

# A SURVEY OF SOME LOW-COUNTRY PROBLEMS\*

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*In this paper which is based on an address given to the Morawak Korale Planters' Association, Mr. Walter gives a general survey of the activities of the new Low-Country Sub-Station. Those interested in the production of tea at the lower elevations in Ceylon will learn from this article how their special problems are being tackled.*

When I started preparing this paper I had in mind as its title: "The Programme Of Research In The Low-Country". However, in order to avoid giving merely a bare outline of the experimental work, I decided to include some of the general background of each experiment with the result that, I think, a more apt title would be: "A Survey Of Some Low-Country Problems, And How They Are Being Tackled". I would add that, partly in order to give as comprehensive a picture as possible, and partly because research in the low-country is still in its initial stages, I have inevitably had to depart from the usual technique of developing fully one or two subjects of special interest to any particular district.

In outlining the programme of research that is in progress, or planned for this year, I would remind you that arrangements have been made to lease 10 acres of land (either cleared or due to be cleared shortly) on Vogan Estate (Matugama) where we also have facilities for carrying out experiments in old tea.

The main headings pertaining to these experiments are as follows:—

1. Vegetative propagation.
2. Methods of centering.
3. Grafting.
4. The response to various levels of manuring.
5. The response, if any, to minor elements, and
6. Types of green manures, cover crops and shade trees.

In addition to these field experiments, which have already been laid-out, the question of shade in the low-country is receiving attention. It is not yet certain, however, what aspects of this rather complicated subject it will be possible to investigate by field experiments with the staff available, since the subject is so involved that a number of field experiments—preferably duplicated in various districts—would be desirable. As a preliminary, however, I intend to do some flush counts with a view to determining the intrinsic effect of shade on yield, and will endeavour to collect data regarding the effects of *Albizzia moluccana* grown under various systems of management.

Although the Vogan management very kindly granted us every facility for carrying out our experiments, they were naturally unable to provide areas where the incidence of shot-hole borer and Rhizoctonia are serious enough for our purposes, so these experiments could not be centralised at Vogan. We are, however, very

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much indebted to the management of Hapugastenne and Galbodde estates for giving us facilities—including staff quarters—for carrying out field experiments in connection with *Rhizoctonia* and shot-hole borer, while our thanks are similarly due to the proprietors of Ingiriya Estate, where a pruning cycle-cum-*Rhizoctonia* control experiment has been started.

So much for the outline of the various experiments that are taking place, and I would like here to acknowledge the ever-ready assistance with their conduct given by my Field Assistant, Mr. F. P. Jayawardene.

I will now give you some general information interspersed with a few details, about each of them.

**I. Vegetative Propagation**—We now have about two acres of selected clonal material established at Vogan to serve as a multiplication plot. Nearly 200 clones are represented, these having been selected either as fresh cuttings, or as rooted plants from estates all over the low-country. Although some of these plants are now sufficiently well grown to supply some cuttings, the supply is not yet equal to our requirements, as there is still about 2 acres of land actually cleared and ready for planting next year. The collection of further clonal material is, therefore, continuing and if any low-country estate is in a position to make any contributions we should be very glad to receive them.

While this subject really provides sufficient scope for a separate address, I should like to take this opportunity for making a few points in connection with it. My impression is that low-country planters are rather sharply divided into two factions—those that V.P. and those that don't—with a possible third one sitting on the fence ; it is to the latter two that the following remarks are particularly directed.

Although V.P. on up-country estates has come to be recognised as a normal part of estate routine since the advent of blister blight, it has, by comparison, lagged behind in the low-country—partly owing to the absence of a definite stimulus such as blister blight to make it imperative, and partly owing to the more difficult conditions in the low-country. I would suggest, however, that the only way to close the widening gap caused by the present trend of rising costs of production and declining prices for low-country teas is by a determined effort to raise yields, and also to improve quality. The only really effective way of achieving this seems to be to make the utmost use of selected high-yielding clones not only for new clearings, but also in conjunction with a vigorous programme of replanting areas whose yield is too low to render their upkeep an economic proposition. An important point to bear in mind is that in the low-country, quite apart from artificially created economic conditions, the life span of the tea bush appears to have definite limitations ; for instance, where too hard pruning in the past has been resorted to, and the sizes of the frames have been still further reduced by wood rot, this economic age limit appears to be as low as 25 years.

Although as already mentioned, vegetative propagation is not nearly so easy in the low-country as at higher elevations, judging from observations I have made on a considerable number of low-country estates, and from experience gained in the initial stages of our low-country sub-station, there seems to be no reason why vegetative propagation of selected clonal material should not be successfully used on a large scale at least in districts with a moderately sustained rainfall ; and in fact there are several estates I know which, in view of the encouraging results so far achieved, are proposing to plant up between 25 and 50 acres this year. Before attempting such large acreages, however, it is essential to gain experience with small scale trials, and I would mention the following points as being particularly worthy of attention :—

1. The plants must be put out in the field at the optimum stage of growth ; it is not, of course, possible to lay down exactly how long the cuttings should be in the

nursery before they are ready for putting out, as the rate of growth varies considerably, not only in different districts but between different clones. It is probable, however, that 6 months and 1 year represent the lower and upper age limits respectively.

2. Special care must also be taken to ensure that the cuttings have just the right amount of shade in the nursery; in the low-country cuttings are far less tolerant of shade, yet of course, the maximum degree of humidity has to be maintained—the necessary balance between the two being achieved only by constant supervision.

3. It is also essential that the rooted plants should be well shaded either with protection baskets or fern when they are put out into the field, for the initial period of establishment is undoubtedly the most difficult; once established, however, only comparatively few casualties need be expected during the dry weather months of the following year.

With regard to the points on which the selection of clones should be based, it goes without saying that high yielding clones should receive top priority; there is no short cut to the method widely adopted of selecting large numbers of apparently suitable bushes for trial, and rigorously discarding the ones that turn out to be unsuitable, with the percentage and type of rooting as the most important criterion. In some districts resistance to blister blight is of course a factor of major importance, while in others the selection of eelworm resistant types may have far reaching advantages.

**II. Grafting**—Although the process firstly of selection, and secondly of development of large numbers of cuttings for propagation from multiplication plots is inevitably a slow one, it is possible that grafting of selected material on to mature bushes may provide a means of side-stepping multiplication plots, thus effecting a very large saving in time. I mentioned in a book review published in the "*Tea Quarterly*" some time ago, that this method was commonly practised in Java, and I intend to do some small scale experiments with it very shortly. In the meantime I have nothing further to add regarding the method.

**III. Centering**—Another aspect of work on new clearings, which is not, however, confined to vegetative propagation is that of centering, and the four methods in common use are being carried out side by side on our new clearing. Again, planters seem to be sharply divided on the question of the best method, most appearing to favour a series of annual cuts at 3", 6", 9" and 12" (or thereabouts)—bringing the bushes into bearing in 4-5 years. Although it is true that, by this method, low-branching frames are produced, it has the inherent disadvantages, firstly that a considerable amount of growth is lost unnecessarily—a wastage of energy which might have been used to better advantage in thickening the frame—and secondly that a cut low down on the main stem inevitably renders it liable to the entry and development of wood-rotting fungi, since naturally the greater the thickness of the wood, the longer is the time required for it to callus over completely.

I would, therefore, take the opportunity of commending for trial the 3 other methods—namely, thumbnail-pruning, pegging down and layering, all of which are equally applicable to vegetatively propagated plants and seedlings. In these methods the knife is not used at all, so that none of the losses normally associated with the centering of young plants—especially in the dry zones—need be expected.

"Thumbnail" pruning produces bushes with a good even spread, though it is perhaps not the best method to use with some V.P. clones which are characteristically poor branchers.

"Pegging-down", as its name implies, consists merely of bending over and pegging down the young shoots when they reach about pencil thickness; any desired shape of bush can be produced, the plucking table being eventually formed merely by tipping the numerous vertical shoots which develop at the required height.

"Layering" is essentially similar, except that the branches are bent down and covered with earth for several inches; in order to achieve the best results, it is desirable to trench the ground before planting—alternatively the ground near the point of layering must be well dug—and neglect of these precautions may account for some of the prejudice against the method. Its effect is seen to perfection on steep hillsides, since the dense mass of roots and branches which develop—if trained along the contour—form an almost impenetrable barrier against soil erosion, and well defined terraces are built up in a matter of a couple of years.

**IV. Manurial Experiment**—I now come to the fourth main experiment, namely, a manurial one. This is a long term experiment designed to find out the response of the tea bush to various levels of the 3 main nutrient elements. Eight different treatments, each replicated four times, have been incorporated in the experiment containing the various combinations obtainable from 39 and 78 lbs. nitrogen per acre; 18 and 36 lbs. phosphoric acid, and 24 and 48 lbs. potash per acre. This experiment has now been going on for just under a year, so it is obviously not yet possible to assess any results from it.

**V. Minor Elements**—Fifthly, a short term experiment has been completed designed to find out whether the tea bush shows any response to minor elements such as boron, manganese, etc., and hence to determine if any of these minor elements is a limiting factor with regard to yields. For the purpose of the experiment a "cocktail" mixture of a number of elements was sprayed at weekly intervals over a period of two months and the yields compared with unsprayed plots. As the yields from the sprayed and unsprayed plots were almost identical, the experiment showed that minor elements do not, in fact, have any effect on yields—a result which has been confirmed by other similar experiments in the mid and up-country districts.

**VI. Green Manures, Cover Crops & Shade Trees**—Sixthly, the question of the best types of green manures, cover crops and shade trees is being investigated, and some 30 different species are under trial. Small areas of Guatemala grass, Napier grass and sunflower—all of which are invaluable for thatching and mulching—have also been established.

Again there are a few points I should like to make here in connection with these:—

(i) **Green manures**—Although the contribution bush green manures make as a valuable source of nitrogen and organic matter is well known, I feel that no opportunity should be missed of further pressing their importance, since there are still far too many new clearings in the low-country where the soil remains exposed for 3-4 years, except for the very inadequate protection provided by the young tea plants and the shade trees. This unnecessary exposure causes not only losses of the valuable top soil by erosion, but a further reduction of the already sparse amount of organic matter in the soil by insolation. In windswept districts their value as low wind-breaks is apt to be overlooked, as well as the contribution they make towards shading the young plants during the all important time gap till the shade canopy is established. In this connection I feel that insufficient use is made of their potentialities, and the following suggestions are put forward as variations of normal estate routine:—

(a) Where tall, bushy species such as *Tephrosia* are grown a single bush should be left every few yards when the rest of the crop is lopped or dug up.

(b) Greater use could be made of tall growing species such as *Indigofera dosua*, and *Crotalaria agathifolia* to provide overhead shade; these might well be intermixed with comparatively short growing species, such as *C. usaramoensis*, which would be grown to provide the main bulk of loppings.

(c) When your clearing programme gets ahead of your planting programme every effort should be made to complete the planting of the cleared

area with shade trees and bush green manures so that by the following monsoon, when the young tea plants are put out, the shade canopy is already there.

(d) To suggest the routine establishment of shade trees on all clearings a year before the tea plants are put out will probably in most cases be regarded as "counsel of perfection" which hard economic facts do not allow to be fulfilled in practice, but the system does appear to have a very definite practical application in the case of clearings that are a mass of boulders and rocks from which the heat radiation—in the absence of shade—is intense.

(e) Greater use could be made of Guatemala grass and Napier grass for thatching—especially new clearings—and it is suggested that small areas be set aside for growing them.

(ii) **Cover Crops**—Although the old adage that "the best cover for tea is tea" remains as true as ever, there are remarkably few estates in the low country that can boast of a 100% cover of tea, and one does not usually have to look far on any estate to find areas where cover crops could be used with advantage. The requirements of the tea plant are, however, somewhat exacting and the ideal cover crop must fulfil the following requirements :—

It must not climb up the young tea plants.

It must have a sufficiently spreading form of growth to give fairly complete soil cover.

It must have a shallow rooting system so as to avoid competing with the tea for nutrients.

It should preferably be thick enough to inhibit weed-growth—yet it should not be so thick that it forms a dense mass of matted roots.

Needless to say, such a cover crop is difficult to find, and I am doubtful if the perfect one exists. While it is, of course, too early to anticipate the results of the trials of various cover crops which are being made, several of the indigenous ones appear promising—notably *Desmodium triflorum*, a dwarf-leaved species commonly found on lawns; gotukola, which grows very well in this district, and *Desmodium heterophyllum*. These latter two are somewhat prolific, and will probably have to be forked in periodically, in which case contour strip forking is recommended.

Amongst other well known ones, *Indigofera endecaphylla* may be suggested, and (especially for the top of terraces, steep banks and drains) *Desmodium ovalifolium*; while among comparatively unknown exotic species which, of course, have the disadvantage that seed is difficult to get in any quantity, I would mention *Alysicarpus* species, *Cassia mimosoides*, and *Stylosanthes*.

(iii) **Shade Trees**—Thirdly, regarding types of shade trees. Although it is most unlikely that any tree will be found that will give a greater weight of loppings in the low-country than *Gliricidia* and *Albizzia moluccana*, there is room for trial of other trees that give a light, feathery shade; of these I would mention particularly *Indigofera teysmanii* (which is fast growing and does well in the low-country), *Sesbania cinerescens*, *A. stipulate* and *A. sumairana*. *Derris microphylla* and *Leucaena glauca* also come into this category, but they have an unfortunate habit of sending up large numbers of root suckers.

Further, the question of wind-breaks does not appear to have received the attention from planters that it merits. While it is difficult to recommend a really suitable wind-resistant tree for planting in the tea, there are a number of indigenous species that are highly suitable for planting along boundaries, e.g., mango, jak, casuarina and toona of which far greater use could be made. Of the exotic species, *Spathodea*, *Cupressus macrocarpa*, and *Cassia siamea* are probably the most suitable.

The most satisfactory way of dealing with the problem is of course, to leave strips of jungle when opening up land in wind-swept situations and some wonderful opportunities have been missed in the past owing to the oversight of the original early planters.

**VII. Diseases**—I come now to the general subject of diseases, and will deal firstly with the fungus known as *Rhizoctonia solani*. This fungus occurs universally in the low-country, and though it is perhaps widest known for the damage it does to all types of seedlings in nurseries it can cause serious damage on mature tea. The presence of the fungus usually begins to make itself felt in infected fields at about the ninth month from pruning, from which time it rapidly increases in severity; it thrives in damp, shady situations with poor air circulation, and especially where there are clusters of dead leaves matted together by horse hair blight. Not only is the mature foliage attacked, but also severe die-back of the young flush may be caused so that yields can be seriously affected. Fortunately, *Rhizoctonia*, like blister blight, is susceptible to copper fungicides such as Perenox, but complete eradication is difficult or impossible owing to the fact that it can survive in a dormant highly resistant state in the soil for a considerable time.

Such is the background of the *Rhizoctonia* control experiment which has been laid out in duplicate on Hapugastenne and Galbodde Estates (near Ratnapura). Five treatments are to be compared in this experiment—namely, spraying with Perenox, spraying with Bordeaux mixture, high tipping (with the object of making the micro-climate unfavourable to *Rhizoctonia* by improving the air circulation); thatching with grass, such as Guatemala grass, and the weekly removal of diseased leaves at plucking time.

**Pruning Cycles**—Although pruning cycles and diseases do not at first sight appear to have any connection, I have included the subject under this heading on account of the close relationship that exists between the optimum length of the pruning cycle and the presence or absence of diseases such as *Rhizoctonia*.

As you know, in the low-country comparatively wide variations in yield may be produced by only slight variations in the cycle length; while these yield variations are often such that different fields on the same estate may be run on different cycles, the main significant factors affecting yields—apart from altitude are:—

- (i) the type of pruning employed.
- (ii) the manurial level.
- (iii) the presence or absence of limiting diseases such as *Rhizoctonia*.
- (iv) the cycle length.

It is not desirable, however, to introduce too many variable factors into one field experiment, so manurial limitations have been excluded by adopting a uniform level of manuring 50% above calculated requirements. For the same reason the "cut-across" has been accepted as the "normal" method, while a "hard" prune leaving rim-lungs is being given to all plots at the start and thereafter every six years or other convenient period.

We are thus left with two factors—cycle length and effect of the presence or absence of *Rhizoctonia*—to be investigated. Accordingly, a pruning cycle experiment, incorporating these factors has been laid down on Ingiriya Estate, the field chosen having in its last cycle been severely attacked by *Rhizoctonia*. Four cycle lengths, namely, 18 months 2 years, 2½ years and 3 years have been decided on, and half the plots comprising each cycle are to be sprayed with Bordeaux mixture as a means of eliminating the effect of *Rhizoctonia*.

Although much of this may appear to be of purely academic interest, an illustration of its practical importance may be given by pointing out that the incidence of shot-hole borer has been found to be greatly reduced when the pruning cycle is lengthened; on the other hand, a vicious circle is created if this method of control is used without reservations on many areas in the low-country, owing to the consequent increased incidence of Rhizoctonia.

**Shot-hole borer**—That brings me to the next subject being investigated—namely, shot-hole borer. Mr. Redman King, Dr. Gadd and Mr. Austin did a series of experiments extending over a period of about 20 years in our Passara Sub-Station in the Uva district; the advice given as the result of their researches is to extend the pruning cycle, and on Uva estates where this has been carried out, a considerable improvement in the position has resulted.

The conditions in Uva are, of course, very different to those in the low-country where it was recently decided that the whole question should be investigated. This required the full time services of an entomologist on the spot, and Mr. Austin has, accordingly, been temporarily transferred to Hapugastenne Estate, in the Ratnapura district. He is now making a preliminary survey to find out the degree of shot-hole borer infection there—with special reference to new clearings—and to find out whether the life history of the beetle follows the same pattern in the low-country as it does in Uva. No further details of his activities can be given at the moment, but we hope that the beetles in the neighbourhood can look forward to having a thin time as the result of experiments now in progress.