevation, taking care not to overcrowd it, C. officinalis, (best of all, as it gives no shade to speak of, and thrives better among tea than in the open), small-leafed Robusta and Ledger; the upkeep is nil, harvesting being the only expense after planting. We can grow *with* with tea to a *large saving of expenditure* in both, coffee or cocoa according to elevation. And let us aim, with tea as our mainstay to grow all the products the elevation of our garden will allow of, with it "*Experientia docet.*"

And now, Mr. Chairman and Gentlemen, I must bring this somewhat lengthy paper to an end. I have endeavoured throughout to be as concise as possible, and have, necessarily, not been able enter into many minor details and "dodges" know to the tea planter. I trust, however I have forgotten nothing useful, and that the practical experiences of a "Ceylon grown tea planter" may, however lamely put before you, be of some benefit to you. We have all of us suffered during the past few years, but I can assure you. gentlemen, that I for one feel the turning-point is now at hand, and that never since the first coffee estate was opened in Ceylon has there been such a future as is now before us: *lasting prosperity* in our many products, among which coffee shall not be the least.

C. SPEARMAN ARMSTRONG.

Rookwood 24th August, 1883.

[*Revised and Supplemented 30th October*, 1884.]