

Short Communication

A SIMPLE COMPUTER MODEL FOR SELECTING A SUITABLE ROLLING PROGRAMME IN BLACK TEA PROCESSING

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A proper rolling programme, in orthodox or orthodox-rotorvane type black tea processing, is essential for optimizing the quality of the end product, and for improving the efficiency of machinery and the productivity of workers. At present, drawing up a rolling programme involves tedious, mathematical calculations and the programme is usually finalized after testing over a period of time. To circumvent this, a simple computer model for drawing up a rolling programme for use during pure orthodox or orthodox-rotorvane type processing was designed using Microsoft Excel software.

Background

Sri Lanka produced about 295 million kilogram of tea in 2001. Apart from being the producer of the best black teas in the world Sri Lanka currently enjoys the position of being the largest exporter of black tea. The tea produced in Sri Lanka is mainly of orthodox type (more than 93%) and only less than 7% consists of CTC (crush, tear and curl) type. The amount of green tea and instant tea produced is negligible.

The unit operations in black tea processing are withering, rolling, roll-breaking, fermenting, drying, grading and packing. After withering, during orthodox or orthodox-rotorvane manufacture, batches of leaf are fed into the rollers for the rolling process. The purpose of rolling is to bring about an admixture of certain chemical compounds, which are spatially separated in the leaf. The mixing initiates oxidation (usually referred to as "fermentation") in the presence of free oxygen. The products resulting from the oxidation contribute to the final quality of made tea.

A well-designed rolling programme for use during orthodox and orthodox-rotorvane manufacture is essential for achieving the following:

an optimum fermentation time for each batch of “dhool” (or rolled particles) to ensure quality and prevent the dhool getting “over-fermented” or “under-fermented”, a continuous feeding of the drier with wet dhool for higher efficiency, a maximization of worker productivity, and efficient machinery usage.

At present, rolling programmes are drawn up by factory officers in consultation with managers. During visits to both private and company factories, it has been noticed that they either do not have rolling programmes at all or only poorly drawn-up programmes. Drawing up a rolling programme involves tedious mathematical calculations and their finalization requires testing over a period of time. However, by using the computer programme described here, it should be a simple matter to draw up rolling programme for three batches, check and confirm that they are in order.

Operation of the Model

The computer programme was developed using *Microsoft Excel* in the *Windows 98* environment. All the mathematical calculations have been fed into work sheets as equations. In order to get the rolling programme, other data such as details of the machinery available, capacity of each machine, the amount of leaf needed to be fed, the anticipated dhool percentages, etc. are filled in according to the instructions in Figure 1. The user is guided by comments, appearing on the screen, throughout the flow chart.

The computer is programmed to display the quantity of withered leaf to be placed in the initial rollers per hour (the “charge”) after the drier output and degree of wither are entered in the cells provided. There is provision to work out different charging intervals (that is, the time intervals between consecutive batches) for each size of charge and, based on the machinery available, a convenient charging interval could be selected. Thereafter, the calculations are made by the computer, and the rolling programmes for three batches will be displayed by pressing the button “Next” on screen.

Suppose the rolling programme practiced is as follows:

preconditioning in two orthodox rollers (15 minutes in each) followed by a 1st pass through one 15" and two 8" rotorvanes (30% dhool extraction), a 2nd pass through 8" rotorvane (40% dhool extraction), a 3rd pass through another 8" rotorvane (20% dhool extraction) resulting in a balance of (called big bulk) 10%.

and the machines available are

2 orthodox rollers (1 x 47", 1 x 45")

4 rotorvanes (1 x 15", 3 x 8")

3 roll breakers (3' width)

1 FBD dryer (output 290kg/h),

The details to be entered are;

actual output of the drier in kg/h

degree of wither aimed at as a percentile of made tea to withered leaf;

quantity of withered leaf to be fed for orthodox rollers (preconditioning or 1st roll) in kg

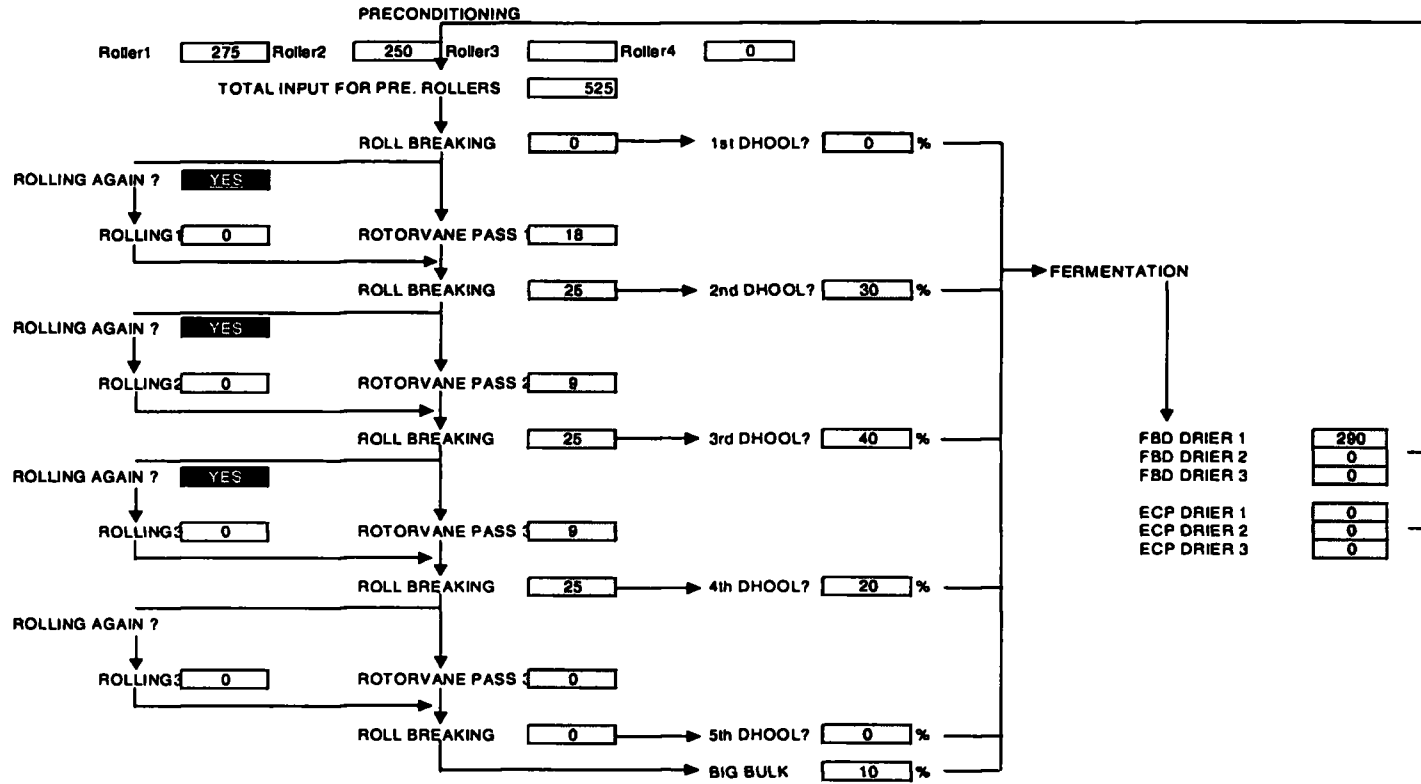
rolling time in minutes for other orthodox rollers;

throughput in kg rolled leaf/min for rotorvanes;

throughput in kg rolled leaf/min for roll breakers where two similar machines are used simultaneously, the combined capacity may be entered.

The rolling programme resulting from this procedure for three consecutive batches will be as shown in Figure 2. From such diagrams, one could easily check for any overlap: that is, to determine whether any machine is needed for two batches at the same time. If there is this overlap, one has to go back to the flow chart (Figure 1) change the parameters in order to arrive at a good, revised rolling program. The whole task of selecting a suitable rolling programme could be completed within 5-10 minutes.

This program was tested under different conditions in commercial factories for both types of manufacture and found to give quick rolling programmes. Adopting this method would ensure made tea quality and the efficient use of machinery and improved worker productivity. It also facilitates selection of different programmes under different climatic conditions to optimize quality of made tea through out the year.



Degree of Wither ? %
 Charging interval Minutes
 Total amount of WL required per hour kg
 Preconditioning Time Minutes
 Time required to charge the roller Minutes

WANT TO KNOW THE TOTAL CHARGE FOR THE REQUIRED CHARGING INTERVAL ?
 THEN TYPE THE REQUIRED CHARGING INTERVAL Mh.
 THE TOTAL CHARGE FOR PRECONDITIONNING ROLLERS IS kg

BACK<< NEXT>>

Figure 1: Flow chart to input process data

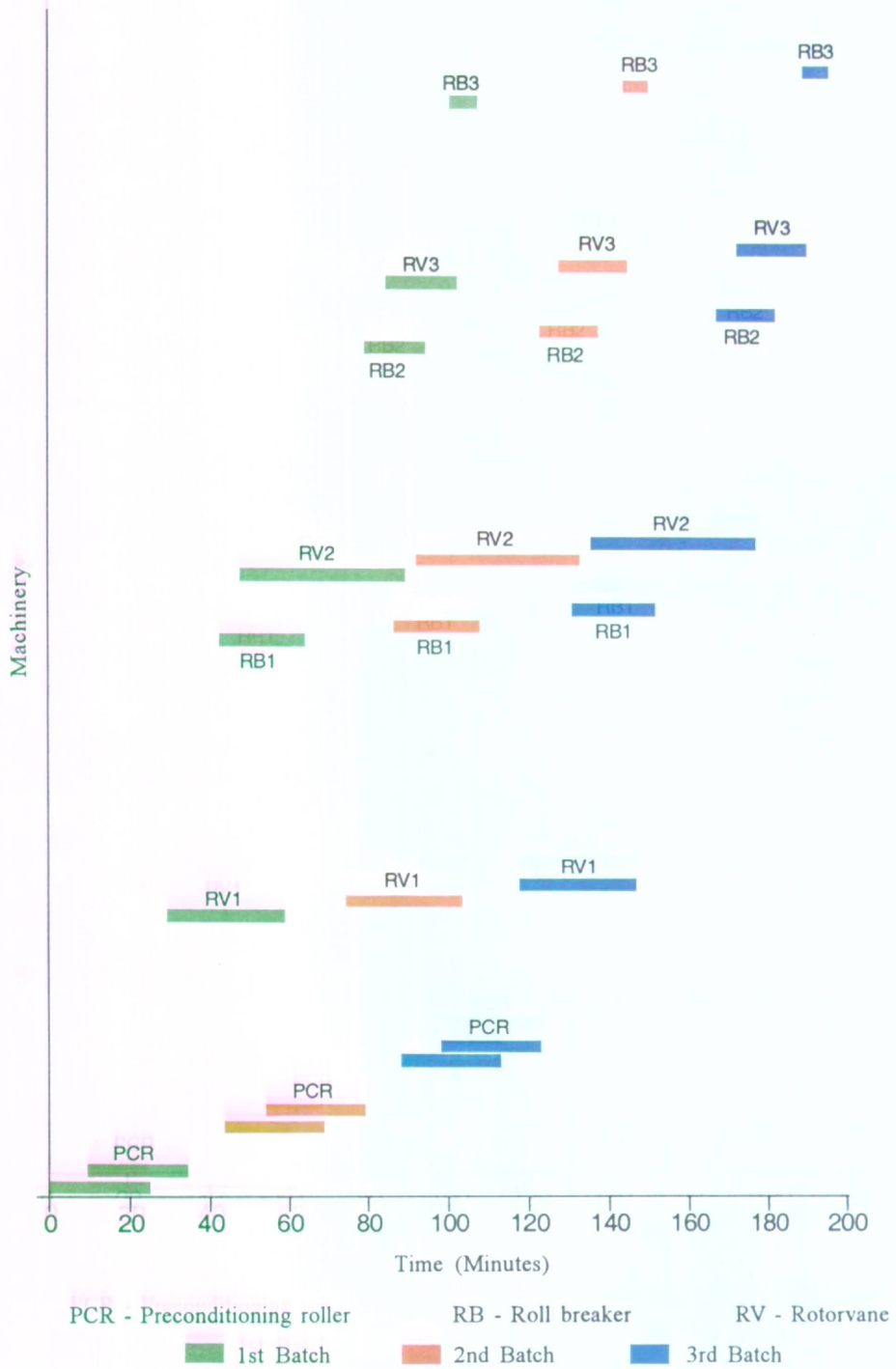


Figure 2: Rolling Programme