Tea, Cardamoms and Areca

CULTIVATION

AND

PREPARATION

IN CEYLON:

DISCUSSED IN LETTERS FROM

MESSRS. RUTHERFORD, HUGHES, (F.C.S.), ARMSTRONG, SCOVELL, HAY, CAMERON, GRIGG, AND BORRON,

CONTAINING ALSO

Mr. C. SPEARMAN ARMSTRONG'S PAPER read before the Planters' Association, on the 29th August 1885.

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THE TEA ENTERPRISE IN CEYLON.

VALUABLE INFORMATION ON THE COST OF MANUFACTURE, TRANSPORT, ETC., OF TEA.

Planters' Association of Ceylon,

Kandy, 27th Feb. 1885.

(*To the Editor "Ceylon Observer."*)

SIR,—I beg to enclose for publication an interesting and valuable letter received from Mr. H. K. Rutherford on the cost of tea manufacture &c.—I am, sir, yours faithfully, A. PHILIP, Secretary.

Watawala, 20th February 1885.

The Secretary, Planters' Association, Kandy.

Dear Sir,—Since Messrs. Armstrong, Hay and Owen and others in the latter part of 1883 gave to Ceylon planters much valuable information regarding the cost of producing tea, I do not think the details of the cost of manufacture have been again brought up in the local papers. I have much pleasure in sending you the following figures showing the actual cost of considerable quantities of tea made on four gardens with which I am connected. The saving by machinery over hand-work, I do not find to be so great as was stated by the abovenamed gentlemen in 1883, but I have no doubt they are now in possession of much further data than they had in those

days and will be able to give their later experience of the saving effected by machinery. As far as I can gather, the following were the estimates given of the saving that would be effected by the use of machinery :—

				Cents.
24th Aug.	1883	Mr. Armstrong gives saving at		6·34
15th Sept.	,,	,, Owen 7 cents afterwards modified to		6·50
12th Oct.	,,	,, Hay (Gallebodde data)		5·50
19th Oct.	,,	"Adam's Peak"*	,,	4·67
23rd ,,	,,	"Proprietor"*	,,	4 75

From the following figures, it will be seen, the most favorable result obtained was a saving of R3·25 per lb. where steam-power was used.

With perfect water-power the saving might be increased to 3·50 cents, but I am of opinion a greater direct saving cannot be obtained, although, of course, the indirect saving and advantages by using machinery are very great, so as to make its application a necessity on almost all gardens.

I beg to suggest it would be exceedingly useful and interesting if you could collect information from others as to cost of manufacturing tea by other machines than those stated below, so that comparisons could be made. As many estates are making large quantities of tea, accurate data ought now to be available. Previously we had to be content with assumptions worked out on the quantity a cooly or a machine could roll and fire per hour; but, to arrive at anything like accuracy, fairly large quantities must be dealt with, and, if possible, a whole season's yield.

I think the Planters' Association ought to be the means of collecting all information of this nature. It is not at all necessary that those affording the information should state the name of the garden the results are obtained from, but I think the quantity of tea on which the data are based should be given :—

* Newspaper correspondents.

Cost of Rolling and Firing Teas by Various Methods.

Process.	No. of lb. made tea.	Labor on withering, rolling and firing.	Charcoal and firewood.	Total.	Saving over hand-work.	
		c.	c.	c.		
Hand-rolling and firing over chulas	201,964	4·11	0·87	4·98	...	*
Hand-rolling, firing with chulas and Siroccos of old type ...	103,042	3·82	0·38	4·20	0·78	†
Rolling: hand-power Challenge; firing with chulas and Siroccos of old type ...	44,070	2·32	0·38	2·70	2·28	†
Rolling No. 2 Kinmond roller, and drying with No. 2 driers & chulas: *water power very imperfect* ...	95,652	1·45	0·31	1·76	3·22	‡
Rolling No 1 Kinmond roller and drying with No. 2 drier: steam power ...	118,362	1·45	0·28	1·73	3·25	§
Total ...	563,090 lb.					

The other items of cost in manufacturing this quantity of 563,090 lb. of tea were as under :—

Average of Four Gardens.

	Cents.
Plucking, including baskets and transport to factory	10·31
Sorting and packing	0·53
Toxes, lead, solder and hoopiron ...	2·80
Transport to Colombo, charges f. o. b. ...	1·75
Tea-house sundries	0·48
	15·87

One Garden.

Cost of rolling and firing, if done by machinery	1·73
Total cost of manufacture f. o. b. Colombo	17·60

* Average of 4 gardens. † 2 gardens.
‡ 1 garden—the saving shown would have been greater, had water-power been sufficient. § 1 garden.

Certain gardens are worked for less than this, but I give these figures as the average results of four gardens, and I think in this form they will be more useful to planters than if I had singled out one particular estate. The cost of plucking is at variance with the rate which was given by many writers on the subject in 1883, when it was put down at 7 cents per lb. The average of 10·31 cents is arrived at on two and a quarter million lb. of green leaf plucked over fields varying from 1¾ to 6½ years old. At 10·31 cents per lb. of made tea, this is equivalent to 2·57 cents per lb. of green leaf. or at an estate average of 33 cents would give a plucking of about 13 lb. per cooly.

The following tables may be found useful to tea planters, and you are at liberty to make any use you like of the information herewith sent you.

Tea Transport.

Railway freight on Tea per lb. calculated on a basis of 1,680 lb. of tea to a ton of gross weight:—Kalutara to Colombo ·20c; Peradeniya ·70c; Kandy ·74c; Gampola ·78c Wattegama ·82c; Nawalapitiya ·86c; Matale ·92c; Galboda 1·04c; Watawala 1·18c; Hatton 1·37c; Kotagala 1·44c; Wattegoda 1·66c; Nanuoya 1·85c. From Patupowla, Kalutara, by canal to Colombo ·30c per lb.; from Yatiyantota by river ·56c per lb.

Ocean Freights and Insurance.

1 Ton of shipping = 50 cubic feet.—an average of 917 lb. of tea. Cost of freight per lb. of tea in cents = freight in shillings × ·067 cents. Insurance at 1s 3d per lb. value; cost of insurance per lb. of tea in cents = shillings per £100 + ·038 cents.

Freights.			*Insurance.*		
Rate per ton.		Per lb. tea.		Per £100	Per lb. tea.
— s.	d.	cents.		s. d.	cents
25	5 ...	1·67		10 0	0·38
27	6 ...	1·84		11 0	0·42
30	0 ...	2·01		12 0	0·46
32	6 ...	2·18		13 0	0·50
35	0 ...	2·34		14 0	0·53
37	6 ...	2·51		15 0	0·57
40	0 ...	2·68		16 0	0·61
42	6 ...	2·85		17 0	0·65
45	0 ...	3·02		18 0	0·70
47	6 ...	3·19		19 0	0 73
50	0 ...	3·36		20 0	0·77

Exchange at 1s 7¼d.

Yours truly, (Signed) H. K. RUTHERFORD.

COST OF GATHERING, MANUFACTURING AND PLACING TEA F. O. B. COLOMBO.

Strathellie, Nawalapitiya, 30th March 1885.

DEAR SIR,—Mr. Rutherford, in his letter on the cost of manufacture &c. of tea, expresses a wish that others using machinery should give data based on experience. The following are the actual figures of cost on the past season's working here with Jackson's Excelsior Roller, Ansell's Sifter and Davidson's No. 1 Sirocco. Facilities of transport give Mr. Rutherford's estates a slight advantage, but practically the cost of plucking, manufacture and placing f. o. b. in Colombo are the same:—

	Cents.		Cents.
Plucking, including baskets and transport of leaf ...	10·36 against Mr. R.'s average of		10·31
Rolling, firing, sifting, and packing including boxes, and tea-house sundries...	5·47	,, ,, ,,	5·54
Transport to Colombo and charges	1·86	,, ,, ,,	1·75
Total cost of manufacture f. o. b Colombo... ...	17·72	,, ,, ,,	17·60

—Yours faithfully, ARTHUR E. SCOVELL.

[The close coincidence of the results is certainly striking; but we hope the figures may be brought down to 15 cents.—ED.]

MR. C. S. ARMSTRONG* ON TEA "DRYING" AND "PLUCKING": VALUABLE PRACTICAL RESULTS:—THE NO. 1 SIROCCO A 1.

Rookwood, Deltota, 13th March 1885.

DEAR SIR,—I beg to give you the results of two trials with my Siroccos No. 1. I have stated the Sirocco No. 1 would work off 45 lb. made tea per hour, and the result of these trials proves this to be correct. My usual charge per tray is 9 lb. of roll. For the sake of experiment, I loaded the trays with all they would hold to allow of their being run into the Sirocco; result, as will be seen, is in favor of the smaller charge 9 lb. per tray.

* For this gentleman's Essay on Tea Planting and Preparation see pamphlet printed at *Observer Press*.

1st trial 100 lb. of roll or 12½ lb. per tray—Sirocco worked at 275°.			
1	Tray fired off in	15 *m*	100 lb. roll which gave 46 lb. tea.
2	,,	25 ,,	
3	,,	28 ,,	
4	,,	32 ,,	
5	,,	35 ,,	
6	,,	40 ,,	
7	,,	50 ,,	
8	,,	60 ,,	

2nd trial 117 lb. of roll or 9 lb. per tray—Sirocco worked at 275°.			
1	Tray fired off in	10 *m*	117 lb. roll which gave 48 lb tea.
2	,,	15 ,,	
3	,,	20 ,,	
4	,,	24 ,,	
5	,,	27 ,,	
6	,,	32 ,,	
7	,,	36 ,,	
8	,,	40 ,,	
9	,,	44 ,,	
10	,,	48 ,,	
11	,,	54 ,,	
12	,,	58 ,,	
13	,,	62 ,,	

With regard to Plucking, the cost of this at the lower elevations and at the higher is about 3 cents in favor of the latter. At the lower elevations I find the cost to be from 9½ to 10½ cents; this tallies with Mr. Rutherford's experience. In the one case, the flushes form more rapidly, and are not so lar ge, the fields having to be gone over at from 7 to 10 days. In the other, the fields are gone round in the hottest season at from 10 to 15 days, and in the colder weather at from 15 to 22 days; result in yield is about the same, always excepting "Mariawatte" with its perfect climate and lay.

My plucking at an elevation of from 5,000 to 5,500 feet cost as follows for the three seasons:—

Season—'81-82 5·57 cents per lb. } Average for 3 years
,, '82-83 6·86 ,, ,, } 7·08 cents per lb. tea.
,, '83-84 8·81 ,, ,,

The high cost of plucking last season is due to two causes: first, the unprecedented drought caused a stunted flush, during what ought to have been our best months; second, 90 acres of young tea was plucked for the first time, coolies only bringing in their 5 to 8 lb. of leaf from it. I think therefore my former estimate of 7 cents is about correct for high-grown teas, to which I then referred.

To revert to *driers*, there can be no question, I think, that those are to be preferred that do good work without motive power, to those requiring motive power, even should the cost of the former be more. Should the No. 3 Sirocco prove to be the improvement on the No. 1 it professes to be, it is in my opinion *the drier* of the day.—More anon.—Yours tru'y,

C. SPEARMAN ARMSTRONG.

TEA DRYING : CAREFUL EXPERIMENT WITH SIROCCOS.

Blackwater, Nawalapitiya, 26th March 1885.

DEAR SIR,—Allow me to send you the result of two careful trials with two No. 1 Siroccos, one of which has the old kind of air-heaters and the other the newest. I was most particular in the weighment of fermented leaf, in the taking out of trays when dry, and in noting the time. You will see the No. 710 only gives me 30¾ lb. with 10 trays and the No. 737 with 9 trays 33 lb., making a great difference between the quantities got by Mr. Armstrong, viz., 46 and 48 lb.

I do not merely state that I worked my Siroccos with the thermometer at 275, because for one hour that exact heat could not be kept, so I show the rise and fall.

My machines stand in one large pit 18′ × 10″ × 4′ 6″ and have splendid draught, the mean temperatures of the two machines being 280 and 278 are higher than Mr. Armstrong's; yet the results are far from being as good. I should like very much to know, 1st, were all four trays put in at commencement? 2nd, were the bottom trays turned over and respread?

I know that there is a great difference in the working of Siroccos, some working better in pits and others on the level; still 33 against 48 is very great.—Yours truly,

C. A. HAY.

A No. 1 "Sirocco."
No. 710 Old style of air-heater.

No. of Trays.	Put in Sirocco.	Taken out of Sirocco.	Time Taken	Time.	Therm
1	11-17	11-31	14 min.	11-17	275
2	11-17	11-37	20 ,,	11-27	280
3	11-17	11-43½	26½ ,,	11-30	282½
4	11-17	11-49½	32½ ,,	11-33	285
5	11-32	11-53½	21½ ,,	11-40	280
6	11-37½	11-59	21½ ,,	11-52	282½
7	11-44	12- 4	20 ,,	11-56	275
8	11-54	12-10	16 ,,	12-6	280
9	12-	12-15	15 ,,	12-9	282½
10	12-04	12-20	16 ,,	12-17	285

From putting in 1st tray at 11-17 until the taking out of the 10th at 12-20, 1 hour and 3 minutes, I only got 30¾ lb. dried tea. Every tray had exactly 9 lb. weighed leaf put on, and every bottom tray was overturned and re-spread taking about ½ minute in the operation: no tray was left in one second longer than necessary to quite dry the biggest leaves. I have never used my Sirocco so low as

275 before, generally working at 300 and 310; still there is a great difference between 30¾ and the 48 Mr. Armstrong obtained.

A No. 1 "Sirocco."
No. 737 Newest style of air-heater.

No. of Trays.	Put in Sirocco.	Taken out of Sirocco.	Time Taken.	Time.	Therm.
1	7	7-16½	16½	7	275
2	7	7-21¼	21½	7·5	280
3	7	7-28	28	7-10	286
4	7	7-34	34	7-20	275
5	7-17	7-40	23	7-25	280
6	7-21½	7-45½	23¾	7-35	286
7	7-28½	7-51	23½	7 40	277
8	7-34½	7-56½	22	7-50	275
9	7-40½	8-5	24½	8	272

From putting in the 1st four trays at 7 a.m. until the 9th tray was taken out at 8-05, 1 hour and 5 minutes, I only got 33 lb. dried tea. Every tray was spread with 9 lb. fermented leaf. The time taken in pulling out bottom tray, shifting down the other three and putting in the fresh one on top occupied from 20 to 25 seconds; once re-spreading bottom tray, 40 to 45 seconds. The last tray of all was not re-spread, and just took 4 minutes more than all the other bottom ones. Time deducted from hour in re-spreading 8 trays, 4 minutes. Time taken in shifting trays, 3 minutes.

GENERALLY ADMITTED FACTS WITH REGARD TO THE MANUFACTURE OF TEA.

[The following paper has been kindly placed at our disposal for publication. It was found amongst the late Mr. Cameron's papers and appears to have been the maxims which he had acquired during his lengthened experience of tea-making in India. They are of peculiar interest to all planters in Ceylon, as the framework on which Mr. Cameron based the teaching that had so powerful an effect for good throughout the island. It will be seen that they refer *only to hand manufacture*].

1. Leaf is best withered when there is free supply of light and cool air.
2. Wet leaf is better withered in the sun or in the wind than by artificial heat.
3. Dried leaf is not necessarily withered leaf.
4. Under-withered leaf breaks in the roll.
5. Over-withered leaf gives most Pekoe tips.
6. Leaf withered in the sun gives red tea.
7. Under-withered leaf gives a green and over-withered leaf a dark outturn.
8. A bright coppery-outturn can only be obtained from well-withered leaf.

9. Under-withered leaf will take longer to fire than well-withered leaf.

10. Low rolling tables cause the leaf to get broken. Anything under 3 feet high is objectionable.

11. If sap comes too quickly in the roll, it shows that the leaf required more withering.

12. Too much sap makes a knobby tea from the leaf getting into lumps.

13. Small leaf cannot be successfully separated from the large before rolling.

14. Heavy rolling destroys the flavor of the small leaf, but improves the strength of the large leaf.

15. Heavy rolling discolors the Pekoe tips.

16. Coarse leaf requires all the rolling it can get.

17. Contact with iron blackens the roll.

18. The roll will color in any temperature, be it higher than, equal to, or lower than, that of the tea house.

19. In a higher temperature than that of the tea house the color comes quickly; in a lower temperature much slower.

20. At some period of so-called "fermentation" the roll gets warm. In the present state of our knowledge there is no certainty whether to check or encourage that warmth.

21. The roll gets blackened by contact with the air and colors more evenly covered up.

22. Coloring in balls is uneven. Roll spread out over three inches to color gets mawkish.

23. The fermentation proper cannot be brought about without heat. Teas coloured in a temperature below that of the tea-house are not "fermented" in the real sense of the word. "Oxidation" or "coloring" expresses the process more correctly.

24. There is no fixed time for coloring; the proper point is determined by the eye.

25. There is no chemical or other test in use to determine the point at which to stop the coloring.

26. The color of the roll immediately before brisk-firing is about the color of the outturn which will be found in the cup.

27. Pungency or rasp and a light liquor accompany a green outturn.

28. Thickness and a dull liquor attend a dark outturn.

29. Over-colouring produces a soft tea.

30. Care given to the withering ensures good color, care given to the roll ensures strength, but care will not ensure flavor.

31. In the present state of our knowledge there is no method by which flavor can be fixed.

32. Leaf opens out during the coloring, and requires re-rolling.

33. Heavy re-rolling before firing softens the tea. A light pressure to excite a little moisture gives the twist and the polish required.

34. Drying in the sun gives a black and tippy tea.
35. Tea dried in the sun, cups out with a metallic taste.
36. Coloring and softening go on rapidly over slow fires, and are checked by all aglow fires.
37. Quick firing gives a brisker tea than slow firing.
38. The roll spread thick on firing trays gets stewed and dull.
39. The roll has been spread too thickly when the fire cannot be seen through the contents of tray.
40. When three-quarter fired, about half an hour, trays can be safely filled up four deep, and the curing finished over slow fires.
41. Choolas can be constructed to consume one maund of charcoal, or less to one maund of tea.
42. Pucka battying developes nose or aroma.
43. Drying in the sun before packing completely desiccates the tea, but gives it a peculiar flavor.
44. Bulking is better before than after pucka battying to ensure the teas being packed hot.
45. Iron-wire, brass-wire, or bamboo trays are all good for firing, but the two former are better conductors of heat than the bamboo ones, and not liable to get out of mesh.—Local "Times."

(*From another planter.*)

I return proof of "Facts *re* manufacture." So far as firing is concerned, the "facts" refer to choola fires, but 36 and 37 are equally true of machine-firing and so far as 38 is concerned you will remember that the roll was after Kinmond's visit spread thinner on the trays with better results. So far as No. 40 is concerned, I think the tendency is now to have final firing done *slowly*, either on choolas, or in self-acting machines. For the first or three-quarter firing the Kindmond dryer suits those who believe in brisk firing and I think most of our tea-makers do; but it can be done too briskly and it probably is when the fan is run at 700 revolutions per minute, apart from the belief that many have in the superiority of Sirocco and coola fired teas. The saving of steam power alone will very likely cause self-acting dryers to be generally used, particularly when the capacity, as in the No. 3 Sirocco, is doubled at such a moderate increase of price.

It has yet to be seen how the new power worked Jackson's dryer is to answer as regards quality. That it will do quantity there is no doubt, but, should it answer well in all respects, it will be more suitable for the larger factories, and the smaller will probably still find their best and most suitable machine in the Sirocco. Of course, there is a strong temptation where a lot of tea is being made to use the

machine that does the most work in the shortest time, but, so far as our experience in Ceylon is concerned the teas fired by the latter class have not given the best results. There seems to be a unanimity of opinion among brokers and dealers at home that our teas are too rapidly fired or too hastily finished, and the sooner we acknowledge that the better, so that we may, keep up our good name instead of having to recover from a bad one. It seems to me very likely indeed that the important process of firing will in Ceylon be done generally by self-acting machines and finished off on chooias, as mentioned in No. 40.

So far as the most of the "facts" are concerned there is not much that is new to those who have for years now been manufacturing tea, but the facts are so clearly and concisely put that they may be of service even to the experienced. To the latter the "facts" point out how far we are from more than a superficial knowledge of the art or science of tea-making. No. 20 shews this very clearly as also does No. 25. We know nothing more than what the eye, the touch, and the nose has told and is telling us. It would no doubt be a great step if "fermentation" was scientifically studied and we had an explanation of the change that taxes place and its progress up and down the scale; and it would be as great a step if we had the tests to know when the "coloring" should be stopped.—*Ibid.*

FACTS RE TEA MANUFACTURE.—Mr. Scovell of Strathellie, to whom we sent a proof of the late Mr. Cameron's memorandum published yesterday by us, writes:—

I have only noticed two points on which my experience does not tally with the "admitted facts," though, for the most part, you will see that I can speak in support of them.

Mr. Scovell's comments are drawn up as follows:—

1. Leaf is best withered when there is a free supply of light and a circulation of *warm* air.

5. I have not found this. An over-wither results in the breaking of leaf, increasing the Pekoe tips.

14. Heavy rolling destroys the *appearance* of small leaf, but increases the strength without taking from the flavor of the tea.

18. Excessive temperature is against good fermentation.

20. The aim should be to keep the temperature as even as possible during fermentation.

30. Care given to the withering is a step towards good color, but will not ensure it. Great strength cannot be obtained from a poor jât of plant, notwithstanding heavy rolling.

44. Bulking is better carried out after final-firing, as that operation may of itself be uneven. Tea final-fired just before bulking retains sufficient heat for packing purposes. It is not desirable to pack tea with too much heat in it.

Strathellie, 30th March, 1885. ARTHUR E. SCOVELL.

In yesterday's article we find we spoke of Mr. Cameron as having been 30 years in India. In reality he had only been 18, and we ought to have said that the Memorandum left by him was the accumulated and concentrated experience of 30 years' manufacturing on Indian estates by Mr. Cameron and others before him.—*Ibid.*

EXPERIMENTS WITH SIROCCO AND JACKSON'S HAND ROLLER.

To the Editor of the "Ceylon Observer."

Theberton, Maskeliya, 3rd April 1885.

DEAR SIR,—I noted in your issue of the 28th ultimo a letter from Mr. C. A. Hay of Blackwater, Nawalapitiya, on tea drying by Siroccos. I note he got 30¾ lb. made tea per hour from No. 710 old style Sirocco, with charge of 9 lb. fermented leaf per tray. I have just made a careful experiment with mine, No. 637, old style, with a charge of 7 lb. fermented leaf and a mean temperature of 283°. I got 34 lb. made tea per hour. (I find that I get more per hour with a 7 lb. charge of fermented leaf per tray than 9 lb. or more.) I never turn my tea, only level tea as the third tray is drawn out before placing in fourth slide.

I promised you the results of Messrs Jackson's hand tea roller made by Messrs. John Walker & Co., Kandy, in January last.

This roller cost R475 nett. It is fitted with pulleys, circular cross action bars of box, also 4 on each side under base sliding plate of table, which decidedly makes it work lighter, as I found, by trying it at first by mistake without the pulleys. Since I have had the machine I took off the hopper fixed on top of box and deepened the box 6". The original size of box when received was 14½" high, 16½" wide each way; increase 6

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present size of box 20½" × 16½". (The measurement given is outside; the correct for inside is 19½" × 15½" × 15½".) The box as first received rolled about 50 lb. withered leaf; now it will roll 85 lb., viz., experiment on 3rd April 1885:—1st roll 85 lb. withered leaf in 1 hour; 2nd 76 lb. withered leaf in 1 hour: or 161 lb. in two rolls in 2 hours, or 229 lb. green leaf in 2 hours. This was rolled by 4 coolies, 1 cooly tending, total 5. On 19th March, it rolled 566 lb. green leaf in 5 rolls with 6 coolies. On 2nd April, 419 lb. green leaf in 4 rolls with 5 coolies: that is 4 coolies rolling, 1 cooly tending leaf. When the quantity of leaf requires over two rolls one or two coolies extra are taken on to spell the others.

I feel sure when this machine is connected to water power it will roll in half-an-hour or three-quarters of an hour the same quantity of leaf better than with hand power in one hour. I would note that the leaf even with the large quantity of 85 lb. was very well rolled—quite as well as done by the Universal, from which so far I have only been able to get from 50 to 60 lb. of leaf well-rolled.

I have deepened the box of the Universal 6", but as yet have not been able to see how it acts, as I have not water sufficient at present to work it. When I deepened the box of the hand-roller I increased the weights by 7 lb. each side, or 15 lb.

I will let you know how the Universal roller works with the increase in size of box as soon as I have water sufficient to work it—streams are lower this year than ever I have known them before.—Yours very truly, T. J. GRIGG.

P.S.—I have made Jackson's sifter do everything. Never use a hand sieve. I have additional sieves to fit in on top, deck on deck, in fact a four-decker. It does its work very well indeed: takes both dust and flat tea out etc., etc., etc. What will Jackson say?

Theberton work of Sirocco No. 637 in one hour from 10-30 to 11-30

Time of trays put in Sirocco.	No. of trays.	Time of trays dried.	Temperature.	Remarks.
10-30	1	10-45	270	Each tray had 7 lb. of fermented leaf. Temp. of Sirocco did not exceed 300. Sirocco fired for the hour 34 lb. dried tea.
10-30	2	10-50		
10-31	3	10-55		
10-31	4	11-		
10-47	5	11-5		
10-51	6	11-10	300	
10-54	7	11-15		
10-58	8	11-20		
11-04	9	11-25		
11-09	10	11-28		
11-13	11	11-30	280	

77 lb. fermented leaf made 34 lb. tea in an hour.

Note.—In a trial I had on the 2nd I got 86 lb. fermented leaf done in the hour, but the 77 lb. in this trial was more carefully done. T. J. G.

TEA MANURES.

Pending the day when the tea-planters of Ceylon will be able to invite Mr. John Hughes, F. C. S., to repeat his visit to this island, we cannot do better than pay attention to the sound and thoroughly practical advice which he has been good enough to send us in the following paper. It will be observed that Mr. Hughes bases his advice on the information published as to crops already gathered of tea on some of our richer plantations. He then shows us, as only a scientific agricultural chemist can, what such crops mean in reference to our soils, and the withdrawal of the various indispensable crop constituents. Finally, he gives us in the plainest form his counsel as to how the principal constituents needed for tea plantations in Ceylon can be supplied; and it only remains, therefore, that merchants who are in a position to sell to the planters finely-ground steamed bones, castor or cotton cake, should make the fact known. We trust that several experiments will at once be made in accordance with Mr. Hughes's suggestion in different districts and at different elevations, so as to have the results made known for guidance in the future. Such results would be most interesting to Mr. Hughes himself, and, as we have already said, he might by-and-bye be got to pay another visit to our planting districts! His paper is as follows :—

It has been very properly pointed out by recent writers in the *Ceylon Observer* that the actual yield

of tea per acre must not be taken as a true guide to the special merits of one estate against another, for the *quality* as well as the *quantity* must be considered.

In these days of new production it would be a serious mistake to expect that quantity should be able to make up for an inferiority in the quality, more especially as the tea industry being comparatively new in Ceylon, and its character hitherto rendered famous in the Mincing Lane markets by reason of its fine flavour and dark-colored liquor, it is most important that the consignments should only be of the best obtainable quality. These practical points will, of course, naturally occur to the minds of experienced planters, but with plenty of available labour, well-appointed machinery capable of turning out a large yield per diem, there is always a strong temptation to pick coarsely rather than finely and so increase the bulk. It should however be remembered that a yield of 1,000 lb. to 1,200 lb. of prepared tea per acre must be regarded as a somewhat exhausting crop, and that, while newly-opened estates may, and probably do, produce so large a quantity for the present, yet we must expect a falling-off in a few years' time as a result of continued and heavy cropping. Indeed, unless the soil is specially rich or some help in the form of manure be afforded, the peculiar forcing nature of a favourable climate only contributes to the more rapid exhaustion of the soil.

According to Peligot, a distinguished chemist who has devoted particular attention to the analyses of tea, the leaves of this plant are specially rich in nitrogen; thus in perfectly dried tea at 110° C. he found :—

In 100 parts of	Pekoe ...	6·58	of nitrogen.
,,	Gunpowder	6·62	,,
,,	Souchong ...	6·15	,,
,,	Assam ...	5·10	,,

From analyses of Ceylon tea made by myself I believe the average proportion of nitrogen is somewhat less

than is usually found in ordinary Assam tea, and I think we may fairly assume that in 1,000 lb. of Ceylon tea as sold we have :—

Nitrogen	...	45 lb.
Potash	...	22 ,,
Phosphoric acid		8 ,,
Lime .	...	2½ ,,

Now, 45 lb. of nitrogen is as much as would be removed per acre by an average crop of wheat, barley or oats, allowing for the nitrogen contained in the straw as well as in the grain; and we know that continuous corn-growing is very exhausting and can only be done under the most favorable circumstances. Further, it is always usual to return the straw in some form to the land so that at least a quarter of the original nitrogen removed is really returned. Again, in the matter of potash, an average crop (30 bushels) of wheat removes 10 lb. in the grain, and ... ... 18 ,, in the straw, also (40 bushels) barley removes 10 ,, in the grain, ... 24 ,, in the straw, and (45 bushels) oats removes 9 ,, in the grain, ... 30 ,, in the straw. Therefore, in respect of potash, we must regard a yield of 1,000 lb. of made tea twice as exhausting as an average crop of the abovenamed cereals, assuming hat the straw of the latter is always returned to the land.

But Ceylon soils are somewhat poor in potash readily available for plant-food, and I should therefore think it most desirable that potash as well as nitrogen should eventually be applied to tea plantations *in* the form of some manure.

Next we come to the phosphoric acid which stands at 8 lb., which seems small, but practical experience plainly shows the good results of the application of phosphatic manures, and the analysis of a great number of Ceylon soils clearly indicates the necessity of supplying this most important constituent of plant-food.

Lime stands last and amounts to only 2½ lb. from 1,000 lb. of tea, but we find that an average yield o corn, whether wheat, barley or oats, does not contain in the grain more than 1 or 2 lb. per acre, as against 8 or 9 lb. in the straw.

There is, therefore, no direct necessity to supply lime, though it may be indirectly useful in the preparation of plant-food, and for the retention of carbonic acid brought down with the rain, and thus assist in the future disintegration of the granite rock.

Having thus briefly noticed the few leading constituents which require to be applied in the form of tea manure it is only necessary to remark that nitrogen can be most usefully provided either from castor, rape, decorticated cotton cake, dried fish, shoddy or cattle manure. That potash can be obtained either as muriate or as sulphate of potash; the latter probably being the most suitable to Ceylon soils.

Phosphoric acid can be applied either in small doses of concentrated super, containing 20 per cent or more of soluble phosphoric acid, or else in the form of finely-ground steamed bones which moreover are also rich in nitrogen. As the latter can be obtained at Colombo at a reasonable rate, planters can make a practical trial for themselves. Lime will be contained also in the super, and the bones will not in such a case have to be applied separately.

In conclusion a mixed manure made from the materials can be so compounded that a 100 parts would contain

Nitrogen	...	4 per cent
Potash	...	3 ,,
Phosphoric acid	...	10 ,,

and this could be applied this next season by way of making a practical experiment.

Highly concentrated manures like sulphate of ammonia, nitrate of soda, and similar readily soluble compounds would be both too stimulating, and tend to produce a coarse growth of leaf.

JOHN HUGHES, F.C.S.

Analytical Laboratory, 79, Mark Lane, March 20th, 1885.

Mr. BORRON

ON

CARDAMOMS

AND

ARECA CULTIVATION.

CARDAMOM CULTIVATION IN CEYLON*:

ALL THAT GLITTERS IS NOT GOLD, AND ALL THAT ARE CARDAMOMS IS NOT A FORTUNE.

(*To the Editor "Ceylon Observer."*)

SIR,—Cardamoms generally in Ceylon have been a fair success, in some instances a great one. On the other hand more than one clearing throughout the country has signally failed to crop, and sometimes, though one portion of an estate has done well, another part has borne badly.

As cultivation extends it becomes evident that like everything else cardamoms have their peculiar enemies, pests and sicknesses. Harvesting in India is usually carried on, I understand, for some three years only, and then the land is abandoned.† Probably as the average Ceylon garden will continue for a similar period, and then rapidly fall of till it ceases to be profitable. In very favourable circumstances, however, at least double the number of these good years may be expected.

By last year's exceptionally dry season most cultivators suffered disastrously, by the loss more or less of blossom and light fruit, while some who had ventured into risky localities experienced total loss of both crop and plant.‡

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*For full information on this subject, see pamphlet by Mr. Owen published at *Ceylon Observer* Office.

†That is the mode adopted by the natives of Travancore, who go into the forest, fell a certain number of trees, allow the plants to spring up, and in due time gather the produce, the felling process being repeated as crops lessen. But this surely cannot be the system on the Coorg estates of Mr. Middleton and others.—ED.

‡As happened to cacao in some places.—ED.

A product so extremely valuable, and so easily stolen, is peculiarly liable to theft, while from the luxuriant growth of the vegetation, detection is difficult and protection expensive. In some exposed situations robberies became so frequent and the cost of watching so great, that cultivation almost ceased to be profitable. In one instance, during the course of a single night, the whole crop of a small clearing away at the top of an estate was ruthlessly cut off and removed.

Grub threatens to become a formidable enemy.* Here and there through some clearings stools may be seen flattened down as if a large stone had fallen on their centre, while by slight pull stems may be withdrawn without difficulty. This may arise from the presence of rock at bottom, but more usually, I fear, it is due to grub. Again a whole field may generally become subjected to this pest, when the leaves turn yellowish, the stems fail to reach mature growth and crop ceases. I have known a fine clearing so affected suddenly, fall from a yield of over 500 lb. an acre one year to practically nothing the next. Seemingly the only cure is time, or the heroic remedy extirpation and renewal.

Excepting during the early days of a plantation, monkeys seldom do much mischief and then only wanton, but wild pigs when they can get admission will always do considerable damage. A gun for monkeys and a fence for pigs become necessities in the neighbour hood of much jungle or chena.

There is an ailment of which little is spoken, perhaps because it is attributed to wind and drought, but it is often to be found badly in sheltered spots and during the rainy season. The leafy portion of the stem, particularly the upper leaves, get blotched and speckled with yellow or brown spots, become frayed, something like the leaf of a coconut tree suffering from beetle, and then rapidly decaying, falls off, leaving the mid rib bare and withered. If anything, cardamoms in the open seem to suffer most from this; but though it is yearly on the increase, and undoubtedly affects the health of the plant, it does not appear so far to diminish the crop.

A poor-looking stiffish hard dry soil tolerably free

* Has this, the most destructive, perhaps, of all pests, been known to attack the roots of the cacao plant?—Ed.

from stones is unfavourable for the cropping if not the growth of cardamoms. To be suitable, a soil can hardly have too much vegetable mould or latent moisture, though dampness of atmosphere is of more consequence than of soil.*

Ordinary wind may be met by close planting; but when cold and dry as well as strong, it becomes fatal.

In some parts during the setting-in of the north-east monsoon, extensive blackening and rotting of fruit-stalks takes place. This is put down by some to prolonged wet with a rainfall of, say over 50 inches per month, but I think it is more the result of continued damp following a long and severe drought that has already weakened if not killed the fruit stalk. Will Dr. Trimen kindly say whether this part of the plant should be called a scape, a race, or a raceme?

The black fungus has been detected on cardamom leaves, but only, I think, when near affected coffee, and, as might be expected, without apparent injury to the plant.

The extent of very suitable land is limited greatly by climate and soil, and as this new product is not a high cropping long liver, it is very doubtful if, unless during the next two years, there will be any over-production in Ceylon.

Prices have already very considerably fallen, and they may likely for a time go much lower still; so that any temptation to rush further planting should not now be indulged in. Local opinion still differs as to the propriety of bleaching the produce. No doubt it weakens the flavor and aroma of the spice; but, so long as it secures a better price in London, it may be desirable, from financial motives, to continue doing it.

As regards the two kinds, the Mysore is undoubtedly the hardier in every way, yields a larger fruit, and is more easily picked, but I can't help thinking the flavour is coarser, and the yield less.

CARDAMOMUM.

P. S.—In connection with the above, it is interesting to note how two other kindred spices—pepper

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* We suppose there is a limit as regards wet, for on a Yakdessa estate with over 250 inches of annual rainfall, we saw cardamoms which grew, but could not produce fruit enough to pay for the gathering.—ED.

and pimento—are also gathered before reaching full ripeness, and how the two, pepper and ginger, also so frequently undergo a whitening process to the prejudice of their strength, before reaching the hands of the consumer.

[This is a very valuable and timely contribution to the history of a plant, the cultivation of which has, naturally, been taken up very extensively, and which, apart from the drawbacks mentioned by our correspondent, has already been overdone. The worst of products like cinnamon, cardamoms, vanilla and such like is, that, being luxuries and not necessaries of life, the market can be so speedily swamped. No doubt sugar, coffee and tea, now absolute necessaries to a large proportion of the human race, have been over-produced. But, in the case of these and similar articles, plenty and cheapness largely and rapidly stimulate consumption, so leading to further demand at remunerative prices.—Ed.]

ARECANUT CULTIVATION IN CEYLON.

We call attention to the useful information on this subject conveyed by Mr. Borron in his letter published on page 26. Although, as the writer says, there is still a good deal of special knowledge only to be attained at the cost of time or money, still enough is told us to show that the European planter might do worse than turn his attention to the areca palm. Six years' waiting for a crop is the chief drawback ; but this is so much less than in the case of coconuts, although the areca palm is almost equally long lived, that it ought rather to encourage than prevent the planting of arecas. Mr. Borron may be depended on as a careful estimator, and his calculation of an average return of 20 cents per tree per annum, with trees planted 10 by 10 feet, is eminently moderate and safe. That would make 435 trees and a gross return of R87 per acre. From this would have to be deducted the cost of upkeep, watching and harvesting the fruit. After six years' growth, the cost of maintenance would be very slight we should say, although, of course, such works as digging and manuring would, if carried on, cost money, but they should bring in a due return if judiciously undertaken. Watching and gathering and selling the nuts would therefore seem practically to be the chief items, on the debit side. We suppose, then, that a net annual return of R60 per acre might safely be counted on (where other products shared the attention of the Superintendent) and this steadily coming in from 100 or even 40 acres of arecanuts is a source of income not to be despised. Fifty rupees per acre was mentioned the other day as the net return from average well-managed coconut

* For further information see *Tropical Agriculturist*, published at "Ceylon Observer" Office.

plantations. So that arecas must be deemed more profitable.

We are aware that more sanguine estimates have been put forward by a planter in the south of the island (vide the *Tropical Agriculturist* for April 1883); but these were based on the planting of 1,200 trees per acre, and such trees still yielding at the rate of 300 nuts per tree. The result was to be a nett profit of R140—the expenditure however equalling R100 per acre. We need scarcely say that Mr. Borron's calculation seems the safer one, and indeed it is based on actual experience over some 40 acres planted by him and in bearing. There may, however, be such a difference between the Lower Matale and Udagama districts as to warrant closer planting, but not surely to the extent of crowding 1,200 instead of 435 palms into the acre.

Anyhow, arecanut planting is worthy of more general attention, and as a very suitable addition to other products on plantations under 2,500 feet elevation with a decent soil and a suitable rainfall, we strongly recommend it. In the Kegalla, Awisawella, Yatiyantota and Kalutara districts, and indeed around Gampola and Nawalapitiya and perhaps Kandy, there ought to be room for putting in fields of areca palms as still another product, and one of the least troublesome, for the planter to add to his reserve list.

ARECA CATECHU CULTIVATION IN CEYLON:

MR. BORRON'S EXPERIENCE.

DEAR SIR,—As desired I have now great pleasure in giving you some information anent areca catechu cultivation :—

1. This tree is known to the Tamil as "pákku," and to the Sinhalese as "puwak." It is most extensively cultivated throughout the East, the nut being in general individual consumption as a masticatory, in conjunction with betel-leaf, lime and tobacco.

2. "It is considered to strengthen the gums, sweeten the breath and improve the tone of the digestive organs. The seed reduced to charcoal and powdered forms an excellent dentifrice. Dr. Shortt states that the powdered nut in doses of ten or fifteen grains every three or four hours is useful in checking diarrhœa arising from debility. The dry ex-

panded petioles serve as excellent ready-made splints for fractures. The catechu yielded is of inferior quality, and has been used to supersede madder for dyeing a golden coffee-brown, 1 lb. being equal to 6 lb. of madder. The petioles can be written upon, and in India are used for making hats, umbrellas, fans, water-vessels, &c." The nuts ringed and strung with ivory on an iron rod make a very pretty but heavy walking-stick. I think there is no doubt that one object for chewing the nut is to allay the pangs of an empty stomach. It is a good vermifuge and used as such both in India and in England.

3. The most desirable elevation for cultivation should not exceed 2,500 feet above sea-level, but I have seen trees in bearing, though how old I know not, at about 3,500 feet.

4. The rainfall should not be low, and it ought to be as well distributed as possible. Last year's exceptional drought affected mature areca palms in the Matale district at an elevation of over 1,600 feet.

5. The lay of the land should be moderate. The formation of the leaves and stem collects the rain and washes away the soil from below the tree in steep land.

6. The soil should not be quartzy, and the better the soil the better the growth and crop.

7. Like all palms, the areca stands the wind well.

8. The presence of slab rock near the surface is very inimical, particularly in a dry climate. If it only gets the chance the areca is a deep feeder.

9. It is preferable to plant from a nursery with plants at least six months old than to venture to plant at stake, though I have seen this latter done with tolerable success.

10. The clearing ought to be kept carefully and systematically clean of all jungle stuff and flowering weeds, and a circle round each plant kept free from grass. So long as the heads are kept above cover, the plants can stand a good deal of neglect, but their growth and bearing will be seriously retarded.

11. The trees in my plantation of some forty acres are planted 10 by 10 in feet, and I would be sorry to risk any nearer distance. When natives plant closer it is usually only in a single or double line and not over a broad space. The close-native system, of planting the coconut is generally understood to be a mistake, and certainly when I have tried it with the areca, even in single lines, I have

found it so. It is quite possible that something closer than 10 by 10 might answer, but I will leave others to try. It is very long to have to wait seven or eight years to find out a mistake which can never afterwards be properly rectified. The close planting and subsequent cutting out is admirable as a theory, but who has the moral courage to ever carry it out properly, and it is wonderful how trees try to adapt themselves, as far as growth goes, to circumstances.

12. Few roads and drains are required in this cultivation.

13. The areca is a great surface-feeder, and so is injurious to other surface-feeding products, such as coffee, near it.

14. According to my experience, even with good soil, climate and cultivation, the areca does not come into bearing before its sixth year. Like cacao here and there a few precocious trees may blossom earlier, but on the other hand others may take very much longer.

15. The early blossoms frequently fail to mature their fruit.

16. Spring is the best cropping season upcountry, say January as the month for choice, but crop extends pretty well more or less throughout the year.

17. If a mature tree fails to give *at least* three hundred nuts per annum, then there is something wrong with the tree, the locality, or the cultivation.

18. The crop can be picked for local sale either three-quarters or fully ripe: the former gives the "kali pákku" preferred by coolies, the latter the "kotta puwak" preferred by the Sinhalese.

19. As my plantation is situated near a large town, I have never found the slightest difficulty in disposing of my produce gathered and delivered on the spot.

20. The price obtained has varied according to maturity, time of the year, and fresh or dried, from 37½ cents to 90 cents per thousand cash on delivery at estate store. Probably, with good management, the average might be taken at 60 cents per 1,000.

21. In Ceylon there are two kinds: the small-fruited upcountry areca preferred by coolies, and the large-fruited lowcountry kind preferred by the Sinhalese and, I suppose, also for exportation.

22. Your Colombo friends will best be able to quote

prices of the prepared article for export, and its value in the London and Indian markets.*

23. The only disease I have noticed is a canker that sometimes attacks the stem from the ground upwards in a long triangular form, but, except when it enables white-ants to gain admission, I have never seen much permanent harm done.

24. In a few rare instances I have seen areca palms attacked and killed off at the head by a large white grub, the parent of which is a brown, and not as in the case of the coconut, a black beetle.

25. The great abiding and serious pest is the thief. The produce is of such universal use, so easily stolen, so difficult to protect, that, when grown on any large scale, the losses, even with much careful and expensive watching, are enormous, and no doubt this drawback checks extension.

26. The cost of planting and bringing an areca plantation into bearing, inclusive of cost of land and interest, should come to something like R200 per acre. It might be done for somewhat less, and, with indifferent management, it may take as much more as a capitalist may be induced to expend.

27. Occasionally the areca palm will produce a sucker and become double-stemmed from the root. I have never heard of the coconut tree doing this, though I remember the double-headed coconut palm that grew on the side of the Galle road a few miles out of Colombo.

A. G. K. BORRON.

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* Quotations for Betelnuts in India are given at from R22 to R40 per cwt. according to quality: 10,000 nuts to a cwt. by a correspondent of the local "Times."

ARECA-PALM CULTIVATION.

(*By an Old Palm Planter.*)

Results of Experience and Observation in the Lowcountry.

I have not been following the *puwak* discussion very closely, but that makes little difference, as my opinion on that as on most subjects is entirely independent, though that again is no measure of their value. Jack Bunsby's opinions were hard to get at and turned out hardly worth the trouble of reaching them, so it may well be with mine.

My first proposition is, that every plant that needs sunshine requires the space it can cover, at thriving maturity. In the case of all palms, the length of the leaf from the stem to the extremity of a mature and healthy tree is one half the distance that the trees should be planted in a field. This rule however, in the case of the coconut, is modified by the habit of the tree. The coconut leaf is eighteen feet, and by the above rule should be planted thirty-six feet apart, but the leaf only descends to a right-angle with the stem after it has done its duty and been succeeded by others; twenty-five feet is therefore found in that case to be the best practical distance.

The leaf of the arecanut is only from three to four feet in length, at its maturity, and maintains its position at an acute upward angle with the stem; therefore at six feet apart, the leaves of opposite trees will barely touch. I am therefore of opinion that ten feet apart, is more space than is necessary and that 435 trees will not take out of an acre of land all it is capable of yielding. I think seven feet ample space, and at that distance, we get 888 plants into the acre.

My own experience is the utter failure of nursery plants, and tolerable success from placing the seed at stake. Were I now going into this cultivation, I would dig eighteen inch holes, and at the beginning of the S. W. rains place the seed three inches deep in the centre of holes.

I believe the Ceylon arecanuts are the lowest priced in the markets, and anyone going into the cultivation should secure the best varieties from other lands. I have seen a kind that would save the vast labour needed for husking the native varieties, as the nut has a smooth surface and the husk is clean fibre.

THE MANUFACTURE OF TEA: MR. ARMSTRONG'S PAPER.

Deltota, 24th August 1885.

Mr. Chairman and Gentlemen,—It is my pleasing duty to give you today my experience, so far as it goes, of the manufacture of tea and the machinery we at present use to aid us in this. It may not perhaps be out of place to digress a little, and begin with what I consider the cheapest and most suitable form of building for our purpose. The ground floor of our factory should be 24 ft. wide from centre to centre of the pillars, with wings 14 ft. wide at each side, thus giving us 52 ft. clear width for all machinery, bins, packing, &c. and this floor should be of cement. Above this we should have two floors at 24 feet wide for withering. Length of factory depends on the size of the gardens but say 132 ft. by 52 ft., upper floors 24 ft., giving us space as follows:—24 ft. by 52 ft. for rollers. Motive power being in an outside building—24 ft. space, then Sirocco pit at 18 ft. by 8 ft by 5 ft. 6 in. Again with 24 ft. between each, two more Sirocco pits—each pit at 18 ft. by 8 ft. by 5 ft. 6 in. holds two T Siroccos, we have thus, for withering purposes, spread our Siroccos well over our building, giving ample room between each for bins, picking, sorting, packing, &c. Should more withering space be required a building at 24 feet wide with three floors can be carried out from the centre of the factory, and if a Blackman's air propeller was in use, this could be moved to the end of the addition and serve the whole of the withering space, except the lower floor of the addition.

Withering Shelves.—The cheapest and best I know of are those invented by Mr. Megginson at Carolina, Jute hessian, cut in lengths to suit the factory, but not to exceed 24 ft. say, being rather unmanageable if longer than this; a reeper 1½ in. square is nailed at each end of the length of hessian, and projecting 1½ in. beyond its width at each side; one end is rounded, the other left square, we then have uprights at 45 in. between each, *i. e.* the width of the hessian, and at the required distance apart, one of which has keyed slots cut at 6 in. apart, the other a 1½ in. auger hole at 6 in. also. One cooly fixes the reeper at his end into both uprights, another cooly opposite fixing in the rounded end only, rolls the reeper till this is pulled forward at a good slant when he then pulls the square end back into the slot thus stretching the hessian quite taut. If the shelves are more than 12 feet in length, an upright, about the centre of the shelf will be required with reepers at 6 in. apart nailed across it, which sup-

ports the shelf, and prevents sagging, 24 ft. lengths su best, and are most economical. In collecting leaf f the roller, each shelf is lifted out, its contents emptie into the trolley, or on the floor, and replaced rea for fresh leaf. 12 shelves at 6 in. apart will be four most convenient.

Withering Floors.—We cannot obtain a healthy with without light and fresh air, and lots of both. The ten ency in Ceylon is, I fear, towards too wide a buildir with a floor at 36 to 40 ft. wide as some are. It is almo impossible, however many windows we may have, th light and wholesome air should get to our cent shelves, through the mass of leaf intervening. A doub row of Mr. Megginson's shelves down the centre of t floor including 6 in. centre posts, will take up 8 ft. 6 i At the side walls we have windows 6 ft. by 3 ft., at 6f apart, and withering shelves between each; these wit supports &c. will take up 4 ft. 6 in. clear, leaving a pas age 3 ft. 3 in. between them and the centre shelve Shelves may be stretched across the windows at nigh when pressed for room, being taken down the firs thing in the morning, when the leaf can be re-spread o the other shelves, as they are emptied for the roller every scrap of room may be thus utilized.

Withering.—Leaf can hardly be spread too thi provided the day is not too hot or dry. 6 feet will ho 1 lb. of leaf *thinly* spread, a shelf 24 ft. by 3 ft. 9 i will hold therefore 15 lb. of leaf thinly spread, or t to double this should necessity arise, make yo calculations at 20 lb. say, and you will be righ Leaf cannot have too much light and fresh a and the best results will be obtained from le withered naturally, in a temperature of from 7 to 80° with all windows open. In our wet, co weather, withering is our one great difficulty, a at present we have no machine to help us here. Ch coal won't do, nor will Siroccos, with leaf appli direct. Hot moist air is what is required, dra rapidly through our leaf, and I hope to obtain t desired result by drawing the hot moist air throu my withering loft from the T Sirocco after it pas through the roll it is firing, with the aid of a Bla man's air propeller, to which our friends of t *Observer* have so often called our attention. The Siroc are spread throughout the whole length of the grou floor as already shown, there are doors in the up floor above each Sirocco, so that the heat may closed off if not required. Should we have no to fire, we can get our moist heat by spreading lanket over the Siroccos kept damp by an occasio

prinkling of water. I have every faith in this suc-
eeding, and am now thus adapting my own fac-
ory. The sooner after plucking, the leaf can be
ithered—naturally—ready to roll, the better, but as
ight work should be avoided if possible, it is best for us
o arrange to have our morning's delivery ready for
olling by 4 to 6 o'clock the next morning, when our
rither from the morning's leaf will be found perfectly
weet, even up to 10 o'clock. We can generally manage
uring the dry hot weather to keep our leaf from first de-
ivery till morning, by excluding light and spreading it a
ittle thicker than is usual. Improperly withered leaf
annot result in good tea, either as to liquor or outturn,
nd our careful attention is necessary in the withering
oft. When leaf is properly withered it is soft and
liky to the touch, and should not be hard or dry,
rricking the hand when squeezed. If from leaf getting
head of us, our plucking is coarse, separate the finer
rom the coarser leaf with a No. 3 sieve, and wither each
eparately. Do not allow your pluckers to bruise or
queeze the leaf in their hands or baskets, and as they
mpty their plucking basket or cooty sack, as the case
nay be, into their store basket, make them turn over the
eaf in the basket, so that it lies lightly. Do not col-
ect your withered leaf for the roller till just before it is
wanted. If necessary leaf may be sunned to bring it
ip to the proper point. In cold weather I have found no
narm result from withering my leaf entirely in the sun.
Care must be taken to see the leaf does not get dry,
and it should be moved indoors before it is quite fully
withered and allowed to cool, by which time it will be
withered to the degree required. Sun-withered leaf
gives a reddish make and fine strong liquor. A red-
dish make is not disliked in the Lane provided it is well
twisted. *Underwithered* leaf gives a thin light-coloured
liquor with a light greenish outturn. Overwithered or
dry leaf gives a thin liquor fairly pungent with a dark ir-
regular outturn. Leaf spread too thickly and allowed to
get sodden gives a dark thick mawkish liquor, strong and
flavorless, sometimes sour, and a dark outturn. Allow
yourselves double the withering space you estimate
you will require, even if a temporary shed has to be
built, or when your best months come, you will find
yourselves with lots of leaf and nowhere to put it, or
so overcrowding it as to make your worst teas when
you should be making your best. A strong healthy
flush, resulting in heavy pluckings, will give the best tea.
And simply for want of withering-room you may stand
to lose 2d per lb on your teas. Four to six coolies will
attend to 1,600 lb of leaf, with an occasional time off,
for picking out red leaf or work at tea below stairs,

Rollers and Rolling.—There is no doubt, I think, that Jackson's rollers are immeasurably superior to all others. They will roll, according to pressure and speed, coarse, medium, or fine leaf, equally well. Other rollers, many of them admirable in their way, will only roll well withered, *fine* leaf satisfactorily; and are at the best not half the machine Jackson's is, so I need not take up our time in expatiating on their good or bad qualities individually.

As you are aware Mr. Jackson has been trying experiments with marble and stone tables, the marble table I understand has so far not been found a success, and the *Observer* tells us a brass table is to be tried. It may be considered great presumption on my part to advise so clever a patentee as Mr. Jackson, yet I do not believe any table will be found better than wood, and for this reason—no matter how careful we are, we cannot prevent sand and grit getting among our leaf. It is this grit that in time wears away the bottom table, and I fear so it will brass or any other material used. My table in constant work, all the year through, sometimes day and night, lasted me 2½ years. With ready planed teak planks from Messrs. Walker & Co., one carpenter can fit in a new table in a day. As far as cleanliness goes, if we souse our tables well with water as soon as our day's work is over, we leave them as clean as the day they were made. Jackson's rollers are so well-known it is hardly worth while my going over them. They are:—

His *Hand Roller*, price at Colombo R500, taking at a fill 40 to 50 lb. of withered leaf, working best at the smaller fill. Requiring 4 coolies at 25 minutes up to 30 minutes to finish the roll. *Maximum* capacity 1,600 lb. green leaf per day of 10 hours; if worked by power ordinary working capacity 1,000 to 1,200 lb. green leaf per day of 10 hours. And this roller may be attached to a water-wheel or other motive power, a 14 ft. wheel with lots of water will work it.

The Universal Roller, price at Colombo £92·15 sterling. About the same capacity as above, 2,000 lb. green leaf maximum, or 1,600 lb. per day if not pressed. Roll finished at 20 to 25 minutes.

The Ceylon Roller, price at Colombo £130 sterling, capacity about 150 lb. withered leaf at a fill, say 5,000 lb. green leaf per day of 10 hours.

The Excelsior Roller, price at Colombo £138·15 sterling, capacity 240 lb. withered leaf at a fill, or about 8,000 lb. green leaf per day of 10 hours, roll finished at 20 to 25 minutes.

In starting our factory if we have not a 16 ft. water-wheel, or if we have, and economy has to be studied, the Hand Roller should be purchased. With this before us, hand-rolling itself is not to be thought of. If in the future our motor is to be steam, then is there all the more reason to purchase, to begin with, the hand-roller, as there are often days on which we have small pluckings when it will pay us better to work by hand than to get up steam. And with steam a hand-roller is never thrown away, as one never can tell when it may not be wanted.

If we have a 16 ft. wheel and lots of water, and money to spare, then begin with the Universal, which is everlasting.

The Ceylon Roller.—This was built at my suggestion to suit our special wants, it can be driven by a 16-feet water-wheel, and with one of the smaller rollers to back it, is equal to a 200 acre garden, to at a pinch even 250 acres if we have lots of water. Most of us who are converting our poor diseased coffee fields into everlasting fields of tea already have valuable 16-feet or 18-feet water-wheels: without the *Ceylon Roller* these are useless lumber. Any garden therefore of from 100 to 250 acres with water-wheels ready fixed and water to drive them, have here the very roller to suit their purpose, always beginning with one of the two smaller rollers.

The Excelsior.—This requires *at the least* a strong 20 ft. to 22 ft. wheel with *lots* of water to drive it, and may be purchased by any garden of over 200 acres having no motive power ready fixed. If an engine is to work it, I would recommend 10 h. p. to be purchased. 6 h. p. will work an Excelsior, but the more power we have the more economical it will be in the end, and we may have to work 2 Excelsiors at one time, besides other machinery.

Motors.—The most satisfactory and the most economical is the water-wheel, but we must first satisfy ourselves we have lots of water and to spare. A dam will be of no use, as it will be required most during the dry weather, and we are not now working a coffee-pulper, a matter of 2 to 4 hours. It may be necessary to work 8 to 10 hours at a stretch if not longer. A dam must be larger then than we can generally make, to be of any use to us. We will require to conduct half as much water again to our wheel as we used in our coffee pulping days. I know but few *large* estates that have sufficient water to work all the year through, although perhaps they can do so for 8 to 9 months. A water-

wheel when once started costs nothing. Use this power then if you can for 8 months, and work your engine for four; the saving in fuel and upkeep will be great.

The Turbine has its advocates. Of these I have not sufficient experience to write for or against, further than to note, they *do* require a large water-supply and they *do* get out of order. If there is any doubt as to water-supply, steam should be our motive power, rather than risk the turbine. I know from sad experience it does not do to work with too low a power, rather allow 2 to 4 h. p. over what you calculate you will require. Machinery is then under command, and full work can be got out of it, with less strain to it. Running power too close to actual requirements is the falsest economy we can be guilty of. Working then a garden of 100 acres, 4 h. p. is the least we should have. 150 acres 6 h. p; 200 to 250 acres 8 to 10 h. p.; above 250 to 500 acres 12 to 14 h. p.

Rolling.—The roller box should be packed evenly and not too tight. Do not put too much pressure on to begin with, but keep on taking it off for the first five minutes, to let your leaf work well; for the second five minutes put on more pressure, only occasionally easing it; at the end of this five minutes take all pressure off, and turn your leaf well, thoroughly breaking it up, aiding the machine in doing this, by the hand; when for the last ten minutes (we are supposed to finish our roll in twenty) allow full pressure, taking it off, half way up, twice, to break the roll. It is only necessary to see that the press works with the leaf, rising with a jump now and then as the roll turns, if the press is not working with the roll, take off pressure for a little and break up the roll; if after this it does not work, remove some of the weights on the press, which are arranged to allow of this being done. Work with full weights if you can, but the press must work with the leaf or an uneven roll, or a mash, will be the consequence. It takes me with ordinary leaf 20 minutes, working at 100 revolutions with the Universal. The Excelsior should be driven at about 90 revolutions. All the rollers from the hand to the Excelsior are worked in the same way and take the same time to complete their work. On some gardens it takes 30 to 45 minutes to complete the roll; this is owing to some local peculiarity in the leaf, stoutness or toughness. Once find out the right time for each class of leaf, and it need never be changed. Rather over-roll than under-roll. Under-rolled tea, although it may

have a good appearance, opens smooth in the outturn, and does not give out its full strength. Well-rolled tea shows a crinkly outturn, and gives out its full strength. Very tippy tea, from light rolling, pleases the eye, but will not give as good liquor as the same leaf, heavier rolled with the tips stained out of all recognition, and it is liquor we want more than appearance nowadays, although a good make, *i.e.*, a tight even twist, is a great thing, and this with Jackson's roller will always be the case with good liquor. Our roll, if properly finished, will show a well-twisted leaf—not in any way mashed—soft and gummy to the touch. If tippy tea is wanted, when the roll is half finished, sift it through a No. 4, and ferment off what comes through, re-rolling what remains in. Directly the day's work is done, thoroughly wash the roller, easily done then, but very difficult if left till the juice begins to harden. Have the top table always turned over out of work; it is then easy to be seen whether it is clean or no, and gives no chance to the cooly to leave his work half done.

Fermentation, or, as it is now expressed, oxidization. I think though we should hold to the former, thoroughly sift the roll through the hands and break up all lumps and put *lightly* into a basket 18″ × 9″ × 6″ at bottom, or into a tray 2 ft. × 2 ft. or 3 ft. × 3 ft. and 3 inches deep, occasionally shaking it down, not pressing it. This, covered with hessian or blankets, not damped unless the weather is very dry, should be put in the coolest part of the factory, and left alone for an hour. Roll thus treated should not be turned during fermentation, nor should fermentation on any account be hastened. No time can be fixed for fermentation to reach perfection, if kept as cool as possible, it will take any time from 1½ to 6½ hours, the longer the time the more constantly must it be examined. Examine it after the first hour, and directly, without too close an examination, it shows a bright copper colour; turn it out on the tables, break it up well, a light hand rolling will do it no harm, and put it in your driers. With properly withered leaf well rolled, except in very dry weather a bright copper outturn is a certainty. In very dry weather we cannot get a bright outturn, and there is no use in waiting on the roll to get it. Young leaf, *i.e.*, leaf for the first three to four rounds after pruning, will not give a good outturn, being a dark olive green in color, with a smoky burnt flavored liquor. In deciding on our color we must use

the nose as much as the eyes. So long as the roll has a bright appearance and smells sweet, we may wait to get color; but without gaining color (copper color) should it begin to look dull, wait no longer or the nose will next tell us we have waited just too long—and decomposition has begun.

Driers and Firing.—I need only, I think, refer to two makers with regard to driers, viz, Davidson and Jackson. Both driers are excellent in their way, it being a mere matter of opinion which is the best,—my fancy leans towards the Sirocco; (1) because the outlay at any one time is less; (2) because they are most simple to work and require no motive power; (3) because I would rather have three driers for my money, than one, as even the best machinery will get out of order; (4) because I can spread the heat for withering purposes more evenly over my factory; (5) because in slack time I can roll up to one or two or more Siroccos as required. For an ordinary sized garden of 300 to 350 acres say, I would prefer Jackson's Venetian to his Victoria—the former is said to fire off 80lb tea per hour, about the same as the sirocco, costing £100 sterling in London or £127·15 sterling at Colombo as against £90 sterling for the T Sirocco As then I could afford three or more Venetians, instead of one Victoria, but although there is not so much difference in cost here as compared with the Sirocco yet again comes the objection as to motive power being required. This where steam is used is felt all the more, as after all our rolling is finished we have to keep up steam to work our driers. For ordinary sized gardens then I would select before all others the T Sirocco; this will work off 80 lb. made tea per hour easily, and as now built are much more lasting than formerly, and should the diaphragm plates burn through they are easily replaced. A pit 18 ft. by 8 ft. by 5 ft. 6 in. will hold two of these, and if our garden is only a small one we might have only one in each pit, a loss in stoking only, so as to spread the heat throughout the withering lofts, a pit 8 ft. by 10 ft. by 5 ft. 6 in. will then be large enough. If the factory is built according to the plan I have suggested, the smoke chimney should be led beyond the upper floor through the roof of the wing, by an elbow bend, thus not interfering with our withering shelves —a chimney running through the withering floor is an objection also in the way of drying leaf in its immediate vicinity, and causing extra labor (if space is not wasted), in moving leaf perpetually as it withers and before it gets dry.

The T Sirocco is too well-known to need description. Nor need I waste your time in explaining how it is worked, as very clear instructions are given by Mr. Davidson with each Sirocco. Suffice it to say I find 14 lb. of roll to each tray give the best results. It should be worked at 275° 80 lb. an hour of dry tea is well within its capacity. 1 cooly will stoke 2 Siroccos if in the same pit. With 2 coolies to each Siroccos to attend to the firing, and 2 coolies carrying and preparing roll, thus 7 coolies are required to work 2 Siroccos in one pit; if 4 Siroccos are in use 1 cooly can be saved in preparing roll, or 4 Siroccos will require 13 coolies, and will turn out 320 lb. made tea per hour, at a consumption of 1½ lb. of dry wood per lb. of tea. Some small gardens of 100 to 120 acres may still with advantage work the old form of No. 1, and I hope Mr. Davidson will keep a few on hand and give them to us cheap. If the old form of No 1 could be obtained at a *low figure*, it would pay young gardens, or gardens of small area, to purchase one or more of these, even in preference as I said above to the T Sirocco, as No. 1 will work well up to the limited rolling power then used. Firing by charcoal should be avoided if possible, as the waste in firewood and cost is so great. That different gardens owing to some local differences in leaf give different results is quite patent. In rollers taking twice the time at the same speed and with the same pressure to give the same results, and in driers worked at the same temperature turning out far less tea, as witness the difference in Mr. Hay's experience at Blackwater and mine at Rookwood, as previously shown: my No. 1, turned out 46 and 48 lb. made tea in one hour whereas Mr. Hay's trial only gave 30¾ and 33 lb. in the hour. I quite lately tried my No. 1 with the result that in 6½ hours' working I got an average of 43·70 lb. per hour, and from a converted No. 1 at 6½ hours' work an average of 73 lb. per hour: both were worked at 275° as near as we could keep it, and the converted No. 1 was working under the greatest disadvantage being in a temporary earth-pit with no draught. In making pits for the T Sirocco we must provide for a good draught by opening a funnel to the outer air, or having windows close-by and low down. From experiments tried I am perfectly satisfied that the T form of Sirocco will turn out an even brighter outturn than the No. 1, and complaints brought against it of stewing the roll or causing a dull outturn is the fault of the manager and not of the drier. We are constantly hearing of our teas being overfired. Tea should never be turned out of the drier completely

fired, it should be crisp yet moist (steamy slightly) to the hand. Evaporation goes on for some time by itself from the heat of the tea, and tea slightly under fired will the next morning when taken out of the receiving bin be found quite crisp and dry. At the side of each Sirocco we should have a receiving bin: on no account should freshly fired tea be turned out on the floor. I find a very convenient arrangement is this. A bin 3 ft. 6 in high and say 7 ft. long by 3 ft. wide. The lid opens in two halves: on one half the spare tray ready loaded rests; the other half is opened, and the tray just taken from the Sirocco is put in bodily; the newly-filled tray takes its proper place on the Sirocco, when the tray previously emptied and left in the bin can be cleaned and placed ready for refilling and the bin-lid shut down. The back of the bin should have an edging say 4 in. high on which the back rim of the tray rests, causing the tray to slope and so allowing any fine tips to drop through. As the lid is lifted these tips fall into a trough fitted at the back of the bin to receive them, and are fired separately. Each half of the lid should have an edging 1½ in. high round sides and front. This form of table bin is most useful also in final firing, receiving any dust or fine tea remaining in the pekoe souchong, and which will fall through the tray as tea is spread, which may be turned out into the trough at the back by opening the lid.

Sorting.—As soon after firing as our tea gets cold, we may begin to sort. Before beginning this operation it is as well to taste the make from each Sirocco to see if all is right. It is as well to sort and pack separately all inferior teas, if our garden is of any size; as inferior teas will only bring down the value of our best makes, without proportionately increasing their own value. Do not therefore try to disguise inferior makes by mixing them with your better teas. All being found as it should be, on tasting, we will now proceed to turn out all our receiving bins, and put the bulk into a No. 8 sieve. Teas retained by No. 8 are souchong and red leaf; this is put aside to have the red leaf picked out, after which the souchong is broken through No. 8, broken tea and dust removed, and then mixed with pekoe souchong natural, made in a No. 10. Teas passing through No. 8 are then put into No. 10 which retains pekoe souchong natural; pekoe, broken pekoe, broken tea and dust passing through. These are then, according to make, put into a No. 12 or a No. 14: if fine the latter; if coarse the former; which retains pekoe; broken pekoe is then separated from the broken tea and dust, with the

shologoo (ordinary rice winnower) and dust separated from broken tea by No. 24. This will be pekoe dust. In firing quite 50 per cent of broken pekoe, dust, &c., passes through the Sirocco tray and is not of course mixed again with the bulk, but sorted by itself and then mixed with its class. In cleaning the souchong, broken through No. 8, the dust taken from it is tea dust. The broken tea is mixed with broken tea natural taken from the broken pekoe. Souchong is best cleaned through a No. 12, or if only a little of it, by the shologoo as with broken pekoe. If our plucking is at all coarse, congou, a round knobby-looking make, will be left in No. 8 after breaking souchong through; this may be shipped as congou or broken by the machine and mixed with the broken tea. So much for sifting by hand, resulting in broken pekoe, pekoe, pekoe souchong, and broken tea, or 4 classes. With tea dust and pekoe dust which need not be looked upon as a class, and are unavoidable. In sifting by machinery we have to choose from Ansell's, Jackson's Eureka, and Gore's. The first is very good although rather expensive; the second also expensive, £81-5-0 at Colombo, is a most ingenious and clever sifter, but the tea travels over too much ground to please me, giving a grey make. In Gore's sifter we have a cheap and very efficient little machine: its cost is R350, and its out-turn about 100 lb. teas per hour, of 4 classes as above. A little hand work is necessary to clean the broken pekoe out properly, which is also necessary with the other machines. Gore's has one advantage over the others in that it separates the broken tea from the broken pekoe and the tea travels over very little ground. This machine is for work by hand, one cooly turning it easily whilst another feeds. A larger and stronger sifter can be made to order, to be driven by power, costing R450 to R475, but I do not think it is yet determined what work this will do per hour. I can strongly recommend the purchase of Gore's hand sifter at R350. A very good and cheap sifter can be made at the factory necessitating the cleaning by hand of the broken pekoe only, thus:—sling three trays one above the other, strongly joined together and about 18 in. apart. Each tray is 8 ft. by 3 ft. inside measurement. These are slung inside a strong framework or on to strong cross beams and worked with an ordinary crank, 6 in. stroke fixed on to the bottom tray all must be good work and strong. The top tray is No. 8 mesh and receives the bulk, souchong passing out in front. The second tray is No. 10—the tea falling through No. 8 drops on to a sheet of galvanized iron leading from the mouth-end of the top tray to

the feeding end of the second at a good slope, thus delivering all teas that have passed through No. 8 to one end of No. 10: this passes out pekoe souchong to the right end (of No. 10) by a little iron spout. Teas passing through No. 10 are delivered by another sloping sheet of galvanized iron to the head of the bottom tray, which as explained in sifting by hand should be a No. 12 or 14 mesh according to circumstances; this delivers pekoe to the left end of the tray, by an iron spout sloping in the opposite direction to that delivering pekoe souchong above. Under No. 12 or 14 and at a good slope forwards should be fixed No. 26 mesh,—on light reepers only. The broken pekoe and broken tea falling on to this are dusted and fed into a box in front of the sifter to be then separated by shologoo as in hand sifting. A sifter like this I made for myself, sorted 600 lb per hour as above, and cost about R300—this cannot be driven by hand, but is a very efficient and cheap machine. If wood has to be purchased teak will be the best, but it will bring up the price to R350 to R375 about. Unless then one's garden is a very large one, it will pay best and give least trouble to buy a Gore's.

I have spoken above of breaking souchong and congou, &c. We have a very efficient machine and perhaps the best in Jackson's recently invented one, the Invincible Cutter, price at Colombo £23-10-0, which may be seen at Messrs. Walker's. A breaking machine is almost a necessity and saves much labor. I have so far been using a Reid's machine; this is an excellent machine for making congou or fannings into broken tea, but is not good for use with souchong. Therefore, Jackson's is the one to get beyond all others.

After sorting for the day is finished our teas are packed away in bins. A skeleton framework $7' \times 3' \times 6'$ high inside measurement of wood $3'' \times 2\frac{1}{2}''$ lined with zinc sheeting which costs about R20 per cwt., 8 to 9 sheets running the cwt., makes the neatest and best bins. There may be a wooden partition in the middle, of $\frac{1}{2}$ inch planking, and the bottom should be of 1 inch planks; there should be a sliding door of $\frac{1}{2}$ inch plank at the top through which tea is put into the bin, and directly underneath it, at the bottom, another sliding door by which the bin is emptied. So that one padlock may suffice for both doors, the lower door may have a handle reaching level with the top of the bin, the staple is fixed on to this handle, the hasp on to the top door, and all can be made secure with one padlock. A bin of the dimensions above will take 7 zinc

sheets to line it top and sides. Bins can be made of any size to suit the factory, but should never be less than 7 ft. long, and in large factories to save space may be 8 ft. high. All bins should be raised off the floor say 6 inches to allow of the floor underneath being swept. Stale tea lying about in corners or under bins may be the cause of ruin to a break, or breaks by getting mixed accidentally, during the packing or bulking.

Packing and Final Firing.—In an ordinary sized garden say of 200 acres, packing should be done every Monday; or in the busy time it may be done twice a week. The sooner tea is packed the better. Monday is a good day, as there is no manufacture to be done. Final firing in siroccos should be done at 260°. The tea need only be turned once a tray takes from two to three minutes, and tea should be spread quite level with the wooden edge of the tray. It is sufficiently fired when the hand (not a horny hand about pruning time) can just bear the heat, and when held to the face it does not feel steamy. Final firing requires as much attention as any of the other operations, and our best firing-men should be told off for this. Tea should be packed hot, straight from the Sirocco. I have a No. 24 mesh for firing broken pekoe and broken tea, or muslin over an ordinary Sirocco tray will do. But the No 24 mesh is preferable. In packing we have a pad of hessian to fit our chest and tea is pressed well down by the coolies' feet, a cooly standing inside the chest "marking time." I know of no better plan than this. Half-chests may hold 4 to 6 oz. more than the declared weight; chests 6 to 8 oz. more. The size of package entirely depends on the accessibility of the garden. The chest is the cheapest as we well know, but if we have any carriage to the main road the half-chest is infinitely preferable. Mr. Deane has well met our requirements in the way of chests now. For gardens on the cart-road his No. 1 chests at 83 cents will be found most suitable. For gardens further off the road his No. 3 at 62½ cents will be found the best. The chests are light and the tares are even, and good as our Ceylon chests are, the Japanese are better and cheaper. Ceylon made half chests need not be hooped; chests must be. Japanese chests of any size will not require hooping, another advantage they have.

Marking.—Do not write a book on the sides of your chests, as is sometimes seen. On the lid have your garden No. and shipping mark, say initials of consignee in diamond, with London underneath; in front have No. corresponding to that on lid, and garden

mark ; at back have class of tea and nett weight only, the other two sides plain. We are advised to make our breaks as large as possible to get full value for our teas, and we are told that the sale of breaks of under 8 chests or half chests or 20 boxes are postponed till after the general sales, when the best buyers will have left the room. With young gardens then, after picking out red leaf, I would break all teas through No. 8, dust and ship as pekoe souchong; put congou and red leaf through the breaking machine and after mixing ship as broken tea.

Bulking.—If this is done at the factory and it will be a saving if it can be done, "factory bulked" should be stencilled above the class of tea in the chest. Bulking must be done after final firing, and the teas thus packed cool, a slight disadvantage, but not so great perhaps as the teas suffer in being bulked at the docks. To bulk then, have all your Siroccos at work, throw your tea as fired into one large heap on the floor and as soon as any one class of tea is finished firing rake out the heap well over the floor, say 3 in. thick, then heap again, the cooly working from the centre towards him, forming a ring round him, the cooly then leaves the ring, again piles the tea in a heap, and again rakes it out and heaps, when the bulking will be finished and tea ready to pack.

I have purposely in this paper, so far, omitted all mention of cost of the works touched on. We have these so often given us before, I would but have wasted your time in again going into them. I may however briefly state, that gardens in full bearing can put their teas f. o. b. at Colombo at from 27 cents to 36 cents per lb., that with careful management and with good machinery, on an ordinary average garden you may positively count on being able to ship your teas at 30 cents per lb. In August 1883 when I had the honor of reading a paper on tea before the Dikoya Planters' Association, I then estimated cost f. o. b. making every and ample allowance at 39 cents, and stated it was more than I should allow at a yield of 400 lb. per acre, and it is 3 cents per lb. over what you will find tea need cost you. With regard to yield a garden giving an average yield of 300 lb. per acre will found to be more uncommon than one giving 500 lb. as an average at 6 years upwards. Longer experience has shown us that there is not so much difference in yield between the lowcountry and the hills. Hill tea is slower at first, but wherever it has soil to work on it will be found I think at 5 to 6 years and upwards equal to any tea of the same age in the lowcountry, and when we

put our millions of lb. before the market our hill flavor will go for something depend upon it, where all is good, comparisons are odious, so no more of this.

To revert again for one moment to factory and machinery. Having formed your garden, spend your utmost farthing in erecting a large and commodious factory, with ample machinery, and it will all be returned to you one hundredfold. You may begin your factory as soon after your planting is done as you like, and you must begin at the end of your first year, money is always of object so it is not to be supposed you are to build the whole of your factory right off. Adopting the plan I have suggested you would begin then with a building say 36 ft. in length by 24 ft. wide, with two upper floors. Your bottom pillars would be 12 ft. high by 2 ft., on them 18 in. pillars 8 ft. high and on the top floor posts 6 in. by 6 in. to support the wall-plate. The two upper floors can be walled by either weather-boards, or wattle and daub plastered inside and outside with lime. The bottom floor is walled with a temporary wattle and daub wall weather-boarded outside. When the time comes to add the wings both weather-boards and windows can be used for them, so there is no waste. Here is the foundation of our permanent factory then—to be added to as more space is wanted or as funds allow. If you have a good coffee store which can be converted into a factory by all means let this be done, but if your store is not a permanent one, and you can do without it pull it down, and use what timber you can for your factory. Temporary factories are most unsatisfactory things: an actual waste of money in themselves, and perhaps losing your pence per lb. on your teas. If then you cannot begin your factory on a proper basis sell your leaf till you can.

In deciding on your machinery it must be borne in mind that to finish your work in daylight you are working your roller 5 to 6 hours not 10, and your driers also half time. Estimate then what you want and multiply by two—the same with withering space. A few large flushes come upon us and we cannot avail ourselves of them as we ought, for want of space. R1,000 or so spent in more withering room will be represented in the gain on tea both by quantity and market value in one month perhaps or even less. Money if it can be spared will be well spent in the purchase of a small circular saw for cutting firewood into lengths without waste, among which firewood alas! comes our coffee trees, just too long in many cases for the Sirocco, and they are tough subjects for the axe. In clearing out your coffee do not burn the trees to

waste, as I have seen done, merely to clear the land in a hurry, but stack them for firewood, or for making charcoal. Do not aim at making *too* fine teas. It is pleasing to see an out-of-the-way average, but what does it mean? Too fine plucking, costly, and resulting in injury to the bush, a less yield which with heavier cost, quite I think, outbalances enhanced value, a large yield with good medium teas fetching a fair average value at from 1s 3d to 1s 6d will pay better and keep our bushes healthy and everlasting. I have seen, we have all seen, young bushes plucked to death, to give fine teas. How can these bushes ever develop themselves and give us the cover we should get. Apart from the injury to our bushes, and as I do not believe a low yield and high price pays as well as a high yield and lower prices, why educate the public taste up to a standard which we will not be able to maintain as time goes on, both on account of impoverishing the bush and—with no coffee to rob of its labor insufficiency of pluckers. Let our standard be an all round average according to the richness of our soil and suitability of our climate at from 1s 3d to 1s 6d per lb. and we will have no cause to grumble, I can assure you, with our tea gardens a permanency.

And, now, Mr. Chairman and gentlemen, I must close. As you are aware in a paper of this kind, it is impossible to enter fully into the subjects you were good enough to ask me to bring before you, as time is insufficient. I trust however I have said enough to be of some assistance to those who require it, and thanking you for the honor you have done me in asking me here to day I leave my humble effort in your hands.

C. SPEARMAN ARMSTRONG.