

## EFFECT OF ROLLING, FERMENTATION AND DRYING ON THE QUALITY OF BLACK TEA

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### ABSTRACT

Experiments were conducted on Black Tea processing to study the effects of rolling, fermentation and drying on the quality of made tea (Black). The trials were carried out at National Tea Research Institute (NTRI), Shinkiari, Mansehra, during 2002. Tea leaves were rolled from 20-30 minutes depending upon the intensity of withering and raw material. Fine plucking (2 leaves and a bud) had bright red colour both in plain and milky tea. The taste and aroma was pleasant as compared to coarse plucking. Quality of coarse leaves was very poor in terms of taste, aroma, colour, strength and infusion. Rolling time (25 minutes) gave better results as compared to 20 or 30 minutes time. Fermentation (4 hours and 5 minutes) gave best results in terms of taste, aroma and strength. Drying of black tea at 110 °C temperature with 1.5 rpm, dryer speed produce good quality tea.

### INTRODUCTION

The tea plant (*Camellia sinensis* L.) is a member of *Theaceae*. It can grow in varied ecological zones and especially in the monsoon climate of tropics, from sea level to 1000 feet. Soil of widely different origin and different morphological characteristics support viable tea plantation in different countries. An acidic soil is the most important requirements with a pH of 4.5 –5.5 being ideal. Soil should be deep, permeable and well drained (Willson and Clifford, 1992). Tea is a common form of beverage being used in almost all over the world. Pakistan imports all its tea from abroad and is the second largest tea importer. The per capita consumption of tea in Pakistan is 1kg/annum. The Government imports about 1,40,000 metric tons of tea costs billions of rupees annually. The demand for tea is increasing year by year in the wake of high population growth (3% annually). Pakistan is expected to become the world largest tea importer in the near future. (Rauf *et al.* 2001).

After partition of East Pakistan in 1971, the Government has started serious efforts to start tea production in Pakistan. Soil surveys and feasibility studies were conducted to identify suitable areas for tea cultivation in Pakistan. Based on topography, soil and climatic data, an area 64000 ha was identified as suitable for Tea cultivation. On the recommendation of Chinese Tea experts the Tea Research Station was set up in 1986 at Shinkiari, Mansehra, which is now upgraded to the level of an Institute. A tea garden of 35 acres has been established at the Institute with a 12 acres nursery infrastructure.

133 acres land has been brought under tea plantation at farmer's field (Annual report of NTRI,2001-2002).

The plucking season starts from April to October (6 months). The average yield obtained at the Institute ranges from 3.5 to 5 tons fresh leaves/acre. As regards the quality of the processed black tea, tasted by M/S Lever Brother in 1989, ranked second best in grade at international tea market, London. (Rauf *et al.* 2001). The same was confirmed by Tapal Tea Company in September 2002.

Keeping in view the importance of this crop, the experiment "Effect of rolling, fermentation and drying on the quality of Black Tea" was designed with following objectives.

### Objectives

- i. To compare fine and coarse plucking.
- ii. To find out optimum timing for withering, rolling, fermentation and drying and its effect on quality.
- iii. To find out adjustment of temperature according to tenderness and coarseness of fermented material.
- iv. To find out adjustment of speed of tea dryer.

### MATERIALS AND METHODS

The following experiments were conducted on black tea processing at National Tea Research Institute, Shinkiari, Mansehra during July-August 2002. Basic material and methods used for the experiments were the same but with different timings and plucking standards.

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**Rolling**

During rolling the leaf cells or components are break up to mix up the chemicals with enzymes. The raw materials were rolled in three different duration i.e., 20, 25 and 30 minutes rolling time. Before rolling the leaves were passed through a cleaner to ensure that any un-wanted materials may not go into rolling machine. After the completion of rolling operation, the dholes (crush particles) were passed through Rotorvane machine for further crushing. The crushed material received was then passed through C.T.C (Curl Turn Cut) machine to make the crushed particles finer. The same materials were passed through a roll breaker to break the twisted balls and slow down the fermentation process. The colour, taste/ flavour, aroma, strength and infusion were compared in different treatment, judged by 10 person panel.

**Fermentation**

The crushed particles were placed in perforated fermentation trays. The trays were connected with a misting machine in the fermentation room to maintain the relative humidity above 90% in fermentation room. The temperature was maintained to 25-28 °C.

The crushed material were kept in the control room for 40-80 minutes depends upon the materials. During fermentation many complex chemical changes take place, the main effect of which was to give a palatable character to the liquor. Over fermentation and under fermentation results in poor colour and quality.

**Drying**

Purpose of firing was to arrest fermentation and stop the enzyme activities. Further, the flavour of tea was balanced during firing because some of the undesirable compounds were removed, thus accentuating the presence of the more useful compounds.

There were three temperature regimes i.e., 100, 110 and 80°C during dryers (End Less Chain Dryer) with speed of 1.5 rpm. (revolution per minutes)

Another purpose of drying was to remove moisture upto 95-97%, to maximize the shelf life.

**RESULTS AND DISCUSSION**

Organoleptic tests were conducted through a panel of 10 persons. Results are briefly outlined below. Fine plucking has bright red colour both in plain and milky tea as compared to course plucking. Appearance of 100% course leaves was comparable with other made tea but its quality was very poor in terms of taste, aroma and other qualitative characters.

**Effect of Fine and Coarse Plucking on Quality of Tea**

Fine plucking (2 leaves + bud ) has bright red colour both in plain and milky tea. Table-I The taste and aroma was pleasant as compared to coarse plucking. The plucking material plays a vital role to process quality tea, black as well as green. The result is similar to Obanda and Owuor (1995) who found that fine plucking has good quality.

The coarse leaves were directly crushed without withering and fermented only for 4 hours to determine its palatability and quality. Appearance was comparable with other made teas but its quality was very poor in terms of taste, aroma and other qualitative characters. The result is in agreement with Obanda and Owuor (1995) who worked on tea and reported that coarse leaves were very poor in terms of taste, aroma and other qualitative characters

**Rolling Time Effect on Quality**

Rolling time (25 minutes) gave better results as compared to 20 minutes and 30 minutes time Table II. Less rolling results in uneven Dholes whereas more rolling causes the loses of chemicals, necessary for quality. The results are in conformity with the results of Feldheim (1994) who observed that 25 minutes rolling time gave better results.

**Different Fermentation Timings**

The increasing trend in fermentation time gave best results (Table III). Fermentation is a critical stage where all the quality characters are determined i.e. color, flavour, aroma, strength etc. These results are in consistence with those of Owuor and Obanda (1998), who reported that increasing trend in fermentation gave best results.

**Different Drying Temperature**

Drying of black tea at 110 °C temperature with 1.5 rpm dryer speed produce good quality tea (Table IV). All the lots were dried second time at

low temperature (80 °C) to remove 95-97 % moisture, results in good keeping and storage quality. The semi made tea with high moisture (more than 6%) lose its quality due to continue fermentation after drying. However, the tea with high moisture contents gets quality improvements for short period of time but later on the deterioration started and have vary short storage life. The results are in conformity with the results of Owuor and Obanda (1998) who worked on tea and reported that temperature increased brightness and colour of black tea.

## CONCLUSIONS

- i. Rolling time of 25 minutes gave better results as compared to 20 minutes and 30 minutes time.
- ii. The increasing trend in fermentation time gave best results.
- iii. Drying of black tea at 110 °C temperature with 1.5 rpm dryer speed produce good quality tea.

**Table I** Effect of fine and coarse plucking on quality of tea

Plucking	Colour	Flavour	Aroma	Strength	Infusion
Fine	Bright red	Excellent	Excellent	Very good	Even
Coarse (50%)	Light red	Good	Fair	Medium	Un-even
Coarse (100%)	Dull	Bad	Nil	Very low	Green

**Table II** Rolling time and its effect on quality

		Rolling time 20 minutes			
Colour		Taste/Flavour	Aroma	Strength	Infusion
Light red & dull		Fair	Un-pleasant	Weak	Un-even
		Rolling time 25 Minutes			
Bright Red	Good	Pleasant		Strong	Mixed
		Rolling time 30 Minutes			
Light Red & dull	Poor	Un-pleasant		Light	Even

**Table III** Different fermentation timings

		2 hours & 15 minutes fermentation time			
Colour		Taste/Flavour	Aroma	Strength	Infusion
Dull		Fair	Fair	Weak	Dark or dull
		2 hours & 20 minutes			
Dull & light red	Fair	Good		Weak	Mixed
		2 hours & 25 minutes			
Dull & light red	Fair	Good		Strong	Even & bright
		2 hours & 45 minutes			
Dull	Fair	Very good		Strong	Coppery
		2 hours & 55 minutes			
Light red	Good	Excellent		Very strong	Dark or dull
		4 hours & 65 minutes			
Bright red	Very excellent	Excellent		Very strong	Dark & dull

**Table IV : Different Drying Temperature**

		Tea drying at 100 °C with dryer speed of 1.4 rpm			
		Second time dryer temperature 80 °C			
Colour		Taste/Flavour	Aroma	Strength	Infusion
Bright red		Good	Fair	Weak	Mixed
		Drying at 110 °C with dryer speed of 1.5 rpm			
		Second time dryer temperature 80 °C			
Light red	Good	Good		Strong	Mixed
		Drying at 120 °C with 1.6 rpm speed			
		Second time dryer temperature 80 °C			
Bright red & light red	Very good	Fair		Weak	Green

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