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OUTTURN CHARTS

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The practical implications of a chart proposed for the estimation of outturn is discussed in this study.

INTRODUCTION

Outturn, literally, means the ratio of output to its input. There are more than one such conventional outturn ratios in tea processing, relating to made tea content *vis-a-vis* green leaf, sifted tea outturn *vis a vis* fired teas, etc. All these ratios are measured on weight by weight basis and hence are computed only after completion of the manufacture for a particular day or a lot/batch.

With the availability of more and more accurate and quick methods of moisture estimation in green leaf and withered leaf, outturns relating to fired teas (inclusive of refuse teas) can be estimated quickly in the beginning itself. Currently there are no accurate methods of estimating the refuse tea percentage prior to manufacture. It is hoped that methods will be found in the near future. With the availability of such methods for quick determination of moisture content as well as refuse tea prior to manufacture the charts presented would be useful to factories for the purpose of estimating the anticipated outputs (of graded teas, refuse teas, etc). However, the estimated outturns will be always more than the actual outturn because of reasons like (i) reduction in dry matter content due to breakdown of carbohydrates to provide energy for respiration during withering and (ii) handling (physical) losses.

The estimated outturn ratios are useful to get an advance indication of the expected outturn. Apart from this, the difference between estimated and actual outturns is also useful to monitor manufacture, quality control and losses during processing.

Calculation of estimated outturns from the moisture content is not difficult, but has to be done carefully on a dry weight basis. Usually the relations are presented in tabular forms (Workhoven, 1978; Keegal, 1983; Anon. 1990). Charts for such calculations are sometimes more convenient. A chart is presented here for the estimation of outturn. This chart is quite simple and easy to use.

How to use the chart

The chart is conveniently given in four parts (chart No. 1 to 4) to obtain more accurate values. Moisture content in both green leaf and withered leaf is represented

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by the X-axis (horizontal lines) and outturn by the Y-axis (vertical lines). Slanting lines above the dotted slanting line indicate made tea moisture content and slanting lines below the dotted slanting line indicate waste per cent while dotted slanting is the base line.

To use the chart, select the suitable one, out of the four enclosed, depending upon the moisture content in the leaf (either withered leaf or green leaf):

(i) To find out the made tea outturn, start with the moisture content in the green leaf and go up vertically to meet the slanting line representing the made tea moisture content. The horizontal line passing through this point is the made tea outturn. e.g. for 76% moisture in the leaf, 2% moisture in made tea, the made tea outturn would be around 24.5% (refer chart No. 1).

(ii) To find out sifted tea outturn, start with the moisture content in the green leaf, go up vertically to meet the slanting line representing made tea moisture content. Then go horizontally to meet the dotted slanting line and come down vertically to meet the slanting line representing the waste per cent. The horizontal line passing through this point indicates the sifted tea outturn. e.g. for 70% moisture content in leaf, 3% moisture in made tea and waste per cent of 2, the sifted tea outturn would be around 30.3% (refer chart No. 2).

(iii) To find out made tea content, start with the moisture content in the withered leaf, go vertically to meet the slanting line corresponding to the made tea moisture content. The horizontal line passing through this point is the made tea content; e.g. for 55% moisture content in withered leaf, 2% moisture content in made tea, the made tea content would be around 45.9% (refer chart No. 4).

The chart is a very useful ready reckoner for factory managers. It can be used to find out any outturn – made tea outturn, sifted tea outturn or made tea content. It does not require any mathematical or technical background and it can be used without knowing the details of its construction (however, they are annexed to this article for the benefit of the readers who are interested).

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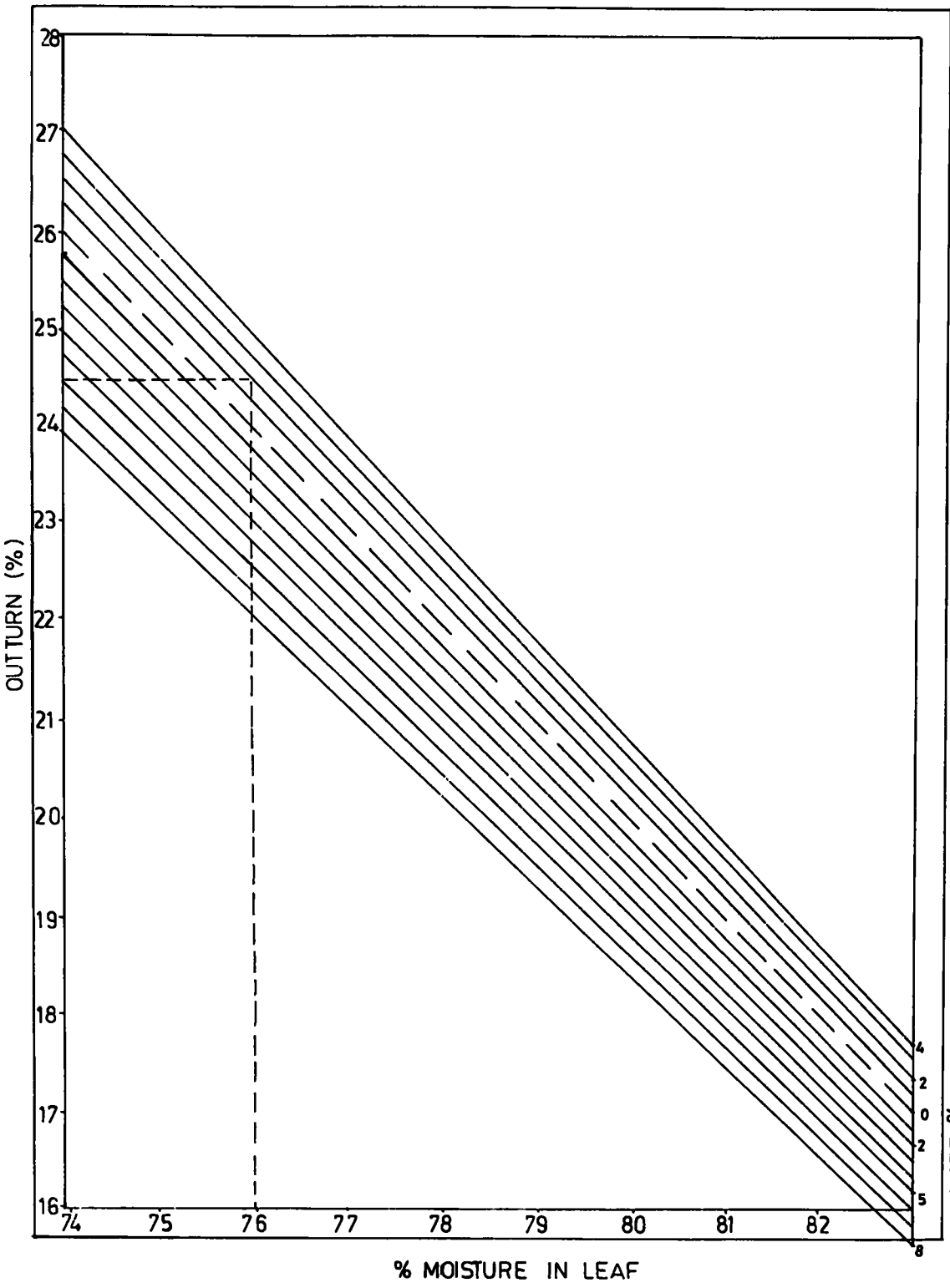
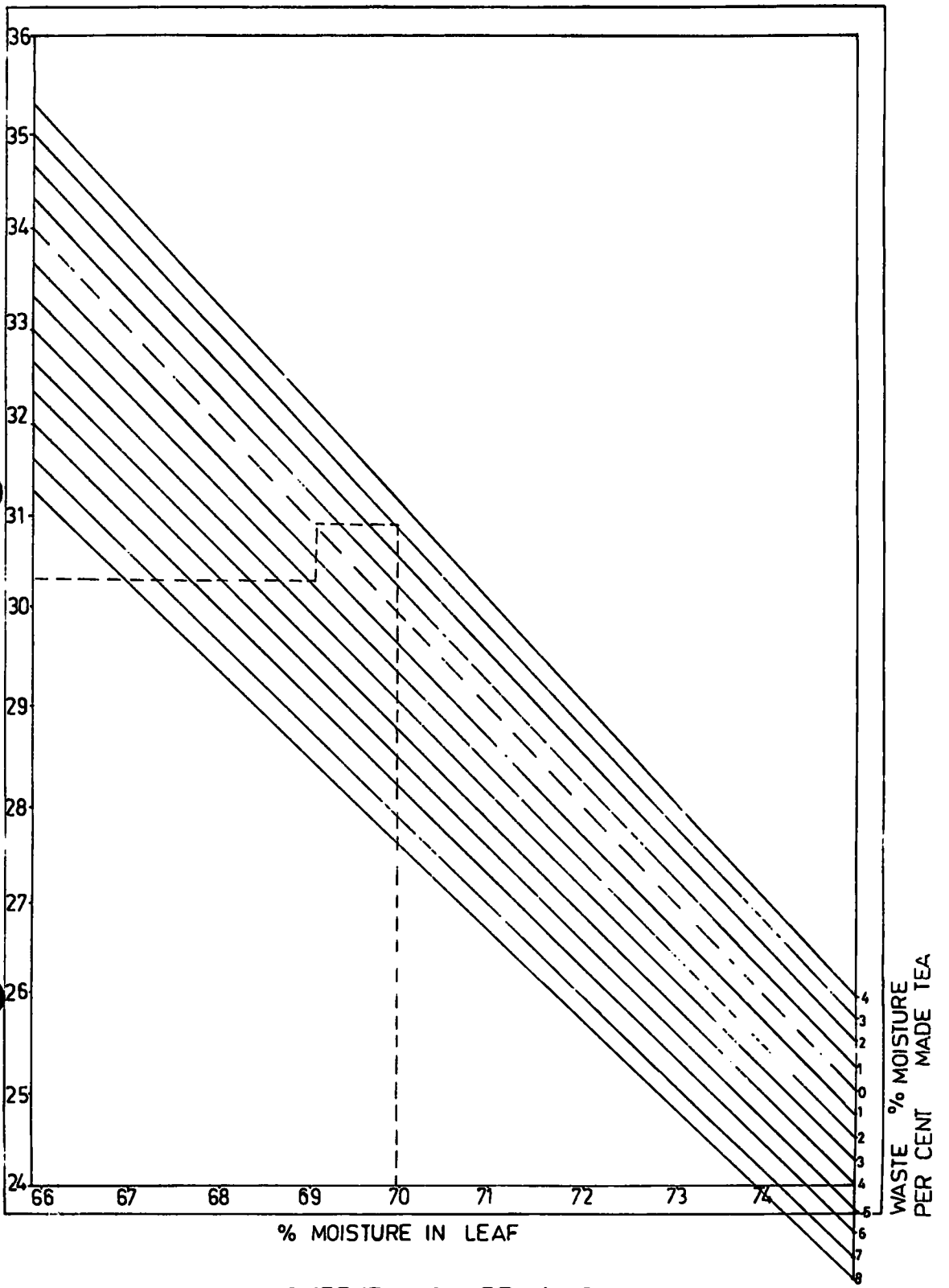
WORKHOVEN, J. (1978) FAO Agricultural Science Bulletin 26, Tea Processing, FAO, Rome.



OUTTURN CHART No 1



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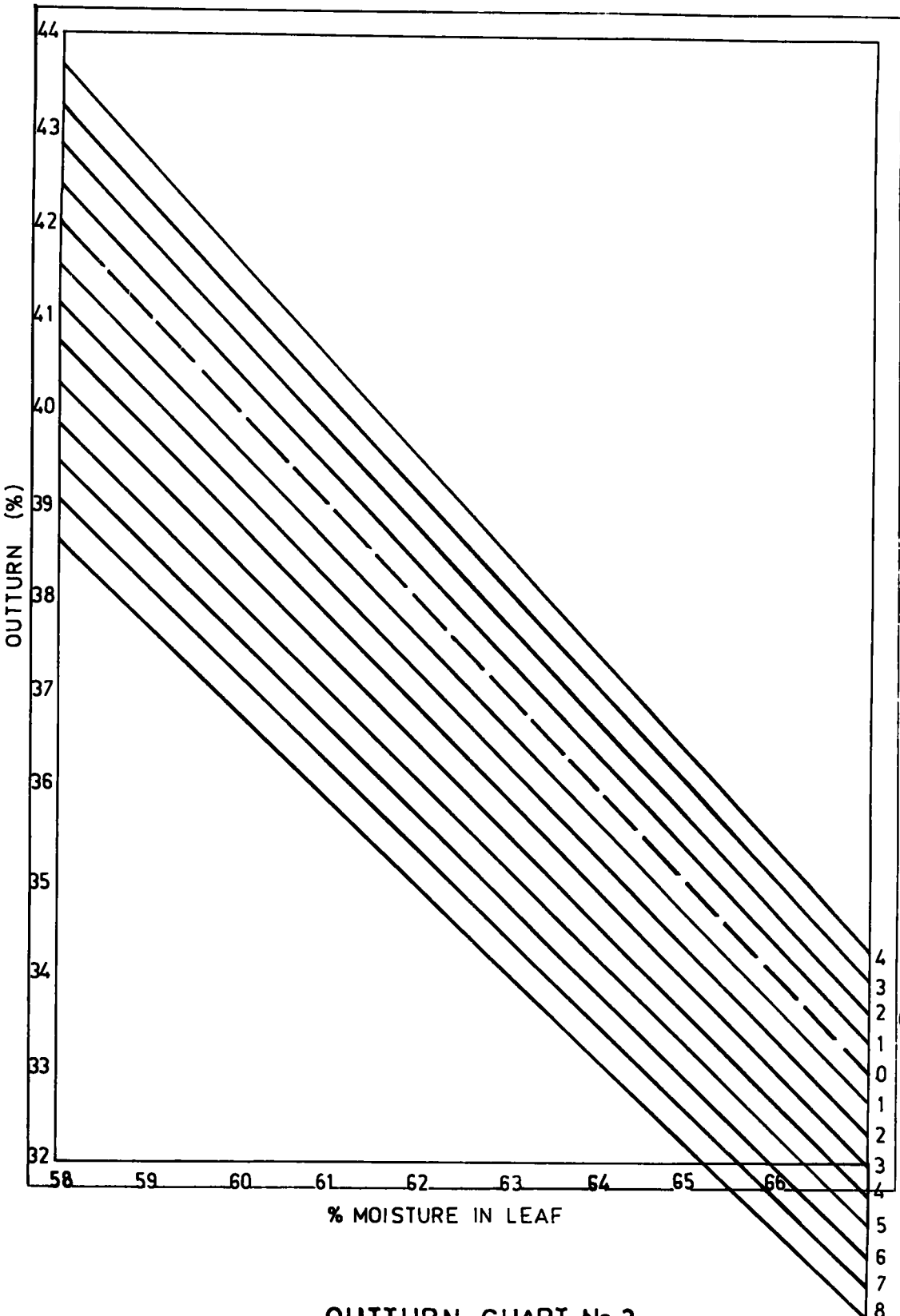
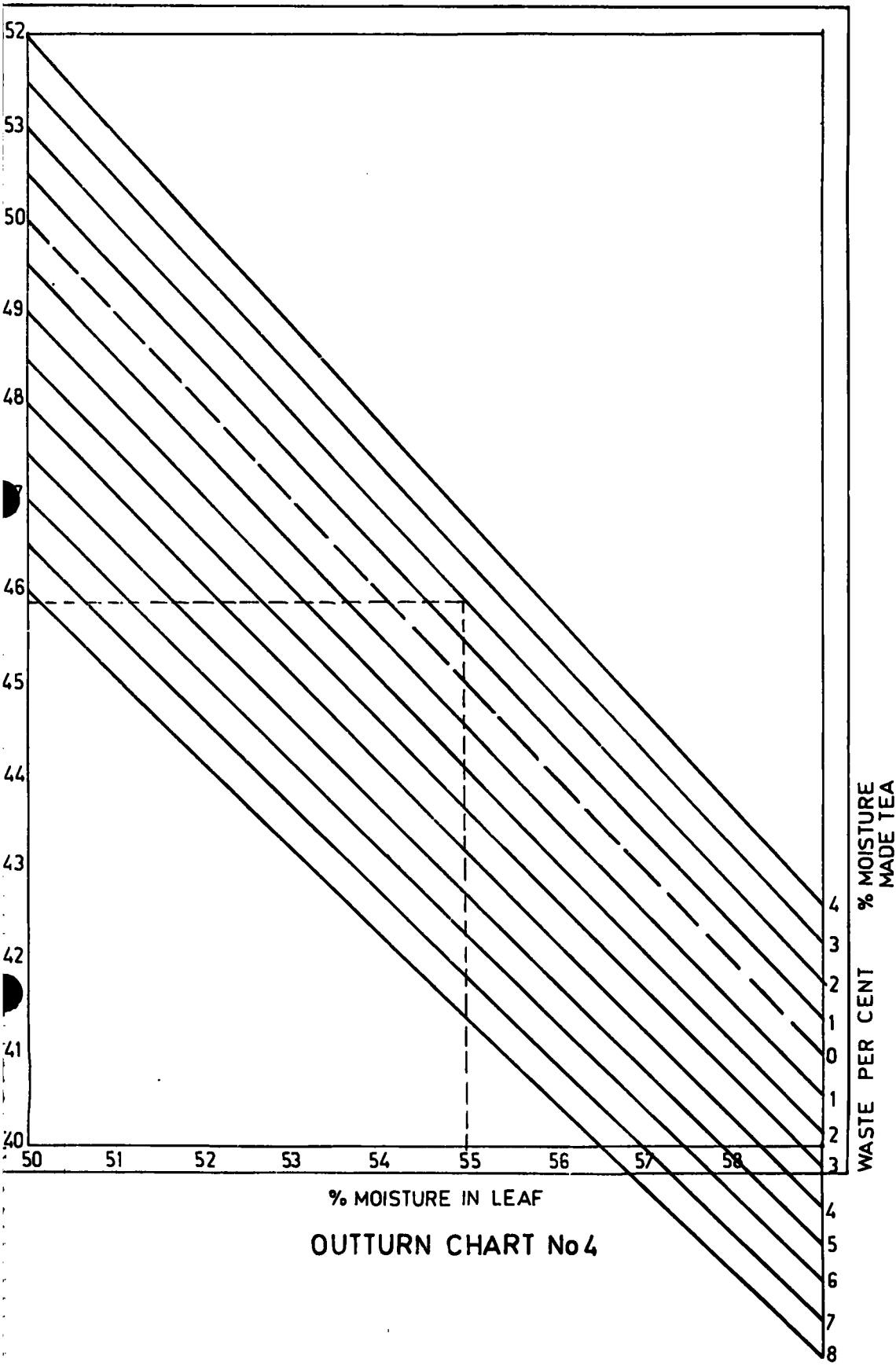


OUTTURN CHART No.3



OUTTURN CHART No 4

Details on construction of the chart

Nomenclature

Y	Outturn	%
X	Moisture content in green leaf or withered leaf	%
M	Moisture content of the made tea	%
W	Waste on dry material basis	%

Relations

Any outturn based on either green leaf or withered leaf, on dry material basis, is given by:

Outturn = 100 – moisture content (%)

$$Y = 100 - X \qquad (1)$$

This equation is a straight line with a slope of -1 and intercept of 100. It represents the outturn based on dry material and may be called as base line.

However, made tea will always contain moisture of 2-5% and outturn in such cases is given by:

$$Y = 100 - X \div \frac{100-M}{100}$$

$$= \frac{100\,(100)}{100-M} - \frac{100X}{100-M} \qquad (2)$$

This equation is also a straight line. The above outturn will always be more than the outturn based on dry material. These lines will always be above the base line and may be called as Made Tea lines.

Certain amount of waste is always recovered from the made tea during sifting and grading. Thus the sifted tea outturn depends on percentage waste obtained in grading:

$$Y = (100 - X) \times \frac{100-W}{100}$$

$$= (100-W) - \frac{(100-W)\,X}{100} \qquad (3)$$

The above equation is again a straight line. The sifted tea outturn will always be less than the outturn based on dry material and hence these lines will always be below the base line. These may be called as Sifted Tea lines.

Chart

The chart was drawn with moisture content in green leaf and withered leaf on X-axis and outturn on Y-axis respectively. The chart was constructed in four different parts for more accuracy. Base line, made tea lines and sifted tea lines were drawn in each part separately by identifying two different points on each line with the help of the respective equations.

The details of the construction of chart 2 are as follows:

i) Base line:

From equation (1) when X = 73, then Y = 27 and when X = 67, then Y = 33 respectively. These two points were located on the graph and joined to get the base line.

ii) Made tea lines:

From equation (2) at M = 1, when X = 73, then Y = 27.27 and when X = 67, then Y = 33.33 respectively. These two points were located on the graph and joined to get made tea line corresponding to 1% moisture content. Similarly the other made tea lines were drawn.

iii) Sifted tea lines:

From equation (3) at W = 1, when X = 73, then Y = 26.73 and when X = 67, then Y = 32.67 respectively. These two points were again located on the graph and joined to get the sifted tea lines at 1% waste. Similarly, the other sifted tea lines were also drawn.

The same procedure was adopted to construct the other parts of the chart.

The relationship between base line, made tea line and sifted tea lines should be clearly understood to use the chart. Made tea line at 0% moisture content and sifted tea line with 0% waste, fall on the base line itself and hence are same as the base line. Therefore the increase in outturn due to moisture content and decrease in outturn due to waste is always with respect to the outturn corresponding to the base line and hence the starting point to find out such increase or decrease should be the outturn at that moisture content or waste per cent respectively corresponding to the base line.