# *FUTURE DEVELOPMENTS IN TEA MANUFACTURE

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Revolutionary changes are being forecast for tea manufacture. The desirability of continuous operation has often been stressed. Existing machines have been condemned for their inefficiency, particularly the three-crank roller. The necessity for withering has been questioned. Present methods have been condemned as being out of step with modern ideas on production. Even our factories have not escaped the onslaught of critics. I do not intend to talk to you today on these visionary ideas. So I hope you will not be disappointed if I touch upon more practical issues, some of which concern us today and are most certainly going to alter our approach to tea manufacture in this country in the not too distant future.

Planters are being faced with problems of increased crops. Some factories have probably reached the limit in conventional expansion and, even if it were possible to build more floors, the cost of enlarging a factory today is beyond the means of even the more prosperous estates. With more and more crops expected in the future, the problem will become more difficult. It has to be faced, however, and the question is—what are we going to do about it?

The easiest path to follow, of course, is to ignore the finer details in manufacture and make the best of the facilities available. This, you will agree, is not the right approach. Sooner or later under-withered leaf, over-charged rollers and over-fed driers will take their toll, and a financial loss may well result.

An alternative method, without much extra capital expenditure, would be a double-shift or multiple-shift arrangement, as in most industries. If no other changes were made, however, multiple shifts would lead to practical difficulties. Labour, for instance, would have to be trained to adapt themselves to new working hours. Leaf would have to arrive at the factory at certain specified times, depending on the crop for the day, and perhaps more frequently than at present. This means that the field programme would also have to be readjusted. That is not all — factory machinery would have to be in perfect working order, as you cannot possibly keep machines functioning continuously day after day unless they are in an absolutely first-class condition. Even if these difficulties could be surmounted, there would still remain the problem of withering. In fact, on a 12-hour shift, the problem becomes bigger since withering periods would have to be much shorter than they customarily are. With conventional fans, it is possible to wither leaf within 12 hours provided the right amount of heat is continuously supplied, but this heat would not be available if driers were continuously loaded with leaf.

So the prospects of a double shift are certainly rather dim on the conventional system of withering; even if tat space is increased or fan capacity increased. An extra source of heat is also required. You would want a spare drier solely to provide heat for withering. This in turn means a larger firing room, the construction of which might involve major structural alterations in some factories. If this is to be avoided we must turn to something else. Fortunately, we have today the withering trough, a commercialized version of the experimental unit we worked with over 10 years ago. (Those interested in the results of research carried out in this field could look up our annual reports for 1952 and 1953).

* An address to the Dimbula District Planters' Association given on 17.7.1962.

The trough witherer, as the unit is also called, consists of two troughs, each approximately 50 feet long and 6 feet wide. Each trough is capable of holding 1,500 lb of green leaf—so the two together have a capacity of 3,000 lb. For this weight of leaf, the spreading is roughly 8 inches thick and about 5 lb per square foot. There would appear to be a tremendous saving in space by the use of troughs. But remember this—that if you have 20 tats on a bank and you spread thickly—say 1 lb per 7 sq ft—it means you cope with 20 lb of leaf per 7 sq ft of floor area or roughly 3 lb per sq ft. So, for the same floor area, the capacity of a trough is little less than twice that of a conventional bank of tats for a spread of 1 lb per 7 sq ft—2½ times for a spread of 1 lb per 10 sq ft and a little less than four times for a very thin spread of 1 lb per 15 sq ft. The amount of air supplied is no different from that provided for tats—nearly 30,000 cubic feet per minute (or may be more) for 3,000 lb green leaf to be withered.

The heat is supplied by a separate unit, which, as far as I am aware, will not be permitted by the C.F.I.A. in the lofts or will raise the insurance rate. So if you desire to use troughs in place of tats, you will have to use the air from the bulking chamber. Allowing for passages, etc., I estimate that two units (*i.e.* 2 pairs of troughs) could be accommodated in a loft of standard width and they would take up the space occupied roughly by 6 banks of tats. That is to say, instead of the 2,000 lb or thereabouts these tat banks could cope with at 1 lb per 15 sq ft, the troughs will enable you to handle 6,000 lb. At 1 lb per 7 sq ft comparative figures will be 4,000 lb for tats and 6,000 lb for troughs. Even then the troughs show an advantage.

There is no doubt about it—the trough wither is space saving. From all accounts the few troughs installed in Ceylon appear to have given the anticipated results. I am not suggesting that you are going to make a better tea by using a trough nor do I say that it will replace the tat. But it is almost certain that the withering trough is going to play an important role in manufacture in the years to come.

A mistaken notion about the unit is that high temperatures are required for its successful functioning and that therefore quality would be impaired. Most certainly such a result is brought about if withering is carried out under such conditions, whether it be on a tat, in a trough, or in a drum. Despite our findings on the effects of high-temperature withering, it took the manufacturers of the withering drum many years to realize that they were on the wrong lines. When the drum was first introduced one of the advantages claimed for it was the considerably shorter period of wither. But what do we find today? Drums are now being operated at much lower temperatures than first recommended and withering periods have been extended. So some of the economic advantages that were expected from the drum have not been realized. Do not therefore expect the trough to reduce withering times appreciably.

The design of the unit is such that a higher thermal efficiency is obtained than in the conventional loft. Better use is made of the air and less heat is wasted. One would therefore expect some reduction in withering costs. In the absence of sufficient data I would rather not comment on this aspect of the trough. But the following figures, taken from an estate where the unit has been undergoing trials, may interest you. At an inlet temperature of 85°F (dry) 70°F (wet)—15° difference—it was possible to obtain a satisfactory wither on 3,000 lb of green leaf in 12 hours, using heated air for 9 hours. Roughly 27 gallons of fuel were consumed. Two men were required to turn over the leaf, and this was done during the period of withering. In conventional withering you do not need this labour, but you will probably need as much as 35 gallons of fuel to wither that amount of leaf in wet weather.

Now what are we going to gain by the introduction of troughs? In the first place, it will help you to increase your withering accommodation without a major structural alteration to your factory. All that is required is a shed outside the factory. Its chief advantage, to my mind, appears to be a better and fuller control of the wither; and if operated suitably the same unit could be used twice during 24 hours. So its capacity, instead of being 3,000 lb, would be doubled. How, if used in this manner, it would be co-ordinated with the normal running of a factory is, I am afraid, going to be a problem. Anyway, even if short withers are not contemplated with the object of using it twice within 24 hours, it will still continue to serve a useful function in the case of a factory short of withering space.

Besides the utilization of a trough independently of the main factory building, we can also turn to the use of nylon mesh to cope with increased crops. Nylon netting may be new to some of you, but plastic mesh and similar types have been tested years ago. The cost was so prohibitive that the matter was not worth pursuing. However, the introduction of Japanese nylon fishing net in recent years at a much lower price has re-opened the possibilities of using such material for withering and many of you are now probably quite familiar with the product.

Like all innovations, troughs and nylon material have come up against the usual criticisms. You may remember the history of the electrostatic stalk extractor, the use of which was objected to because it was supposed to grey teas and even impair their keeping properties. These canards were easily disposed of by experiments we conducted. Likewise we now hear of opinions expressed on the trough and nylon material, which have nothing to support them. For instance, the trough is condemned because it is believed that it can only be used at very high temperatures. In the case of nylon, objections such as that some leaf tends to stick in the mesh, and drip of water from wet leaf are being bandied about. Are we going to throw away the immense possibilities of open-mesh material for the sake of such insignificant shortcomings when we know very well that by using it you can almost double the capacity of a loft without a detrimental effect on the wither? You might well ask why go to the expense and trouble of substituting hessian with open mesh material? Could not we spread thicker on hessian? The answer to that is that if the spread on hessian is unduly thickened, you will never get the same result as you would with the same rate of spread as on open mesh. That is the important point to be remembered.

Other advantages of nylon mesh are as follows:—

1. It does not stretch. Sagging tats will therefore cease to be a troublesome problem.

2. We imagine it will last longer than hessian. Even if it does not, its potential extra capacity compensates for its extra price.

3. It is non-inflammable. Some reduction in insurance premium can be expected—not much, but still a relief.

4. It is supposed to be more resistant than hessian to the corrosive effects of the acidic compounds in the discharge gases from direct-fired heaters.

5. The period of withering is shortened—so better quality must result.

For those of you who have no experience of the material and who intend to try it out, a word of caution is necessary. Tat posts will have to be reinforced by additional cross bars, and perhaps some strengthening of the supports. The material

should be pulled taut in all directions and may be fastened with the usual ekel pins, or if you wish to make a better job of it, you can even sew it. Materials are now coming in, which do not have to be stretched as much as the usual fishing net type —so the tensioning of such tats will probably be the same as for hessian. A coating of resin makes them stiffer. Tat wires have to be wrapped with hessian or cloth to prevent abrasion. This applies to the middle wires as well. It has been suggested that because of extra abrasion in the middle, the middle wires could be dispensed with. We are investigating this. We are also considering the substitution of the wooden sticks for gathering leaf by plastic sticks, because any rough edge can cause damage.

Importers are alive to the requirements of the industry and with the competition at its present pace you can be sure that sooner or later existing snags will be removed.

We have had inferior quality types submitted to us for approval, mesh of different sizes and so on, and our recommendations now, in the light of the results of our experiments, are broadly speaking as follows:—

1. Mesh size of not more than 4 per linear inch when material is fully stretched.

2. Free from knots.

3. Interwoven at intersection points of mesh to avoid divergence in the shape and size of apertures.

4. Broad selvedge for better fastening but primarily to prevent fraying.

5. Nylon twine to be of a reasonable thickness and having at least 6 strands.

6. A smooth surface. With this end in view we are considering monofilament plastic materials manufactured in the U.K. and in the United States, and at a price competitive with that of Japanese fishing net.

So we are confident that with the availability of the trough and open mesh material, we shall not be faced with insurmountable problems in regard to the withering of increased crops. But do remember this—that to remove the moisture from double a given amount of leaf, you will require double the amount of air. By merely installing open-mesh tats, or replacing them with troughs, you do not solve the problem—fan capacity should be proportionately increased to correspond to the amount of leaf handled.

When we come to future developments in rolling, the Rotorvane comes first to our minds. It is a machine developed by McTear, the Development Engineer of the Tocklai Research Institute, and from what I have seen of it and the teas turned out from it, I have no hesitation in saying that most of us will soon be talking of Rotorvane manufacture. Expressions such as "how many minutes on and how many minutes off", "half pressure, quarter pressure and full pressure", rolling periods, roller charges, and so on, would be things of the past.

First let me describe the machine, in simple terms. It consists of a cylinder approximately 4 feet in length, with a worm and rotating vanes inside it. It is probably designed on the same lines as a fruit juice extractor and mincing machine combined. The degree of leaf rupture is controlled by a pressure plate at the delivery end. If pressure is excessive or leaf is not properly withered, a pulpy mass is obtained. On the other hand, given the right material it will turn out a tea not much different from the orthodox. It does not twist the leaf, however,

but reduces its size considerably without making it too flakey. The appearance of the tea would be described as "crepy", which combines the characteristics of twisted and flakey teas. I am assured by certain members of the tea trade in Colombo that such teas will be acceptable.

The Rotorvane or R.V. is available in two sizes, 8 in. and 15 in. diameter. At the rated speed of 40 r.p.m. its capacity is staggering. The 8 in. will deal with 800 lb withered leaf or 1,600 lb rolled leaf per hour, and the 15 in. four times as much. Outputs can be decreased by lowering the speed, but whether the product will be affected or not I cannot say. Power consumption is only 10–15 H.P. and the cost of an 8 inch machine is no more than that of an ordinary roller. Subsidiary equipment with the R.V. is a feeder and a ball breaker.

Its high output, its relatively rapid action, and relatively low cost are its worth while merits. Though it can be used directly with withered leaf, I envisage that until the market requirement for teas with appearance relaxes, its function will be to reduce the size of the leaf after it has been rolled one or two times in an orthodox roller. What normally now takes an hour or more, can with a R.V. be completed in a fraction of that time. That is not all, liquoring properties would also improve. Since the rise of temperature of the leaf during its short passage through the machine is, I gather, not more than 10°F, there is no reason to suppose that high-grown quality will be adversely affected. However, as far as the mid-country is concerned, there appears to be a bright future for the R.V. (we shall be having one at St Coombs shortly).

Another possible development in tea manufacture in Ceylon is the C.T.C. process, which has in N.E. India proved a complete success as judged by prices. At first it was thought that the market could only absorb a certain amount of this type of tea, but there does not seem to be any indication of saturation point having yet been reached. In fact the demand for these teas appears to be on the increase. What is the reason for the C.T.C. process winning more and more advocates? It produces a strong, coloury liquor sought after by blenders, much superior to what we would call a coloury liquor by Ceylon standards. The question is: will Ceylon stand to gain by the adoption of the process? Three important considerations are:—

(1) the complete change in the appearance—the C.T.C. is reddish—and somewhat flakey;

(2) the possible loss of high-grown quality and flavour;

(3) would our Ceylon liquors gain in colour and strength to the same extent as in Assam? This, to my mind, is the most important consideration because if our C.T.C. liquors do not come up to the N.E. Indian standard, there is little hope of success.

Now can we produce the required colour and strength from our leaf? You should not forget that in Assam the leaf is very succulent and in that part of the world the bushes are pruned annually. We do not have this initial asset. However, we can produce the required colour and strength even with some of our tougher leaf—but with such leaf the teas would be brownish and fibrous, so that they will virtually be unsaleable. It is pointless therefore trying to attain Assam standards of liquor with unattractive grades—it will not benefit anyone. So it would appear that the estates most suited for the C.T.C. are those in the low country, and perhaps some mid-country areas where the leaf being more sappy need not be subjected to excessive rupturing for the required colour and strength.

I personally do not think there is the possibility of the C.T.C. machine completely ousting the orthodox roller—which will still be required for that preliminary twist and in any case for conserving tip in low-country teas. Whether our low-country C.T.C. tea will be able to compete with the Assam C.T.C. tea is of course a question I cannot answer just now because there is one vital difference between the two regions. In Assam they have some quality in the leaf—probably due to the latitude, or some other factor. Anyway, we shall have the answer soon because we are getting a machine on trial any day now.

The older planters amongst you would probably remember the time when the C.T.C. was first introduced into Ceylon in the 1930's. The modern machine differs very little from the earlier model. Lack of technical knowledge may have contributed to the failure of the machine initially, or the pre-war standards of leaf appearance were perhaps so high that a tea neither black nor twisted was just not tea. Be that as it may, you might like to know how it is used today in many Assam gardens.

Leaf is first rolled in an ordinary roller for 30-60 minutes—one roll or two rolls as the case may be. If tippy grades are required, the rolled leaf is put over a roll-breaker before feeding it into the C.T.C. machine. Depending on the condition of the leaf, it is given 2 to 4 successive cuts; it may then be roll-broken or taken straight to the fermenting tables. Period of fermentation is in the region of 2 hours. A very high percentage of fannings—as much as 50%—is obtained.

The C.T.C. costs about twice as much as the R.V. and, depending on width of the rolls, handles two to four thousand lb of rolled leaf per hour. This leaf has to be fired at the right time and within a certain period. Unlike orthodox manufacture, which permits a fairly wide latitude in fermentation times—firing of C.T.C. leaf or R.V. leaf cannot be delayed—dull soft liquors will be produced.

In firing and grading no revolutionary changes can be expected, but from these other innovations will undoubtedly come shorter working days, cheaper costs and a completely different outlook on manufacture. We will have to leave our slow and laborious methods of manufacture behind us and enter what one would call the jet age in tea manufacture. The quicker things are done, the more care is obviously needed. Half measures cannot be permitted. A small slip may have serious consequences. The present leisurely approach to manufacture will therefore have no place in the future and our teamakers of the future may well have to be men of a different calibre.