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FACTORS AFFECTING PRODUCTIVITY ON TEA ESTATES IN SRI LANKA

1.—THE IMPACT OF EACH FIELD ON ANNUAL CROP PRODUCTION

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Estates are divided into component units called 'fields' which are often separated by natural boundaries such as ravines and hill crests, or by artificial boundaries such as trees, windbreaks or fences. Sometimes, fields are separated by lines drawn arbitrarily on maps and demarcated on the ground by drains or footpaths. In many instances fields have a 'history'. An entire field has often been planted in one year with one type of seed from a particular source; or another field may have previously been a patna and yet another may have originally been under forest. The 'history' of a field may often have been lost because of carelessness, disinterest or for a variety of other reasons but it would perhaps be useful had this history been placed on record in the office. It is never too late to begin piecing it together, as it may help later on, particularly for the guidance of new managers or owners. The main point of significance is that records for each 'field' are maintained separately and this information must be utilized in planning a future programme of development for that field.

Fields are of varying area, and genetically varying planting material, and they may also vary greatly in the cultural practices that have been adopted in them. Fields are often compared with other fields in respect of response to fertilizer, cropping potential, pest or disease proneness *etc.* Sometimes a field is of such an area that a plucking gang can complete its work in a day, whereas the same gang may take two days to harvest another field. With all these variations one must naturally expect that each field will have a different impact on the total production of the estate each year. Some fields will be highly productive and others much less so, and each will contribute a disproportionate quantum of crop to total production depending on the impact of each of these variables. Fields assume importance because crop and other records are maintained separately for each field and this information if properly exploited, can be of great use in the further development of the entire estate.

CATEGORIZATION OF FIELDS

In order to relate inputs to the productivity of fields, it would be necessary to have some idea of their productivity relative to others, and to assess their individual contribution to total production. When the quantum of crop realizable from each field is known, one will be in a better position to draw up a suitable programme of development for the property as a whole.

The basis of categorization of fields into groups should be the 'performance' of each field in the context of the topographical, microclimatic and other constraints that may prevail. Crop obtained from each field is usually the most reliable integration of these factors and we therefore consider '*yield per unit area*' as an index

which will enable us to categorize fields according to 'performance'. Of course this is based on the assumption that yield per unit area is not profoundly affected by complicating factors like strikes and variations in standards of plucking. If they are, we can only hope that the effect of such errors will be minimized if we have sufficient units of data. It would therefore be necessary to obtain from past records the yield per unit area per year for each field for the previous three or four pruning cycles. To base categorization of fields on the data from a single pruning cycle may result in an erroneous categorization because undue weightage could be attached to fluctuations in weather *etc* which could be expected to cancel out if we consider three or more cycles. On the other hand, categorization on the basis of too many pruning cycles, going far back into the past may also be disadvantageous because yields recorded decades ago may hardly reflect the present position of each field and will have even less relevance to the future performance of that field. A convenient balance must be struck, and we have found that data for three or four cycles is the most suitable, where errors due to changing stands of tea and varying fertilizer policy are likely to be largely ironed out.

METHODS OF COMPUTING YIELD

If records of yield per unit area of each field for three or four cycles are available, the next step would be to decide on how to use this data to categorize the fields. Several schemes are possible and it would be necessary to select the most suitable one for a particular estate. Suitability would depend on the reliability of the data and the cultural practices adopted in the past.

Scheme 1

This scheme is suggested for estates where pruning cycles in all fields have been constant at either 2, 3, 4, 5 or 6 years. For such an estate, obtain the *mean yield per unit area per year* from data for the last 3 or 4 cycles for each field.

Scheme 2

For estates where the duration of cycles have been occasionally changed in the past on some fields, we have found that it is misleading to use mean yield per unit area over 3 or 4 cycles because the changes in pruning cycles may give an erroneous picture of field performance. Some fields for example may have completed only three cycles and therefore would have been pruned thrice whereas others may have been pruned four times within, say, a 12-year period. For such estates we have found that the most reliable index to use for assessing performance of fields is the mean yield per unit area for a particular year of each pruning cycle. The question is which particular year should we consider?

In our studies we have, for convenience, as well as other reasons, considered the time of pruning to be the beginning of the first year of the cycle. The first year would therefore include the period of recovery from pruning and the post-tipping period and this first year would end 12 months after pruning. The second year would be from the 13th to the 24th month inclusive, the third from the 25th to the 36th month inclusive, the fourth from the 37th to the 48th month inclusive and so on. On

this basis we find that the yield per unit area for the *third year* of the cycle is the most reliable for use in categorizing the fields of estates. This conclusion has been arrived at after testing out various other possibilities.

We realize that some estates may maintain their records according to calendar or financial years. The start of the calendar or financial years hardly ever coincide with pruning. The best procedure for them would be to take the yield per unit area for the year closest to the third year from pruning.

METHOD OF CATEGORIZATION

For convenience let us call the yield per unit area of each field for the third year of the pruning cycle (or for the year closest to the third year), the 'third year yield', and then proceed as follows:

1—Obtain **either** the arithmetic mean of the yield per unit area per year for 3 or 4 cycles (*Scheme* 1) **or** the arithmetic mean of the third year yields for the last 3 or 4 cycles (*Scheme* 2) for each field.

2—Construct a table with four vertical columns.

3—In the first column enter the arithmetic mean (obtained by Scheme 1 or 2) for each field *in decreasing order of yield,* and not according to field numbers.

4—In the second column, enter each field number.

5—In the third column, enter the area of each field.

6—In the fourth column, enter the accumulated total area of the fields. For example, the highest yielding field may be 10 acres and this figure will be entered in the 1st line of column 3. The next field may be 25 acres and this figure should be entered in the 2nd line of column 3. The figure to be entered on the 1st line of column 4 will be 10, and that in the second line of column 4 will be 10+25=35. Accordingly the figure in the last line in column 4 should be the accumulated area of all the fields, and will be the total area of the estate under tea.

7—If the estate needs to be divided into 3 categories, divide the total estate area by 3. If the estate needs to be divided into 4 categories divide the total estate area into 4. If we want 3 categories, see which figure in column 4 comes closest to 1/3 the estate area and draw a horizontal line at that point across the table. All fields above this line will fall into the best category. Similarly separate out the next two remaining categories by drawing a horizontal line across the table at the point where the figure in column 4 is closest to 2/3rd the estate area.

By this method we can arrange the fields in order of performance and we can divide the entire estate, reliably into categories on this basis. Each category will be of the same area. Category A will contain the best third of the estate, category B the average third and category C the poorest third.

VALIDITY OF CATEGORIZATION

Errors in ranking can arise as a result of yield figures relating to old tea that has since been uprooted being included in the data. Further, the replanted tea may not have come into full bearing.

It may therefore be best to place immature replanted fields in category A in their own right.

Errors in ranking can also arise when categorization is carried out according to Scheme 2 which has the drawback that the number of units of yield data used is as small as three or four, for any one field.

It is therefore desirable to check on the validity of categorization arrived at by Scheme 2, by comparing the % area of fields with their % contribution to the total estate crop for a period of about ten years.

To do this, a six-columned table has to be constructed as indicated below :

Column 1—Field numbers in the order in which they have been categorized.

Column 2—Area of each field. This column is totalled and the total entered at the bottom.

Column 3—% area of each field *ie*, $\frac{\text{Value in column 2}}{\text{Total of Column 2}} \times 100$

Column 4—The total of the yield per unit area of each field for the ten year period (total of ten figures).

Column 5—Total yield of each field for the ten year period,
ie Value in column 2 x value in column 4.

This column is totalled and the grand total is entered at the bottom.

Column 6—% contribution by each field towards the total crop of the estate for the ten year period. *ie*, $\frac{\text{Value in column 5}}{\text{Total in column 5}} \times 100$

Fields at the top of the table should have a lower percentage in Column 3 than in Column 6, whereas fields at the bottom of the table should have a higher percentage in Column 3 than in Column 6, while fields in the middle of the table should have similar percentages in columns 3 and 6.

Fields which do not conform to the above requirements are faultily ranked. Such fields must be evaluated on the basis of their observed performance, visual impression *etc*, and may, if it is felt necessary, be transferred to appropriate categories. The categorization will then have to be appropriately amended.

ADVANTAGES OF CATEGORIZATION

For any development programme, the most important prerequisite is finance. On many estates development is limited by this constraint. Where funds are short, we must know into which part of the estate the available funds should be channelled and in what proportions, so as to bring about the maximum advantage in the quickest period. Most estates have a good idea of which fields are the best and which are poorest. Categorization on the basis suggested above, quantifies these ideas. When

we know the quantum of crop contributed by each field to total estate production, we should then be in a better position to gear our financial inputs on a more judicious basis.

Again, where inputs like fertilizers are in short supply and restriction in their use becomes necessary, there would be no need to impose, say, a flat 10% cut on the entire estate. The required restriction can be effected more logically by imposing cuts based on field performance and the effects of this restriction could be more accurately gauged. The same is true of various other activities such as the clearing of *Poria* patches, the eradication of couch, the spraying against Blister Blight *etc.* Priorities can be more clearly laid down in respect of most cultural operations. It will certainly lead to a better utilization of funds, less waste, and ultimately better agricultural development and increased profitability.

Categorization of fields on an estate would depend on the state of development of fields relative to one other. This could alter with time. Categorization may therefore have to be reviewed every few years, and this is both logical and desirable.

It must finally be remembered that small differences in the position of two similarly-yielding fields are not important. What is most important is that we are able to identify categories of fields, each category being of almost the same area, in order to identify the best, the poorest and the average sections of a plantation. This enables us to gear financial inputs to increase profitability in the shortest time. Rational programmes of development can then be drawn up not only for each field but for the estate as a whole.

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