TEA FACTORY ORGANISATION AND MANAGEMENT*

GORDON K. NEWTON

INTRODUCTION

This paper is written by kind permission of the Directors of the New Dimbula Co., Ltd., compiled from notes taken by the writer when working tea factories at different elevations, ranging from old converted coffee stores to the most modernly equipped of Ceylon factories built to date, and is intended as a guide to efficient working of personnel and machinery concerned in teamaking.

It is hoped that it will be particularly interesting to the younger generation of Planters who, possibly having had little or no factory experience, suddenly find themselves in charge of a tea factory, and expected to get the best possible results from it.

Centralisation of estates is rapidly taking place and must increase in Ceylon, if we are to compete successfully with other tea-producing countries having advantages we lack. This will result in the scrapping of small factories, several of which will be replaced by large, modern, well-equipped ones, where strictly organised methods must be the rule or chaos will result.

If methods on the following lines are carried out it will be found that standardisation of work will ensue, which the writer contends will give results more acceptable to the trade than methods of a more haphazard nature.

Within the last decade what was known as the art of teamaking has practically disappeared, to be replaced by science and modern methods of control.

Many admirable books and papers have been written from time to time which help the individual in obtaining the best results from the leaf to be dealt with, but all this knowledge is valueless unless

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factory management is such that nothing is left to chance, and all processes checked in such a way that the planter has not to depend on the vagaries of his factory staff for the results he wishes to obtain.

Before continuing I wish to make it quite clear that the following suggestions do not necessarily indicate the best way to make tea — every estate has its particular requirements and peculiarities, of which those responsible are the best to judge -- but it follows that by having some system of control, consistent results will be obtained.

CONTROL OF LEAF TO FACTORY

Following the leaf from the pluckers' hands we will assume that plucking is arranged so as to give an even flow of leaf to the factory, and that the leaf arrives at specified times by whatever method of transport is used.

It is most important that those responsible in the field should have definite written instructions as to when their leaf should be delivered at the factory, and that these instructions be strictly carried out. The factory staff then knows when to expect leaf — with different seasons of the year times of weighing will probably vary, arrangements for which can easily be made.

The teamaker should know what amount of leaf he is to receive daily and the best time for estimation of leaf intake for the day is usually found to be at the morning muster, after the number of pluckers to work on each field has been ascertained, when a note can be made on the muster chit and the information transmitted to the factory.

STANDARDISATION OF MANUFACTURE

We will assume that, after experimentation in the factory, a system of manufacture has been evolved, giving a result most advantageous to the estate as regards sales. With the vagaries of the tea market this may have to be altered from time to time if found necessary, but, should a system be adopted, whereby the best local characteristics are developed to the utmost, and that system adhered to, results will tend to be better than by continuously changing to follow a tricky trade demand.

For the sake of economy and general efficient working of machinery it is necessary that the manufacturing process, from day to day, be timed so that there shall be no intervals when machinery and labour will be idle.

To obtain this result we should calculate backwards from the drying process in order to estimate the rate at which leaf must be stripped from the tats, and maintain this until all leaf for the day's manufacture has been finished.

Where it is possible for control to be kept over the withering process time sheets can be compiled as a guide for the Teamaker in working the machinery at his disposal.

To illustrate what is meant we will assume a factory has a complement of three drying machines, "A" capable of firing 450 lbs. per hour; "B" 250 lbs. per hour; and "C" 150 lbs. per hour, and that other machinery is so balanced as to meet the demands of the driers working at any particular time.

Let us assume figures are based on inlet temperatures of between 190 and 200 degrees, firing fermented leaf having a moisture content of, say, 50 to 53 per cent. Any variation in moisture content will affect the out-turn of the driers, hence the necessity (apart from other considerations) of being able to control a wither to within 2 or 3 per cent over a given period. For this purpose we will assume we are stripping from the tats leaf having a moisture content of 52 to 53 per cent.

If our made tea is to contain 3 per cent moisture we shall be driving off 49 per cent to 50 per cent moisture in the drying process, and in the rolling process a loss in weight of from 2 per cent to 3 per cent is usually registered.

Hence, for all practical purposes, to calculate the amount of withered leaf the driers are capable of dealing with one must double the drier out-turn figures.

If one is withering harder or lighter than these figures allowance can be made either way.

Therefore, with the following combination of driers, we see we can deal with leaf as under:—

"A" can fire	450 lbs.	tea approx. or	900 lbs.	withered leaf	hourly
"B"	250 ,,	,,	500 ,,	,,	,,
"C"	150 ,,	,,	300 ,,	,,	,,
A and B	700 ,,	,,	1400 ,,	,,	,,
A and C	600 ,,	,,	1200 ,,	,,	,,
B and C	400 ,,	,,	800 ,,	,,	,,
A, B & C	850 ,,	,,	1700 ,,	,,	,,

From the above we can see that in, say, a 6-hour firing period, we can deal with the following amounts of leaf in our driers:—

	Made Tea	Withered Leaf	Approximate green leaf
	lbs.	lbs.	lbs.
"A"	2,700	5,400	10,800
"B"	1,500	3,000	6,000
"C"	900	1,800	3,600
A and B	4,200	8,400	16,800
A and C	3,600	7,200	14,400
B and C	2,400	4,800	9,600
A, B & C	5,100	10,200	20,400

Thus it will be noted that we can handle amounts of green leaf (approximate) varying between 3,600 lbs. and 20,400 lbs. over a period of six hours, keeping our drying machines steadily working. With totals of leaf between the above figures small gaps in the firing may occur, which should not be serious enough to cause uneven firing.

To take an example, supposing we get 14,000 lbs. of leaf in one day, and wish to calculate how to deal with it on the above lines — we know we shall wither down to approximately 7,000 lbs. Take the nearest figure in our table which is 7,200 lbs., and we see we want the combination of "A" and "C" driers to deal with it in our proposed drying period of six hours.

To calculate roller charging periods in this instance, assuming we wish to charge three rollers at 300 lbs. each (total 900 lbs.) for the first roll, and knowing our combination of driers deals with 1,200 lbs. of withered leaf hourly, therefore 900 lbs. can be dealt with in

$$\frac{60 \text{ minutes} \times 900}{1{,}200} = 45 \text{ minutes}$$

Therefore 45 minutes will be our charging interval of manufacture for the 7,000 lbs. withered leaf.

In the same way a complete table can be worked out for any factory, for any individual drier or combination of driers, showing how it is possible to keep them full over the day's work. The Teamaker can see from this table the approximate amount of withered leaf to be expected from green leaf received. He will then know *immediately* how to control his wither, what machinery to work the following day, and at what intervals his rollers should be charged. In taking the approximate green leaf figures intelligence must be used when dealing with wet leaf.

It will often be found that the amount of leaf per charge must be regulated to suit certain combinations of driers in order to keep charging intervals conveniently long. The important point is that, in using this method, a programme can be worked out in any factory to keep work continuous, once started, and provided the withering process can be controlled to suit one's requirements.

FACTORY STAFF AND DUTIES

In a modern factory, where the methods as outlined are practised, the following staff is necessary as a minimum if full control is to be maintained:—

(1). Head Teamaker. (Sometimes a Factory Assistant).
(2). Withering Loft Assistant on Day Shift.
(3). do. do. Night Shift.
(4). Rolling Room Assistant.
(5). Firing Room Assistant.
(6). Sifting Room Assistant.

I have used the word assistant for the above under heads (2) to (6) being a designation covering, in many cases, Factory K.P.'s, Kanganies or trained intelligent coolies.

The duties of the Head Teamaker will be supervision of all works connected with manufacture.

It is his particular duty to see that each assistant carries out the instructions that have been given to him, which may be either permanent or temporary ones. To ensure that no misunderstandings take place, written instructions, even if only of a minor nature, are found to be advantageous.

He should make it a special care to test the working of machines daily, check speeds at least once a week, examine drier furnaces personally after cleaning operations, and take moisture content tests from time to time.

A day and night Loft Assistant is necessary if withers are to be properly controlled and furnaces looked after.

These Assistants must keep a log of the way in which conditioned air is controlled, showing the time fan withers are commenced and stopped in each loft, and in what direction the air is flowing; as well as wet and dry bulb temperatures through the lofts when fan withers are in progress. In addition hygrometer readings outside the factory should be taken at agreed periods by the Loft Assistant on duty.

At the end of each day's manufacture the Assistant on duty should analyse the log entries for the past 24 hours in a book showing full details, as per Fig. 5.

If the maximum life of a drier furnace is to be obtained, correct stoking at night is essential. This should be fully understood by Loft Assistants, who are responsible at night for this work. Unless good supervision is given to the stoking cooly (especially at night) irreparable damage can be done. It may be said that thermograph charts tell the tale, but the stoker who knows his furnace and wants a few hours' sleep, knows how to close down the fan inlet valve and

open cold air ducts after loading the stove with excess of fuel (this does not apply to liquid-fuel burners of course), which results in completely incorrect readings as far as furnace temperatures are concerned.

Until the drier makers provide thermometers showing the furnace temperatures, as well as drying chamber temperatures, this danger must continue.

Loft Assistants should take it in turn, week about, on day and night duty. By day, of course, he will have to weigh in all green leaf to the lofts, and distribute it according to the thickness of spread previously decided on, as well as weigh all leaf tatted down for delivery to the rollers.

As regards checking withers it is very simple to walk into the factory and take samples haphazard of leaf being tatted down, from any bank of tats, or any particular tat. The moisture content of these samples can be taken which will show if the leaf is having more or less moisture taken out of it than the amount decided to work to.

The time over which withers are to be taken has previously to be decided and can easily be checked by looking up the rolling room records to see when leaf was delivered to the rollers. (See Fig. 6).

Now we come to the Rolling Room Assistant whose duty it is to see that the rolling programme is properly carried out, weigh up all dhool and bulk, and see that fermented leaf is taken to the driers at the correct time. Judging fermentation is an extremely difficult task, and it will be found more satisfactory if a table of fermenting times is made out varying the length of ferment with the temperature of the dry bulb in the fermenting room, or wherever the leaf is fermented.

In order to maintain the firing process without breaks the same period of fermentation must be taken for the corresponding dhool and bulk of each charge, and, although the temperatures of the rolling and fermenting rooms may not be controllable to 100 per cent, in practice, over a day's working, the difference in infusions will not be found to affect the made tea commercially.

The Assistant in charge of firing must weigh tea as it falls from the driers, keeping a careful record of the different dhools and bulk, also drier fall. He is responsible for the stoking of the furnaces, until relieved of his duty by the night Withering Assistant.

The Sifting Room Assistant must be responsible for whatever grading is decided upon, and for any other duties that may be allocated to him, such as infusion of samples, etc. He should also be capable of helping the Head Teamaker when packing is in progress.

Packing and despatch must come under the immediate supervision of the Head Teamaker, with help from the Sifting Room Assistant. When taring of chests is fully understood it is a very simple and straightforward process. The attention of the most responsible person available will eliminate any risk of packing materials being included with the tea.

SUPERVISION MADE EASY

The Manager should, on entering the factory, be able to see at a glance exactly what is happening. Suitable boards such as are illustrated in Figs. 1, 2 and 3, should be in a conspicuous position showing exactly how the factory labour is distributed, the green leaf crop for the previous day, and the leaf estimate for the current day.

To amplify Fig. I, the Manager knows approximately how many coolies per 1,000 lbs. green leaf are necessary for, say, spreading, so he looks at the estimate for leaf expected for the day, then to the labour distribution board, and sees at a glance if too many or too few coolies are being employed. The same system applies for all the other main heads — the number of coolies per 1,000 lbs. will naturally differ in different factories, but an economic unit can quickly be discovered and this check applied daily.

A board to indicate how the fans are being used will save time, especially in a large factory. The illustration in Fig. 4 shows an easily worked withering indicator, controlled by the Assistant in charge of the lofts. The drawing is of a double bulking chamber factory with lofts numbered 1a, 1b, 2a, 2b, 3, 4, 5, 6, 7a, 7b, 8a and 8b. Slides on which the loft numbers are indicated can be pushed from side to side to reveal or conceal the painted arrows shown on the loft sections 7a, 7b, 8a, and 8b. On the left section withering

lofts slides have been positioned to show that fans are working in lofts 1a, 1b and in the centre section No. 6.

Whenever an alteration is made in the direction of the air flow, or conditioned air transferred to other lofts, the necessary alteration on the board is made by the Withering Assistant by sliding the movable sections along so as to show painted arrows indicating the direction of the air flow.

By having this simple indicator working it can be seen at a glance where withering is going on, and immediate inspection can be carried out without having to ask which loft to go to.

Having given instructions that leaf is to be withered with a certain difference between the wet and dry bulbs at different temperatures, it is a matter of a few seconds to see if instructions are being carried out.

Under "Factory Staff and Duties" I referred to certain figures to be kept by the Rolling and the Withering Assistants and which can be checked over by the Manager from time to time. Figs. 5 and 6 show types of forms that, if properly kept, make checking of factory records easy, and give useful information.

In addition to these forms it will be found an advantage to keep a Factory Journal or Diary, which the Manager can see daily in his office, if unable to get to the factory, and from which he will be able to know what is going on.

The specimen forms illustrated must not be taken as a suggestion of the only way to keep figures for factory control. They have been evolved to show as few figures as possible, and, at the same time, to enable the Manager to see if his instructions are being carried out or not. In practice it will be found that the fewer the figures the easier and more accurate the check, hence the simple type shown. When more figures are required it is easy to amplify these.

The writer has purposely avoided the inclusion of many percentage columns for the reason that it is so often found possible to "Work" factory figures backwards from percentages if the Manager insists on a particular figure being worked to. When one sees very even percentage figures day by day, charge by charge, then the time has arrived for the man in charge himself to take a turn at weighing up and see if he can be so skilful.

CONCLUSION

More and different figures as checks can be kept according to the desire of the individual but, if a routine as suggested here is maintained in a tea factory, and the figures indicated kept correctly, it will be found that very little is left to guess work, given ordinary supervision.

FIGURE I.

GREEN LEAF EXPECTED

Date	
Division	lbs.
Division	lbs.
Division	lbs.
Total	lbs.

FIGURE II.

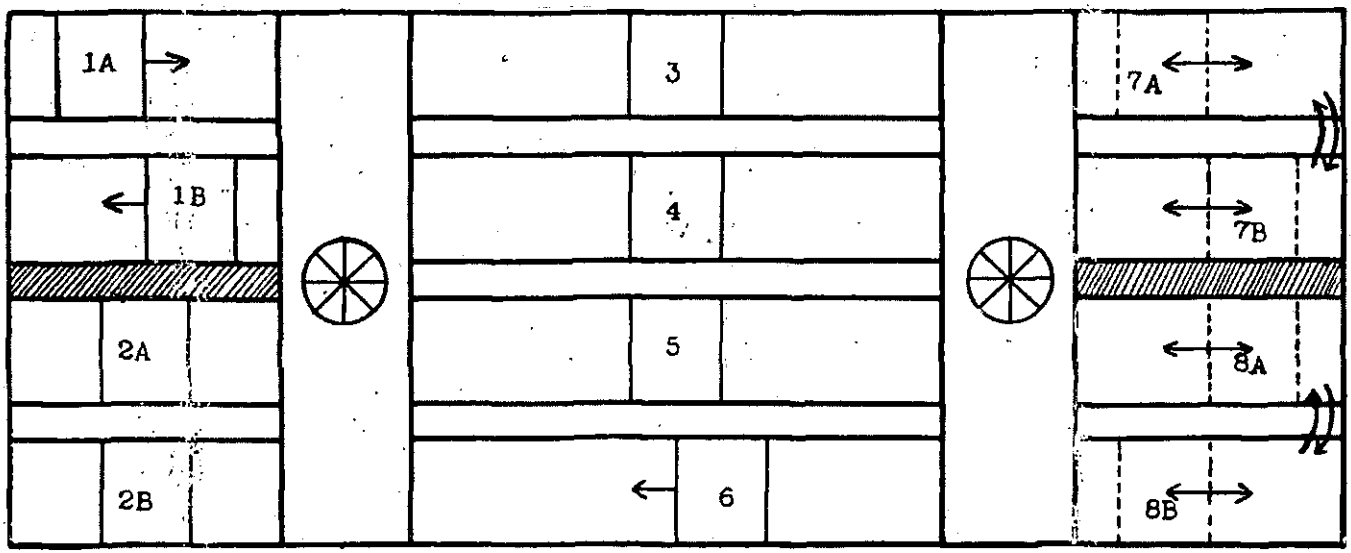
GREEN LEAF RECEIVED.

Date	
Division	lbs,
Division	lbs.
Division	lbs.
Total	lbs.

FIGURE III.

TEA HOUSE LABOUR	
Spreading	
Tatting	
Rolling	
Fermenting	
Firing	
Sifting	
Red Leaf	
Contingencies	
Lead Lining	
Engine	
Turbine	
Packing	
Transport	
Tats Upkeep	
Boxes	
Machinery	
Factory Upkeep	
Lent Labour	
Total	

FIGURE IV.



The writer is indebted to Mr. N. Reeks of Bogawana Estate for allowing him to illustrate the working of this withering indicator

FIGURE V.

WITHERING

Month:—

Date	Time received	No of Weighing	Factory Weight of Leaf	Condition and Type of Leaf	Spread in Lofts	TIME FANS WORKED			Time knocked down	Weight of withered Leaf	Period of wither	Weight of made tea	% Out-turn on withered Leaf	HYG. AT BULK. CHAMBER			
						On	Off	Period						Removal of Surface Moisture		Withering	
														Dry	Wet	Dry	Wet

FIGURE VI.

ROLLING

Weight of Green Leaf for day

Date:—

Time of Charging	Weight of withered leaf	ROLLERS											Mist Chamber	Weight of fermented leaf.	Loss in rolling.	Period of Fermentation.	Made tea weighed up.	Addipu chool	HYGROMETRIC READINGS					
																			Rolling room		Fermenting room		Outside	
		1	2	3	4	5	6	7	8	9	10	11							Dry	Wet	Dry	Wet	Dry	Wet
Total																								
Per-centage																								

FIGURE

.....Tea Factory.....

Date,.....

WEATHER			RAINFALL			
A.M.	Noon	P. M.	This Day	Previously	Month To Date	Season To Date

GREEN LEAF ACCOUNT

Division	This Day	Previously	To Date	To Date for Season
Total				

MADE TEA ACCOUNT

Division	This Day	Previously	To Date	To Date for Season
Total				

OUT-TURN OF MADE TEA.....%

OUT-TURN OF MADE TO WITHERED.....%

OUT-TURN OF WITHERED TO GREEN.....%

	Drier	Drier	Drier	Percentage of Dhools	
Firing temperature				1	
No. of hours worked				2	
Amount of fuel used				3	
Pounds of tea fired				4	
Hours firing tea				5	
Out-put per hour				6	
				B.B.	

VII.

Journal for Season.....

TEA HOUSE LABOUR					Balance tea in Stores .....lbs.
Headings	This Day	Previously	To Date	Season To-Date	
Spreading					
Tatting					Invoice..... Packing To-day
Rolling					
Fermenting					MANUFACTURE
Firing					Began
Sifting					Finished
Red Leaf Pickers					Hours worked
Sorting					
Contingencies					POWER SUPPLY
Total					Source.....

TEAMAKER'S REPORT ON GREEN LEAF

Weighing	Division	Division	Division	Division	Division
1					
2					
3					
4					

GENERAL REMARKS :—