EVALUATION OF THE PHYSICAL DAMAGE OF GREEN TEA LEAVES INFLUENCED BY THE DIFFERENT POST HARVEST HANDLING PROCEDURES

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ABSTRACT

The quality and quantity parameters of made tea were drastically affected due to the processing of damaged tea leaves. This study was conducted to quantify the damage of the green tea leaves during post harvest handling. The physical damage of green tea leaf was observed in three phases as farmer level, transport level and factory level. Leaf samples were taken just before transport at farmer collecting centers, during and after the partial withering process. The different packaging methods at transport level were evaluated as coir sacks, plastic crates & bulk method. The amount of physical damage of Green tea leaf was tested along the entire transportation distance. The damage level of tea leaves was estimated by “Ranadalu” leaf evaluation standard method famous in Sri Lanka.

Physical damages of the green tea leaves were estimated as 10.47%, 17.16% and 11.26% at farmer level, transport level and factory level respectively. The physical damages of different packaging methods during the transport were estimated as 17.16%, 6.81% and 13.39% at Coir sacks, Plastic crates and bulk method respectively (p=0.05). The leaf damage with the transport distance was observed with increasing trend up to 40 km distance and after that with decreasing trend in all methods. The plastic crate method is the most suitable for green tea leaf transportation for long distance as the minimum physical damage was observed. The bulk method is appropriate for short distance. The Coir sacks method cannot be recommended as a package for transport the tea leaves.

Key words: green tea leaves, physical damage, package, post harvest loss

1. INTRODUCTION

As the third biggest tea producing country in the world, Sri Lanka is one of the world’s leading exporters, accounting the share of around 19% of the global demand. The total extent of land under tea cultivation in Sri Lanka has been assessed at approximately 187,309ha (Anonymous, 2007a). Among the major tea growing areas, Matara district gives a significant contribution to low country tea production. (46.63 millions kg of made tea in year 2006). (Anonymous, 2007b).

The quality of the made tea mainly depend on chemical composition and physical conditions of the green tea leaf arrives to the factory. The physical damage to the green leaf and the presence of coarse leaf are the major determinants of the quality. Physical damage to the green tea leaf occurs due to the high temperature with poor aeration (may cause browning of the leaf). These are referred to as post harvest losses of green tea leaf and post harvest damages by physical factors deteriorate the quality of the made tea.

The physical damage may happen at the different levels of the post-harvest handling procedure of green tea leaf such as from plucking to loading at
farmer level, during transportation at transport level and during the post harvest handling in the tea factory at factory level. The severity of the damage depends on the condition of the vehicle (tractor), total distance from field to the loading point, condition of the roads and time duration taken for transportation of green tea leaf (Wijeratne, 2004).

Post harvest losses of green tea leaves are higher during transportation due to the usage of the coir sacks, overloading the vehicle, inappropriate condition of the vehicles and improper handling of the plastic crates. Because of these conditions it is necessary to minimize the post harvest losses and improve the cost effective green leaf transport method (Anonymous, 2003).

The Objectives of the study were to quantify the damage to the green leaves during post harvest handling operations, ways of damage at different stages such as at the farmer level, at the transport level and at the factory level during the post harvest handling procedure, evaluate the damage percentage of different packaging methods during transportation, estimate the damage percentage of green tea leaves along the total distance of transportation and assess the effect of time duration on the damage percentage of green tea leaves.

2. METHODOLOGY

Andaradeniya estate in Deniyaya division in southern Sri Lanka was selected as experimental site. Andaradeniya estate is one of the major tea estates in the Deniyaya division located in Matara district. Physical damage of green tea leaf could be commonly observed in Deniyaya division rather than other divisions in Matara district (Anonymous, 2003).

2.1 Experimental procedure

Transportation of the green tea leaves by coir sacks, by plastic crates and transport leaves as bulk were evaluated as different treatments. Leaf samples were taken randomly before and after transporting by each method. Leaf samples were collected from troughs in the partial withering stage and in full withering stage after the transportation. The amount of damage was estimated by observing the sample according to the leaf standard method (‘Randalu’ in Weight basis method) (Anonymous, 2007c). Green tea leaves damage percentages were estimated at farmer level, transport level and factory.

2.2 Sampling technique

Factory has 15 Lines which represented the different area supplied the green tea leaf. All the lines are subjected for the experiment. The 10% of the green tea leaf samples were observed from the leaf collective points from each line. Weight of the representative sample of green leaf is 200g. Sampling is done as follows.

Total transport distance of one line was categorized into four groups. Total number of collecting points for each group was observed. The 10% of collecting points were considered for random leaf sampling before transportation.

Green leaves in each group were kept in troughs separately after transportation in the tea factory. Then 10% of leaf samples were taken separately at the partial withering stage and at the full withering stage.

2.3 Estimation of physical damage of the tea leaves

Basically ‘Randalu’/Weight basis method was used as the leaf standard measuring method (Anonymous, 2007b). Leaf samples were categorized into five groups as best (B), below best (BB), poor damage (PD), poor non damage (PND) and impurities (Im) according to the amount of mature leaf, damage leaf and impurities.

2.4 Data recording and analysis

The weight of damaged leaf was evaluated according to the leaf standards and the values were represented as percentage. Data were analyzed using descriptive and non descriptive statistical methods. Complete randomized designed (CRD) was used to analysis the damage percentage of different transportation methods and different identified levels of total post harvest handling procedure of green tea leaves. Non descriptive statistical methods were used to present the damage percentage of green tea leaf against total distance and time duration of transportation.

3. RESULTS AND DISCUSSION

3.1 Estimation of the physical damage of green tea leaves in different levels
The damage of green tea leaves in different levels during the post harvest handling procedure was shown in figure 1. The physical damage of green leaves in farmer level, transport level & factory level are observed as 10.47%, 17.16% and 11.26% respectively.

According to the figure 1, there were no significant difference (p=0.05) in amount of leaves damage between the farmer level and factory level but the damage percentage at transport level was significantly higher than others. The highest post harvest losses were observed in transportation level in Deniyaya region because coir sacks are used for transporting green tea leaves.

So that green tea leaf was damaged due to the pressure build up inside the sacks and produce heat which may cause to poor quality of made tea.

The minimum damage were recorded in plastic crates because it gives proper ventilation during transportation and prevent over loading inside the crates. Damage of the bulk method was recorded as 13.4 percentages. This method is rarely used as the leaves cannot be properly handled due to poor road facilities and evapo-transpiration losses are higher in bulk method as leaves are transported openly (without cover).

3.2 Estimation of the physical damage of green tea leaves according to the different packaging methods during transportation

The damage of green tea leaf in different packaging methods during transportation were shown in figure 2. The damage percentage due to the use of coir sacks, plastic crates and bulk methods were observed as 17.2, 6.8 and 13.4 respectively.

The significant different were observed among the three packaging methods. Maximum physical damage was observed when using coir sacks, and the reason for this may be over filling the coir sacks, staking the filled coir sacks tightly on each other as layers during transportation, peoples sitting on the filled coir sacks during transportation, overloading the filled coir sacks by pressing etc.,

The graphically representation of the variation of damage percentage of green tea leaf along the total distance of leaf transportation by coir sacks method, Plastic crates method and bulk method were shown in figure 3.

Same pattern of variation was observed in three packaging method along the transport distance. The relationship between the damage percentage and total transport distance was modeled by logarithmic regression curve. The leaf damage was increased with decreasing rate in each method. When the three different packaging methods were compared, coir sacks were caused to higher damage along the distance of transportation. Plastic crates were
recorded as lower damage along the transportation distance.

Considerable damage could be observed in bulk method. People are sprinkling water on leaves to avoid weight loss during transportation. That practice may cause more loss.

### Figure 3. Damage percentage of green tea leaves along the total transportation distance according to the different packaging method

3.4 Estimation of physical damages of green tea leaves according to the time duration with different packaging methods.

The figure 4 was illustrated that relationship between the time periods spend for the transportation and the physical damage % of green tea leaf.

The leaf damage were not depended on the time spent for transportation due to apply the lower pressure on leaves, good ventilation and less number of handling practices of leaves through out the time period.

But the damage percentage of coir sacks method was increased with time. The reasons were observed as overfilling the sacks and it cause to build up an internal pressure and poor stacking method during transportation. The moderate damage percentage was observed in bulk method.

### Figure 4. Damage percentage of green tea leaves according to the time spent for transportation

**4. CONCLUSION**

When consider the different levels of post harvest handling procedure of green tea leaves, damage percentage observed as 10.47%, 17.16% and 11.26% at farmer level, transport level and factory level respectively. Therefore green tea leaf damage was significantly recorded at the transport level and lower damage was recorded at the farmer level.

The damage percentage of green tea leaf of the coir sack method, plastic crates method and bulk method was observed as 17.16%, 6.81% and 13.39% respectively at transport level during the post harvest handling procedure. Therefore green tea leaf damage was significantly higher in the coir sack packaging and lower damage was recorded at the plastic crates packaging method.

Plastic crates method is the most suitable method for green tea leaf transportation for long distance with less damage to green tea leaf.

Bulk method is suitable for short distance transportation and the areas where bulk amount of green tea leaves were produced. The vehicle for transporting tea leaves as bulk should be modified for transporting the leaves with less damage.
Coir sacks method should not be used in green tea leaf transportation due to high damage during the post harvest handling procedures.

5. REFERENCES