

## FACTORY EXPERIMENTATION.\*

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The methods used in the manufacture of Ceylon teas have been evolved from experiments carried out in a large number of factories over a long period of time, and great credit is due to those planters who by investigation and experiment have gradually evolved the methods in use today. The methods employed for experimentation have been necessarily empiric, and the question arises whether similar experimentation is likely to carry us much further along the road of knowledge and towards improvements in manufacturing methods.

Empiric experiments are less likely to lead one astray so long as the differences resulting from the various treatments are tolerably large, but when small differences have to be determined more accurate methods of experimentation become necessary.

Most of us realise how differently a scientist designs a field experiment today from the manner he did it some years ago. Then, one had a single plot under each treatment and any differences in yield were ascribed entirely to that treatment. That was all right so long as the difference resulting from the treatments was big, such as might occur when testing the yield of a manured plot against a no manure plot. But as soon as the scientist was called upon to determine whether one manurial treatment was better than another, when a difference of 5 per cent or less was of vital importance, he found that the simple method of single plot experimentation would not work. He thereupon set to work to determine why that simple method did not work, and to devise methods which could be relied on. Those methods are continuously being improved. They may appear extremely complicated to the layman but does that matter? It cannot be expected that complicated problems can always be solved by simple methods. If one calls in a scientist to help solve a problem he must be allowed to use his own methods and tools.

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The field experimenter has one great advantage over his colleague in the factory; he can determine any actual differences in the yields of his plots accurately by means of a balance, but what is our factory experimentalist's criterion? He must rely upon the personal opinions of one or more tea experts, or upon a vagarious market for judgment.

It is an easy matter to distinguish a good from a bad tea, but it is a matter for an expert to detect the difference between teas differing but slightly in quality. Minute differences in quantity can be accurately determined and measured, but there is no infallible test for quality, nor is there a rigid standard by which it can be measured. There is, therefore, no cause for surprise that rigid agreement cannot be found in tasters' reports. We are accustomed to divergent views from literary and dramatic critics, but they do not have to appraise the books and plays they review in terms of sales and box office receipts. The tea taster, however, when used as the criterion of a factory experiment, is expected to state which is the better of two teas and to evaluate the difference. It is evident, therefore, that there can be no rigid and infallible measure of the results of a factory experiment, and this fact has to be kept in view. Although the tea taster is not infallible, as he would be the first to admit, he is the best criterion available, and great credit is due to him for his skill and endeavours to assist in the improvement of tea manufacture.

The real test of an experimental result is that when the experiment is repeated similar results are obtained; the frequency with which similar results are obtained is a measure of its accuracy. It is extremely difficult to repeat a factory experiment. An experiment carried out today frequently cannot be repeated tomorrow. Tomorrow's leaf will probably be of a different age from pruning, there may be a slight change in atmospheric conditions with the result that withering will take longer, or the leaf will not be withered to the same degree, the temperature of the rolling room may be higher, and so on. It is extremely difficult to reproduce exactly the same conditions, and such changed conditions constitute a reason why different results are frequently obtained from what are intended to be similar experiments.

The lack of uniformity of results is one of the reasons why we are asked if we have tried this, that or the other in the Tea Research Institute Factory. It would be very difficult to name experiments which have not been carried out in some factory at some time or other. The effects of varying the time and degree of wither, the pressure during rolling, the time of fermentation, etc., and the many combinations of these factors must have been tried over and over again. But there can have been no absolute unanimity in the answers the experiments gave, else there would be no divergent opinions on the various aspects of manufacture now.

A large number of experiments have been carried out in St. Coombs factory, and very many of them have been carried out on lines similar to those used in estate factories. These experiments have been necessary to meet the great demands for advisory work. We can rightly claim to have achieved a somewhat increased degree of accuracy owing to special facilities and the keeping of accurate records, but we have not yet achieved the desired degree of accuracy. Improvements in the technique of factory experimentation have still to be devised, but continuous efforts are being directed towards that end.

Teamaking is at present more an art than a science! There is a huge fund of information on the subject, but it is not all to be found in books. It exists in the minds of experienced planters and tea makers, but it has not been completely standardised. If the why and wherefore of each operation could be definitely expressed and the effect of environmental conditions clearly stated, improvements in the method of manufacture and in the design of factories and machinery would come apace.

For example, one of the few points in manufacture on which planters are unanimously agreed is that a natural wither gives the best results. What then is a natural wither? To state that it is a wither obtained by merely opening the loft windows, and without the use of fans or heat, is not to define it. The conditions which allow of a natural wither would have to be defined in terms of temperature and humidity. If the optimum conditions for withering could be stated in definite terms, that air moving at a certain speed, having a certain

temperature and a definite humidity to enable the leaf to be brought to a stated degree of wither in a given time is necessary to give the very best result, it is not beyond the ingenuity of engineers to install in the factory apparatus which would give these conditions every day of the year. Moreover, if it were known that one set of conditions are required for quality leaf and another for rush teas, then arrangements could be made to switch on whatever conditions may be desired at any particular time.

But can anyone state exactly what those optimum conditions are? It is undoubtedly part of the duties of the Tea Research Institute to determine such points, and the why and wherefore of the various operations on manufacture. It is only by what may be termed 'fundamental' research that such information will be obtained. The chances of a really fundamental new discovery by random experiment or purely speculative theorising are well-nigh negligible. The necessity for fundamental research is imperative. The resources of science will have to be fully drawn upon and scientific methods will have to be applied. Instead of becoming less scientific as one of our critics at the last Conference at St. Coombs would have us be, we shall have to become more scientific, if the Institute is to serve the purpose for which it was founded.

I need hardly remind you that the Institute is being asked to obtain by means of research, information which has so far eluded a very wide awake, observant, planting community. The problems confronting the scientific investigator are not simple; only a few of them have been indicated here. The work must necessarily be slow. Not only has the most accurate means of measuring the results of factory experiments to be ascertained, but methods and apparatus have to be designed to extract the information necessary to speed on progress.