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NETT OUT-TURN OF MADE TEA TO GREEN LEAF IN LOW-COUNTRY

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Small holders generally contribute for about 60% of the tea production in Sri Lanka. Their green leaf is mostly processed, in private bought leaf factories. The price paid per kg of green leaf mainly depends on the net sale average price achieved by the factory, as the nett out-turn of made tea to green leaf (MT/GL) was fixed at 22.22%. Tea factory owners are concerned about this nett out-turn as they face difficulties in achieving the set limit.

Experiments on commercial scale were carried out in the Low-Country (0 – 600m a.m.s.l*), to test whether the set limit is achievable. Results reveal a maximum outturn of 24.55% during the dry season and a minimum outturn of 18.30, during the wet season, and an average nett out-turn of 21.50%. The nett out-turn, depends on moisture content in green leaf only and not on leaf standard, under Low-Country conditions. A highly significant linear relationship was observed between the two elements. The relationship was used to predict the nett out-turn, by determining the moisture content in green leaf received at St Joachim factory, regularly. Results indicate that during the dry months, although a nett out-turn of almost 24.00% could be achieved from estate leaf, it was difficult to obtain even 21.50% from bought leaf, due to addition of water.

INTRODUCTION

Keegel (1955) suggested an average nett outturn of made tea to green leaf of 22.22% for the year. This figure was arrived at by monitoring the nett outturn recorded daily at St Coombs factory (in the Up-country), over a period of one year, mostly using seedling leaf. Since the 1960s, tea production in the Low-Country has increased mainly due to the proliferation of small holdings and planting of vegetatively propagated (VP) tea. VP tea is more succulent especially when grown in high humid conditions as found in Low-Country. Therefore, the average nett out-turn suggested by him may not be applicable in Low-Country.

Small holders account for almost 60% of the national tea production. Their leaf is mostly processed, in bought leaf factories. According to records maintained by the Tea Commissioners' Division, there are about 313 factories in low-country (0 – 600m a.m.s.l*), most of them involved in processing bought leaf.

In black tea processing, green leaf is converted into black tea through various unit operations such as withering, rolling, roll breaking, fermenting and drying. After drying, the amount of tea collected at the drier mouth is defined as fired tea.

* above mean sea level

This includes the drier "blow out" as well. Fired tea is then graded, divided into different grades based on particle sizes and/or shapes. Total quantity of grades thus separated is defined as made-tea. The waste material consisting of stalk, fibre and fluff is removed as refuse tea in the process. Out-turn could be defined as amount of made tea or fired tea one could produce from a unit weight of green leaf.

The gross out-turn, nett out-turn and refuse tea percentages could be defined as follows:

$$\text{Gross out-turn \%} = \frac{\text{Wt of fired tea}}{\text{Wt of green leaf}} \times 100$$

$$\text{Net out-turn \%} = \frac{\text{Wt of graded tea}}{\text{Wt of green leaf}} \times 100$$

$$\text{Refuse tea \%} = \frac{\text{Wt of refuse tea}}{\text{Total fired tea}} \times 100$$

Earlier experiments carried out to assess the gross out-turn have shown that among the several agro-climatic factors, the monthly rainy days and the pan evaporation rate are the only inputs that serve to determine/predict the outturn (Thevathasan and Thevadasan 1987).

Net out-turn and green leaf price formula

For decades a formula (see Annexure I) has been used to work out the price paid for green leaf. According to this formula, the price depends on the net sale average price achieved by the factory and the nett out-turn of made tea to green leaf, which is usually fixed by the Tea Commissioner, based on experimental evidence. Until the 1990s an average of 22.22% out-turn, was implemented throughout the country. However, this ratio was changed to 21.50% only for the wet season i.e April – June and October - December with effect from February 1994. It was brought back to 22.22% from mid-June 1994. According to the Tea Commissioner's formula, the Nett Sale Average (NSA) price of tea should be shared between the green leaf supplier and the factory owner.

MATERIALS AND METHODS

Commercial scale experiments were carried out using estate leaf and bought leaf to determine the nett out-turn achievable from different types of leaf (i.e) having different leaf standards and varying moisture contents. The experiments were carried out, over a period of 14 months with 18 replicates at St Joachim factory, Ratnapura, managed by the Institute.

The green leaf weight used was 1050 kg (approximately). Withering was carried out in a 70' x 6' size trough. 5 x 20 minutes rolling program was adopted and the teas were fired in a 3' ECP drier, graded and nett out-turn was calculated for each replicate, taking almost 3 - 4 days to complete. The data recorded for all replicates are given in Table 1. Experiments were planned in such a way as to include leaf from dry season as well as wet season.

In the samples selected for these experiments, the moisture content in green leaf varied from 74.50% to 80.84% and good leaf percentage varied from 49.00 to 86.70 on weight basis. The moisture content of drier mouth teas was determined and standardized to 3%. The moisture contents of graded tea (each grade) and refuse tea were determined and standardized to 5%.

Table 1: Gross outturn, net outturn and refuse tea percentage with varying moisture content and green leaf standards

Replicatei No.	Moisture content (%)	Good leaf (%)	Gross outturn (%)	Refuse Tea (%)	Net outturn (%)
1	79.06	83.00	22.18	2.22	19.65
2	79.11	80.50	21.31	2.68	20.25
3	76.19	73.50	23.82	3.09	22.80
4	77.83	86.70	21.39	1.98	20.41
5	80.84	84.60	19.75	0.57	19.47
6	79.42	77.50	19.67	1.18	19.08
7	74.73	85.27	24.86	1.60	24.55
8	77.00	73.60	22.60	3.68	22.21
9	78.00	62.00	21.65	5.73	20.99
10	77.18	66.20	22.30	3.96	22.46
11	76.23	72.80	23.65	1.80	23.22
12	74.50	70.00	24.88	2.72	23.97
13	77.56	70.27	22.75	4.28	22.17
14	79.90	71.65	20.27	4.13	18.30
15	76.80	71.83	23.28	5.13	22.48
16	77.80	72.55	22.38	5.24	21.08
17	74.60	71.40	24.80	4.84	22.69
18	79.00	49.00	21.47	4.98	19.41

RESULTS AND DISCUSSION

Regression analysis on the data obtained was carried out and is explained below:

NO = 91.2 - 0.912 MC + 0.0128 GL ..... (1)

NO - Net out-turn, MC - Moisture content in green leaf, GL - Good leaf %

Predictor	coeff	St. dev	t-ratio	Probability
Constant	91.172	7.325	12.45	0.000
MC	-0.91191	0.09375	-9.73	0.000****
GL	0.01278	0.01893	0.68	0.510 (not significant)
s = 0.7101	R - Sq = 86.3 %, R-sq (adj) = 84.5%			

From the above, it is evident that the nett out-turn does not depend on the good leaf percentage, in the range tested which is the common accepted standard.

Regression analyses were also carried out taking the good leaf percentage and the moisture content separately and the details are as follows:

The predicted equation for nett out-turn Vs good leaf %

NO = 21.2 + 0.0024 GL ..... (2)

Predictor	coeff	St.dev	t-ratio	Probability
Constant	21.227	3.660	5.80	0.000
GL	0.00235	0.04947	0.05	0.963****
S = 1.859	R - Sq = 0.0 %, R-sq (adj) = 0.0%			

This again confirms the fact that the nett out-turn does not depend on good leaf percentage. The scatter diagram for nett out-turn vis-a-vis good leaf percentage is given in Figure 1.

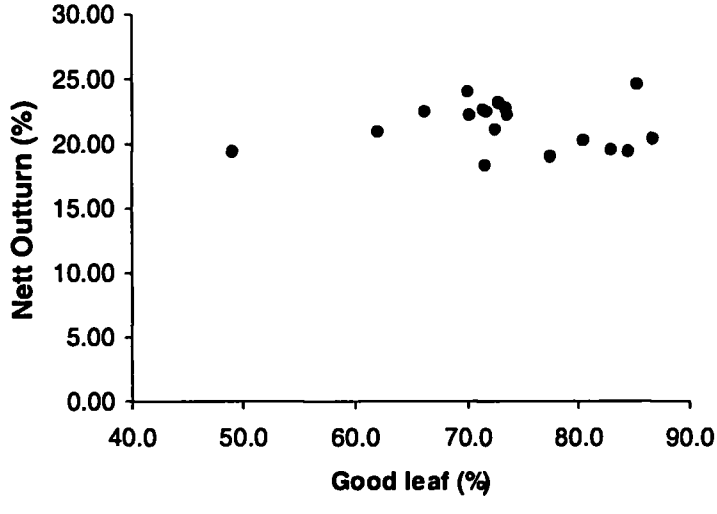

Figure 1: Nett out-turn vis-a-vis good leaf percentage

The predicted equation for nett outturn Vs moisture content in green leaf

NO = 91.8 - 0.908 MC ..... (3)

Predictor	coeff	St.dev	t-ratio	Probability
Constant	91.833	7.135	12.87	0.000
MC	0.90833	0.0199	-9.87	0.000***

P < 0.001, R - Sq = 85%

This implies that 85% of the variation in nett out-turn is explained by moisture content in green leaf. The scatter diagram for nett out-turn vis-a-vis moisture content in green leaf is given in Figure 2.

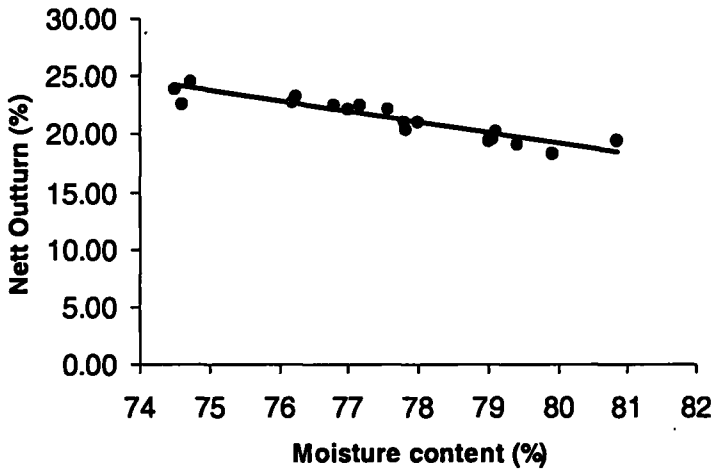

Figure 2: Nett out-turn of made tea to green leaf vis-a-vis moisture content in green leaf

The predicted equation for refuse tea % Vs good leaf %

RT = 12.4 - 0.124 GL ..... (4)

Predictor	coeff	St. dev	t-ratio	Probability
Constant	12.401	2.182	5.68	0.000
GL	-0.12357	0.02949	-4.19	0.001***

s =1.108, R - Sq = 52.3% R - Sq (adj) = 49.3%

A maximum of 24.55% and a minimum of 18.3% and an average of 21.51% (MT/GL) nett outturn were recorded during the experiments.

Once the correlation between nett out-turn and moisture content in green leaf was established, it was decided to monitor the nett out-turn achievable over a period of one year, merely by drawing random green leaf samples and determining the moisture content of the samples. The details are given in Table 2. The microwave oven method

recommended by the Institute (Ziyad Mohamed, 1998) was used to determine the moisture content of green leaf within a short time.

Table 2: Average moisture content (MC) in green leaf and the nett out-turn (NO) achievable

	Estate Leaf		Bought Leaf	
	MC %	NO %	MC %	NO %
Jan	75.60	23.16	78.80	20.25
Feb	74.10	24.51	79.00	20.07
Mar	74.70	23.97	79.00	20.07
Apr	76.70	22.15	78.50	20.50
May	78.30	20.68	79.10	19.99
Jun	78.10	20.88	80.20	18.95
Jul	78.08	20.90	79.74	19.39
Aug	78.23	20.76	79.87	19.27
Sept	78.90	20.15	79.58	19.54
Oct	78.59	20.44	79.77	19.36
Nov	77.15	21.74	79.87	19.27
Dec	79.13	19.94	80.05	19.11

From the above data, it is very clear that it would be easy to achieve an out-turn of 21.50%, if a factory is processing only estate leaf or small percentage of bought leaf. However, it may be difficult for a factory, which is processing 100% bought leaf to achieve the average out-turn recorded in this study. This may lead to deductions with a view to achieve the recommended out-turn. But if addition of water could be prevented an out-turn of 21.5% could be achieved. It is pertinent to note, that St Joachim factory, which is processing almost 95% of its crop as bought leaf, had recorded an out-turn of about 21.5% or more during the last 5 years.

While small-holders reportedly add water to keep the shoots fresh, leaf collectors too tend to add water to increase the weight of the leaf. Although the leaf collectors tend to gain by this unscrupulous activity, the loss to the small holders is two-fold. On one hand, the factory owner is compelled to make a deduction for surface moisture. On the other hand, the quality of tea produced suffers and as a result the Nett Sale Average (NSA) price of tea. It is difficult to produce good quality tea with leaf containing surface moisture, due to multiplication of microorganisms in the presence of surface moisture and further multiplication resulting from use of hot air (Sanderson, 1964; Wickremasinghe, 1978). If the Nett Sale Average price of tea sold gets depressed, the price paid for green leaf too will suffer.

CONCLUSIONS

Nett out-turn depends only on moisture content in green leaf and not on leaf standard, under Low-Country conditions. If the moisture content is known, using equation (3), the nett out-turn could be predicted.

For eg. If, MC = 76.64% NO = 22.22%
MC = 77.40% NO = 21.50%

It must be noted that when the above equation is applied to predict out-turn, there should be no deduction for surface moisture, since this aspect also had been taken into consideration in these trials.

A maximum out-turn of 24.55% during the dry season and a minimum out-turn of 18.3, during the wet season, and an average nett out-turn of 21.5% were recorded. Above figures were arrived at, by adjusting the moisture content of graded tea to 5%. But in practice some grades are packed at much higher moisture content than 5%. This too would give an advantage to the factory-owner, as it would push the outturn up.

Data collected also indicate that, during the dry months of February, March etc. although a nett out-turn of more than 24% could be achieved from estate leaf, it was difficult to obtain even 21.5% from bought leaf, due to addition of water (Table 2). From the data collected, it was very clear that it would be easy to achieve the out-turn recommended if a factory is processing only estate leaf or small percentage of bought leaf. However, it may be difficult for a factory, which is processing 100% bought leaf to achieve the average out-turn recorded in this study. This may lead to deductions with a view to achieve the recommended out-turn. But if addition of water could be prevented, an out-turn of 21.5% could be easily achieved.

However, it must be reiterated that it is far more advisable to predict the actual out-turn on a daily basis, using the microwave oven method for determination of moisture content in green leaf and the equation established. But practical difficulties are bound to occur with regard to time involved in sampling and testing, even if random sampling is carried out.

It may be worthwhile considering abolishing this limit and pay according to the exact outturn achieved. This would mean that the small- holders might be paid at a higher out-turn during the dry months and a lower out-turn during the wet months. Impact of such a system may be assessed through a survey.

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ANNEXURE I

GREEN LEAF PRICE FORMULA

A particular factory could be realizing a NSA higher, lesser or equal to the Elevational Average (E.Av), which is computed by the Tea Commissioners' Division, based on figures from all the factories coming under that category (elevation). Depending on these differences, the price paid for green leaf varies, and worked out as follows.

a) If a factory has a net sale average (NSA) equal to or less than the elevation sales average (E.Av), the grower receives 68% of the NSA and the producer 32% or

b) If a factory receives a higher net sale average (NSA) than the elevation sales average (E.Av), the grower receives 68% of the E.Av + 50% of the value in excess of the E.Av, while the producer receives 32% of the E.Av + 50% of the value in excess of the E.Av.

Example 1: If NSA is Rs.120/= per kg and E.Av is Rs.130/=,

then the component for the factory will be 32/100 x 120 = Rs 38.40/= **per kg of made tea**
and for the leaf supplier 68/100 x 120 = Rs 81.60/= **per kg of made tea**

Assuming i) The out-turn is 22.22% made tea/green leaf
4.5 kg green leaf is required to produce 1 kg made tea,
Green leaf price = $\frac{81.60}{4.5}$ = Rs 18.13 per kg

ii) The out-turn is 21.50% MT/GL and
4.65 kg green leaf is required to produce 1 kg made tea,
Green leaf price = $\frac{81.60}{4.65}$ = Rs 17.55 per kg

Example 2: If NSA is Rs 150/= per kg and Elev. Av is Rs 130/= per kg

the component for the factory will be $\frac{32}{100} \times 130 + \frac{(150 - 130)}{2}$ = Rs 51.60/=

and for the supplier $\frac{68}{100} \times 130 + \frac{(150 - 130)}{2}$ = Rs 98.40/=