

SOIL EROSION PREVENTION ON TEA ESTATES*

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I have been invited to bring up-to-date previous articles appearing in *The Tea Quarterly*, Vol. VI, Part IV, Page 176; Vol. VII, Part I, Page 118; and Vol. X, Part IV, Page 206.

A description will be included of the methods by which an almost complete ground cover was established on two estates in the Dimbula District, resulting after a period of years in increased cropping of the tea with applications of nitrogen which did not exceed 35.3 lb. per acre per annum.

The Report of the Ceylon Soil Erosion Committee was signed on October 1st, 1930. The consensus of opinion of that Committee was that "The first and most important step in the control of the present soil erosion on tea estates is the provision of ground covers."

With regard to other preventative measures, the officers of the Tea Research Institute have designated these as a second line of defence only.

What has prevented a more wholesale adoption of ground covers on tea estates is that the ideal cover has not yet been found. An ideal cover would perhaps be one (a) which is leguminous, (b) does not climb into the plucking surface, (c) does not possess a deep and tenacious root system and (d) can easily be eliminated if required.

I submit, however, that if this ideal be awaited, a further long period will ensue of soil denudation on tea estates. Further I would welcome an official statement from our scientists as to whether a leguminous plant supplies enough additional nitrogen to the soil to make a very great difference.

After a period of some nine years of ground cover establishment on one of the estates previously referred to, the following advantages can now be claimed: A record tea yield in the ninth year with no abnormal or increased applications of nitrogen and soil erosion brought to a minimum.

* The Institute does not necessarily endorse the views expressed by contributors other than members of the Staff.

The cost of upkeep of roads and drains on this property is now estimated at 50 cents per acre, but much of this is not actually spent as it would be unnecessary. The same policy of ground cover establishment was adopted on the other estate a few years later, and last year the yield would undoubtedly have been a record one had not the Directors decided to restrict crop in the last three months of the year. On both estates certain obvious control measures have been rigidly adhered to and these will be mentioned later on in this article.

A Visiting Agent some eight years ago remarked to me: "Why bother about soil erosion on estates such as these where the question is not an acute one?" I maintain that the question is acute on every tea estate in the Ceylon hills. To prove this, one has only to establish a *Paspalum dilatatum* ridge, even on slightly sloping land, and after a period of even a year it will be found that a distinct "step" has been formed, in some cases as much as eight inches in height. The abuse of the scraper still continues on clean-weeded estates, and the best Visiting Agents and Superintendents have not, as yet, been able effectively to prevent this. I maintain that the scraper will never be effectively controlled and that therefore this dangerous implement should be discontinued.

Then again, one often hears it laid down that tea itself can be a cover to the soil. But can it? What about the period between pruning and refoitation? The evils accruing can well be noted from a bird's-eye view of any considerable area of tea when the large proportion of bare eroding land can be appreciated.

I will now endeavour to demonstrate the measures actually adopted on the two estates in question.

CONTOURING

A small two-acre clearing was planted on very steep land where the soil was so gravelly and poor that it had never previously been considered economic to plant anything but gums thereon. This was done in June-July 1929. The tea was planted strictly on the contour at intervals of two feet, the spacing between the lines being one of five-feet, resulting in a plant incidence of 4,356 per acre. No holes were cut and no soil was removed; the actual method was to lay a six-foot reaper on the ground with a spirit level thereon, pegs being put in at six-foot intervals. Instead of cutting out a drain along these lines, the earth was merely forked carefully and deeply without removal of soil. In order to counter the fact that the plants were to be put out in a large proportion of sub-soil, artificial manure was sprinkled along the line and carefully mixed with the soil by hand. The result from this method was an entire retention of soil on this

steep land, which was proved by the fact that a watercourse conveying water to the factory and running below the whole length of the clearing was at no time out of commission. As time went on terraces were gradually cut and *Paspalum dilatatum* was planted on the edges.

There are no field drains whatever in this area and only two nettikhans; which are carpeted with *Paspalum* grass. A five-foot spacing was necessary between the lines in order to give room for cultivation and standing room for pluckers. Where these lines go round a curve in the hill it was found that the spacing increased in places to as much as ten-foot intervals and intermediate lines were established where necessary. These have never led to disputes amongst the pluckers. The bushes are now pruned and plucked at a slope parallel with the slope of the land and tipping is done by laying a rope down the hill as the work is in progress and seeing that the rope is touching the plucking surface down its whole length.

Plucking was commenced in June, 1934 and the following yields have been recorded:—

1934	297 lbs. per acre
1935	672 " " "
1936	368 " " "
1937	1,138 " " "
1938	938 " " "
	(Truncated in September)
1939	932 lbs. per acre

I have come to the conclusion now that even if terraces are not deliberately established, if tea is planted strictly on the contour at a spacing of three feet, natural terraces will form and the soil will not break away between the bushes. This would have reduced the plant incidence from 4,356 per acre to 2,904.

GREEN MANURE SHRUB ESTABLISHMENT ON THE CONTOUR

This is another form of soil preservation but, if adopted, it is essential that a second sowing of seed should take place just above the first a few months before the original plants are eradicated or the last stages of the land in question will be worse than the first.

GRASS TERRACES AS OPPOSED TO THOSE CONSTRUCTED OF STONE

Paspalum dilatatum terraces can be effectively established throughout a property in a far shorter period than those of stone and have the further advantage of costing a great deal less. They are actually more effective in that the soil further collects as the grass

takes root therein and the height is continually increasing which is not the case with stone terracing. One often notes these *Paspalum* terraces established above roads only and not above the field drains; this to my mind is not logical in that exactly the same conditions of breakdown can be noted above drains as above roads and the incidence above drains is far more.

Control of these *Paspalum* terraces is certainly an expensive matter but it is amply offset on an estate where a ground cover is in existence by the great saving in drain cleaning. My experience is that these terraces require to be trimmed back effectively at least once in two years.

TEA HEDGES ABOVE ROADS AND DRAINS

A better way still of establishing permanent terraces above roads and drains is by means of tea hedges, initiated by the use of:—

- (a) Backward and root-twisted plants discarded from nurseries.
- (b) Self-sown tea plants which can be found in the fields nearing the pruning period, especially from fields of a low jāt variety.

The effect of soil collection from tea hedges can best be seen after pruning in instances where these have been established on many estates in the Lindula section of the District of Dimbula.

CONTOUR PLANTING OF SHADE TREES

I do not note any great benefit from the point of view of soil erosion prevention in planting shade trees on the contour. I do however prefer planting these on the contour below drains because, planted thus, the mortality of young plants can be more effectively noted as one has only to walk along definite drains to find them.

DRAIN CONTROL

The Open Drain and Its Action.—It is now universally agreed that free run-off of water by means of open drains in districts of moderate rainfall such as Dimbula and Upper Dickoya is wrong in principle. Existing drains of this nature can at no very great cost be converted to hold up water. The more common methods are:—

- (1) By establishing bunds in existing drains.
- (2) By cutting out pits on the reverse slope principle.

To my mind the cheaper and more effective method is that of leveling the bottom of the drain in sections of six to the chain on slopes of 1 in 15 to 1 in 20 and using the resulting earth to form bunds on

which *Paspalum* grass can be established to prevent the bunds washing away. These insure a very even distribution of water for eventual seepage to the tea roots below. The late Mr. C. E. A. Dias was the originator of this system.

The reverse slope principle when first cut is certainly the neater to view, but on clean-weeded estates it will be found the silt gathers in the pockets and, unless this receives immediate attention, the system reverts to that of the banded drain. My experience has been that a man will for a day's name cover about double the length of drain under the former system as under the latter.

Main Drains or Nettikhans.—I do not think it is fully realised what the evils of ravining are where drains which run directly down hill are kept clean. The best method to prevent this evil is, to my mind, first to encourage these drains to fill up by bunding them at intervals, and then to establish a carpet of *Paspalum dilatatum* which acts as a "sponge hold-up," gradually dispersing the water later. This method of control, particularly in areas where there is a ground cover in the tea, results in the necessity for putting in far fewer culverts in any cart road below.

Where the land is very steep, further measures will be found necessary such as cutting reverse slope pits at intervals in the course of the drain or even adopting the water cushion system described in the Soil Erosion Report and illustrated therein. This was initiated by Mr. John Horsfall, and the principle is that a stone step sloping backwards is established with a projecting lip so that the rate of flow of water is reduced to a minimum and the water drops vertically from one step to the next.

PROTECTION OF RAVINES

Ravines, too, especially if they run down steep land, should carry a carpet of grass of some sort to help to hold up water; this with the object of prevention of flooding during the heavy spates of rain. *Paspalum dilatatum* grass is useful for this purpose up-country and has the additional advantage of providing good fodder for the cattle of the labour force in addition to that provided by the *Paspalum* soil barriers above roads and drains. Spaces can be kept clean round gum plants and should sunflower be required for provision of compost from areas other than where the tea is growing, this can be established by planting the cuttings in the grass.

WEED COVERS

We now come to the main provisions for prevention of soil erosion, those mentioned previously being in the nature of a second line of defence.

The only way to prevent erosion at its source is by means of establishing ground covers *in situ*, unless the estate has a good stand of *Grevillea robusta*; the latter is generally the case in a district like Uva, where ground covers are not so easy to establish owing to long periods of drought. *Grevillea* has the double advantage of providing a means of breaking the intensity of rainfall before it reaches the ground and, being very deciduous, the continual leaf-fall provides a wonderful carpet to the ground. If, however, *Grevillea* be established sufficiently close to be efficient in the above respects, it will be argued that the shade caused will be a factor against good quality teas being produced for reasons which need not be gone into in this article.

METHOD OF ESTABLISHMENT OF GROUND COVERS

The method I have adopted is first to allow every species which *wants* to grow to establish itself except the varieties which are suspect for particular reasons. The latter are at the moment the following:—

- (a) *All kinds of grasses*—including of course Cootch and Illuk. The reasons for keeping out the two latter are obvious.
- (b) *All soft weeds* which grow up through the ground cover. Though I do not argue that they compete to any extent with the major crop, I eliminate them as not being to my mind a type of true ground cover and, besides, the general distribution of flowering weeds throughout the tea areas has a psychological effect and gives an appearance of abandonment.
- (c) *Desmodium triflorum*.—This is apt to form too close a carpet and, unless heavily forked at least once in 12 months, certainly has a deleterious effect on the tea.
- (d) *Artemesia vulgaris*.—This is what is commonly known as the Chrysanthemum weed and is considered too deep rooted. I do not however consider that it has been established that it has harmful effects for this reason. I would bring forward the argument that deep-seated roots of ground covers (and, for that matter, of shade trees and bush plants as well) are always gradually decaying and affording channels which are useful from an aeration point of view.

- (e) *Centella asiatica*.—This is commonly known as the violet weed. The objections with regard to this are the same as those set forth under section (d) above.
- (f) *Plantago asiatica*.—This is akin to the lawn plantain in Europe and has the same objections as those given under section (d).

Using the method adopted by me the following will eventually be found to predominate in most estates in Dimbula:—

- (i) *Drymaria cordata*.—This is objected to by many Visiting Agents on the score that it is untidy and has a distinct tendency to creep up through the bushes and establish itself on the plucking surface. My reply to this is that it can quite easily be prevented from doing this by insisting that the weeders each month scrape it away from the bowls of the bushes. A karandy can be used for this purpose where the cover is thick because the soil thus shifted cannot go very far. Complete elimination of *Drymaria cordata* is a very expensive and very often impossible undertaking.
- (ii) *Justicia procumbens*.—This forms a very efficient ground cover if only the weeders are taught to let it establish itself. It has a very high returned-nitrogen content — equal to that of the sun flower. It also, like *Drymaria cordata*, has a fine root system but, unlike *Drymaria*, can be quite easily eliminated if that were at any time required. It also has a tendency to climb up through the tea bushes if not controlled in the way mentioned above. The low cost of control of ground covers with this tendency is set forth further on in this article.
- (iii) *Biophytum proliferum*.—This is indigenous on many estates, at any rate towards the upper end of Dimbula, as can be seen by careful examination in ravines where the weeding scraper is not brought into play. It establishes itself fairly quickly, though not so quickly as the two varieties mentioned before.

The above three are the most likely to establish themselves at the expense of other varieties which have been left alone.

We now come to the more easily introduced varieties which become predominant among other ground covers:—

- (iv) *Oxalis corymbosa*.—A description of this and the two following varieties will be found towards the end of

this article. If this has not already become established it is fairly easy to achieve this object by continually strewing its bulbs behind the forkers.

- (v) *Oxalis latifolia*.—The same remarks apply with regard to this as to *Oxalis corymbosa*.
- (vi) *Fragaria indica*.—This is a wild strawberry, the fruit of which is tasteless. This is an advantage in that the labour force does not pick the fruit and this, having a multitude of seed on its outer surface, has a tendency, when leaving the plant in a ripe state, to roll down hill, sowing itself and establishing very quickly. This forms an excellent ground cover and ultimately appears to stand alone.

I admit that none of the six above varieties are legumes and can only say again that I have not been able during a period of years to establish a really successful cover of a leguminous variety.

There is a school of thought which prefers to endeavour to establish only two, or at the most three, varieties of leguminous varieties as ground cover. All I can say is that I hope they will be successful in their efforts.

METHODS OF CONTROL

In order to prevent matting it is very necessary that the land should be forked well at least once in twelve months. That means that a normal regime of forking alternate lines every six months would suffice. The artificial manures more commonly used in these days, if spread first over the ground cover, have a distinct tendency to make the latter wilt; this has the great advantage of affording an easy means of checking whether it has been evenly spread. The forking then takes place and as much of the ground cover and manure is buried beneath the fork as possible with other green stuff. Ground covers which have a tendency to climb up through the bushes must be scraped away *monthly* as explained before. Soft weeds, as they show up through the ground cover, are hand gathered and taken to the nearest road *monthly*. Grasses and any other ground covers which it is considered desirable to eliminate are attended to *once a year*, in the dry weather for preference, by a special gang under strict supervision.

Paspalum dilatatum soil barriers and edges of grass ravines are cut back carefully at intervals of 24 months.

COSTINGS

It is often stated that the cost of weeding in tea where ground covers are the order of the day, will be very high. This has not been my experience. Latterly I have paid the weeding contractors Rs. 1.25 per acre per month during the four wettest months and Re. 1.00 per acre during the remaining eight months. This work includes careful hand weeding of all soft weeds appearing and the scraping away of ground covers which have a tendency to climb round the bowls of the bushes. The cost of the control gang which goes round the whole area during January, February and March works out as a rule at about Rs. 3.60 per acre, or an average over 12 months of 0.30 cts. Add to this the monthly cost of the monthly control, 1.08 cts., and the resulting total cost comes to 1.38 cts. Rs. 1.60 per acre per month is the inclusive estimate and the balance, .22 cent per month, is taken up in the wages of the supervising K.P. and in such odd jobs as the collection of weed material into heaps for compost purposes, etc. The actual cost per acre works out in practice at between Rs. 1.50 and Rs. 1.60, and I am inclined to think that this is cheaper than the average weeding bill on clean weeded estates in the neighbourhood.

The cost of Paspalum control is not included under this head and it would vary between Rs. 1.50 and Rs. 2.00 per acre on the average over the whole area, between Rs. 3 and Rs. 4 per acre being spent on half the area in alternate years. This, as I have mentioned, is offset by a very considerable saving on upkeep of roads and drains.

DEMONSTRATION GROUND COVER PLOTS

I by no means claim that after nine years I have discovered the varieties of ground cover which will eventually prove to be the best. I have been responsible now for the establishment of about fifty different kinds of possible ground covers in plots for investigation purposes, some of which have been also established actually under tea. I would therefore urge that similar plots be laid down on estates for further investigation of their habits.

SPECIES ACTUALLY FOUND TO GROW

Below will be found a list of species actually found to grow in the district of Dimbula at an elevation of about 4,400 feet. Against each variety I have put down further information I have collected in the way of vernacular names, habits noted, and medicinal properties.

I might add that a good number of the plants mentioned below will be found illustrated, but not in colours, in a recent excellent publication of the Department of Agriculture called "The Kandy Flora."

Achynanthes sp.—Identification requires confirmation; a promising ground cover having roots on the nodes; probably indigenous.

Aeschynominae americana.—Probably indigenous.

Alternanthera sessilis.—Tamil, Poonankani, Sinhalese, Mukunu-henna; Amarantaceae (Pigweed family); shallow rooted; used as a poultice for wounds and aches; boiled with onions used as a fermentation in Beriberi; also used with cummin for intestinal inflammation.

Artemisia vulgaris.—Tamil, Maru-kolunthu; Compositae; probably indigenous; deep rooted; this has been confused at Kew with the tall-growing *Artemisia* with the same leaf shape which is found growing round line vegetable gardens, but Macmillan in his book on gardening differentiates between them. The leaves of *vulgaris*, if bruised, have a very pungent scent.

Atylosia rugosa.—Leguminous, Papilionaceae; grows freely on the Bo-Pats but does not appear to thrive under tea.

Cardamine hirsuta.—Tamil, Kadukup-pillu; Cruciferae; probably indigenous; apt to die off under drought conditions.

Cassia mimosoides.—Sinhalese, Bin siyambala; probably indigenous; promises well as good leguminous cover on certain estates.

Cassia kleinii.—Introduced; apt to form too much of a carpet at times; also apt to die out.

Cassia leschenaultiana.—Leguminous, Caesalpiniaceae; has too extensive a root system and grows too high and rank; also subject to sooty mould.

Centella asiatica.—Sinhalese, Gotukola, Heen gotukola, Makulu-venna; Tamil, Vullarai-pillu, Elekalu-pillu; probably indigenous; apt to form too thick a carpet. Bundles of the leaves can be bought in the caddies at 1 cent per bundle for medicinal purposes — for worms and as a tonic.

Centrosema pubescens.—Leguminous, Papilionaceae; introduced; apt to climb.

Desmodium heterocarpum.—Sinhalese, Et-undu-piyali, Leguminous, Papilionaceae; a preparation of this is used as a restorative after fainting and convulsions; also used for poulticing sore breasts; a decoction is used as a cough cure and as a tonic.

Desmodium microphyllum (*D. parvisolum*).—A rather promising ground cover; small-leaved and shallow-rooted; probably indigenous.

Desmodium triflorum.—Tamil, Narunkody, Soory pillu; Sinhalese, Hin-undu-piyali; probably indigenous; apt to form too tight a carpet.

Euphorbia hirta.

Fragaria indica (wild strawberry) Rosaceae; probably introduced; a splendid ground cover and easy to establish.

Hedyotis corymbosa.—Tamil, Imbura siyavaputhai; is used as a cough cure.

Hedyotis monosperma.—Tamil, Peenara kody; Rubiaceae or Madder family; probably indigenous; forms a good ground cover; the crushed leaves have a very offensive smell.

Hedyotis nitida.—Sinhalese, Pita-sudu-pala; probably indigenous; the leaves are chopped up, boiled and eaten with rice.

Hydrocotyle javanica.—Tamil, Meen vullarai; Sinhalese, Val gotukola, Wahakola; Umbelliferae; large leaves; does not spread easily and does not climb.

Hydrocotyle manii.—Tamil, Sinna vullarai; probably indigenous; leaf intermediate between *H. javanica* and *H. sibthorpioides* but varies in size; establishes fairly easily as a good ground cover.

Hydrocotyle sibthorpioides.—Tamil, Kussup-vullarai, Kullai vullarai; has a very small leaf; prefers damp situations.

Indigofera endecaphylla.—Leguminous; introduced; apt to die away after a period of years; climbs.

Justicia procumbens.—Tamil, Ottu-pillu, Poom-pillu; Sinhalese, Mayani; Acanthaceae; probably indigenous; has a tendency to climb but is a splendid ground cover; root system fine and feathery; high nitrogen content, 5 tons of green matter returning about 78 pounds of nitrogen; has been seen thriving under drought conditions in the Jaffna Peninsula.

Laurembergia wangerinii.—Tamil, Tunnai parsun, Podithal-lai; Haloragadaceae; apt to die out if exposed to too much sunshine.

Osbeckia sp.—Probably indigenous; rather similar to *Richardia scabra*.

Oxalis bowii.—Introduced; long, thin bulbs and a large red flower.

Oxalis corniculata.—Tamil, Sinna puliyari; Sinhalese, Ein-embul-embiliya; leaf is bronze or green; does not form as thick a cover as other *Oxalis* varieties; no bulbs.

Oxalis corymbosa.—Tamil, Periya puliyari; Sinhalese, Loku-embala; Oxalidaceae; introduced and cannot now be eliminated where established; heart-shaped leaflets with rounded corners; root system bulbous; used as a salad by labourers.

Oxalis latifolia.—Tamil, Puliyari; introduced and cannot be eliminated; triangular acute-angled leaflets; root system bulbous; also used as salad.

Parochetus communis.—Tamil, Arlankoddai; leguminous; probably indigenous; difficult to establish in Dimbula; is apt to die out when tea is pruned; has a tiny blue pea flower and a leaf similar to *Oxalis* but with a dark midrib.

Phyllanthus urinaria.—Tamil, Chivappuk-killay-nelli, Keel-kunellai; Sinhalese, Rat-pilavakka; Euphorbiaceae (Spurge family); probably indigenous; resembles the sensitive plant in appearance but the leaves are not sensitive.

Plantago asiatica.—Tamil, Punnai pillu; Plantagineae or Ribwort family; probably indigenous; deep-rooted; is of the same family as the lawn plantain in Europe.

Polygonum nepalensis.—Tamil, Kangany-machan-pillu; Polygonaceae; indigenous; is not perennial; forms a splendid cover at times and rapidly re-establishes itself from seed; dies back under heavy shade or in drought.

Pouzolzia triandra.—Urticaceae; probably indigenous.

Pouzolzia zeylanica.—Urticaceae; probably indigenous; quite promising as a ground cover; has small leaves and is shallow-rooted; the leaves are eaten as a vegetable and as a cure for worms; also used as a poultice for sores; the juice is used to encourage arrested flow of milk.

Pueraria javanica.—Leguminous; introduced; apt to climb.

Pycnospora lutescens.—Leguminous; rather like *Desmodium triflorum* but not so close-matted.

Ranunculus wallachianus.—Ranunculaceae or Buttercup family; prefers damp situations and is therefore likely to die out in the open when a field is pruned.

Richardia scabra.—Rubraceae; probably indigenous; is very firmly rooted and is establishing itself considerably in parts of Uva; might prove an excellent ground cover for the dry zone; also known as Mexican clover and considered by some to be a good cattle fodder.

Sedum sp.—Crassulaceae; dies off under dry conditions.

Sida rhombifolia.—Tamil, Atipala-cheddu, Peria pullam parsai; Sinhalese, Kotikan-bevila; Malvaceae or Mallow-family; probably indigenous; grows too high to be a good ground cover; heavy root system; used by the Tamils as a headache cure and considered by the Malays to have magic properties; formerly believed in Europe to be of value in pulmonary tuberculosis and rheumatism but this is now said to be unjustified; root decoctions also used for fever, stomach complaints and irregular menses.

Sindernia rotundifolia.—An extremely small variety of ground cover but not likely to withstand drought.

Spilanthes acmella.—Compositae; probably indigenous. rather too woody to be a good ground cover.

Synedrella nodiflora.—Tubiflorae; fine rooted and promising as a ground cover; used for poulticing and as an embrocation; the juice is used for earache; probably indigenous.

Torenia cyanea.—Scroppulariaceae (Figwort family); probably indigenous.

Vigna oagosperma (*Dolichos hosei*).—Leguminous, Papilionaceae; apt to climb.

FURTHER GENERAL OBSERVATIONS

A table of approximate percentages of returned nitrogen, kindly supplied by Dr. Joachim of the Department of Agriculture, is not repeated here but may be found by those interested on page 208 of Vol. X, Pt. 4 of *The Tea Quarterly*. I am not in a position to make any authoritative statement as to whether it is better from the point of view of moisture competition in dry weather for the major crop

to have a ground cover which defoliates or does not do so. From the point of view of effective elimination of grasses and other undesirable growths, however, the variety which defoliates in dry weather is the better. I might add here that *Drymaria cordata* has this advantage of defoliation and a further advantage with regard to its root system. This is that, though light in texture, the roots are very numerous and tenacious of the top soil surface, thus preventing dry erosion during drought and wet erosion when the first rains descend, the plant bursting into full foliage almost immediately after.

There is one disadvantage with regard to ground covers and that is in relation to the supplying of old tea. Unless extremely careful attention is continually paid to cleaning away the cover round the holes, planting by seed-at-stake or by basket plants is not advisable. On the other hand, lengthy two-year-old stumps come to no harm in a ground cover.

Efficient stopping of soil erosion can only be effected *at the source* and the most logical way in which to achieve this object is by means of ground cover. Other control measures should be considered more in the light of a second line of defence.

The ideal non-climbing legume has apparently not yet been found. Are we to continue to wait until this is found or would it not be better to utilise non-leguminous ground covers and, if of a climbing variety, to control them?

Note.—When sending specimens to the Economic Botanist for identification, the following instructions should be observed:—

1. *What to send.*—The following should be included if possible: Specimens of bud and flower attached to stem; also mature fruit and leaf-bearing twigs, including matured as well as tender leaves. Also roots.
2. *Information required.*—The name and nature of the locality where the plant occurs should be given; also the local names of the plant and its nature (whether herb, shrub, tree, etc.) Whether it grows wild or is cultivated (if cultivated, its origin should be stated if possible). The colour of the flower, the uses of the plant and any other points of interest should also be included.
3. *How to send.*—Large specimens should be wrapped in plantain leaves to keep them in fresh condition or they can be pressed in folded sheets of blotting paper.
Small hardy specimens may be sent in ordinary envelopes but small delicate specimens should be pressed in folded sheets of blotting paper.