NOTES ON THE EFFECT OF *DRYMARIA* ON AN ESTATE IN UVA*

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HISTORY

Drymaria cordata appeared first in the experimental weeding plots late in 1936. These experimental plots were laid down in 1932 to observe the effects of a weed cover on tea. Grasses only were removed from them and tall weeds were slashed across monthly, the whole area being forked in both rows twice a year. Any form of creeping weed that would cover the soil was encouraged and *Drymaria* was considered to be an acquisition.

By April 1937, *Drymaria* had established itself and was spreading all over the experimental weeding plots. In November 1938, *Drymaria*, in conjunction with *Oxalis*, had formed a complete cover in these plots, and it was decided to eliminate all other forms of weeds in future. This was done and the plots were cleaned up and brought into the normal weeding round by March 1939 when all special cultivation, like extra forking, was abolished.

In the meanwhile *Drymaria* had been spreading into the surrounding fields, and by December 1941 the soil of all the central fields was covered by a dense growth. The weeding policy at this date was to treat *Drymaria* as a cover crop and to leave it unmolested in the cultivation lines, making the weeders clean it from round the bushes in the tea lines monthly.

At the end of 1942, the soil in all except the comparatively isolated fields at the extreme ends of the group was more or less completely covered with *Drymaria*, and it was beginning to creep into even the isolated fields. The whole estate had an unbroken cover of *Drymaria* on it in 1943, which proved to be the peak year of its growth.

Since then the *Drymaria* has been gradually losing its vitality and has been declining steadily, not only in the rapidity and exuberance of its growth but also in the number of new seedlings coming up after each period of drought. It has disappeared, in fact, almost completely from some portions of the fields wherein it appeared first and quite considerable parts of the estate are comparatively free from it now.

EFFECT ON CROP

Drymaria has seasonal periods of maximum growth correspond with the flushing periods of the tea. It is reasonable to suppose that active competition with the tea for available foodstuffs during maximum flushing periods would result in reduced tea crops. Table 1 shows the March rush crop yield from this estate compared with the average of two other *Drymaria*-free Uva estates in the same Company.

Table 2 shows the seasons' final yields for the estate compared to the mean yields for the same periods of two other of the Company's estates in Uva, which are used as a control. In no case are "Off grades" included in the yields. General cultivation, plucking and labour conditions were very

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TABLE I

Tea Yields in lb. per acre during the March Rush.

Year	1938	1939	1940	1941	1942	1943	1944	1945	1946
Infested estate	133	135	163	—	78	63	102	87	103
Average of 2 other estates	102	88	131	—	112	82	105	97	107
Difference	+31	+47	+32	—	−34	−19	−3	−10	−4

TABLE II

Tea Yields in lb. per acre and the amounts of nitrogen applied (in lb. per acre.)

Season	1937/38	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44	1944/45
	Yields							
Infested estate	800	863	908	*	745	670	699	812
Average of 2 other estates	758	823	842		823	829	766	824
Difference	+42	+40	+66	*	−78	−159	−67	−12
	Nitrogen applied							
Infested estate	35·2	35·2	42·36	42·38	25·1	25·5	16·27	26·0
Average of 2 other estates	35·2	35·2	35·2	35·2	25·0	26·84	17·08	25·0

* Crop restricted.

similar on all 3 estates throughout the period under review and full crops were harvested without restriction of any kind.

For the three seasons before *Drymaria* may have begun to influence crop, this estate had averaged 49.3 lb. per acre of crop *more* than the control estates. During the four seasons after *Drymaria* had become established, crop averaged 79 lb. per acre *less* than the control estates. It is difficult to escape the conclusion that *Drymaria* has been responsible for an average annual loss of crop, amounting to well over 100 lb. per acre off this estate during the past four seasons.

The weeding experiments carried out on St. Coombs Estate by the Tea Research Institute have shown (Eden 1944) that weeds have caused definite loss of crop during the first 6 years of the experiments, and that it was only after seven years that "equilibrium conditions" were reached with crop levelling out on the non-weeded and the clean weeded plots.

The crop figures given above for this estate compare fairly closely with the St. Coombs experimental weeding figures, *(loc. cit.* p. 42) except for the fact that the loss of crop has been heavier on this estate, due possibly to the cover of *Drymaria* being thicker here than at St. Coombs. The writer would like to think that the recent improvement in crop returns noticeable on this property compared with the control estates, was in some part caused by the efforts in fighting *Drymaria* that are described in these notes; but he must point out that any improvement in crop may just as well have been from the same natural causes that operated at St. Coombs.

CONTROL

When *Drymaria* first appeared, it seemed to be an ideal cover crop as it grew along the ground and gripped the soil securely. It was, however, a prolific grower and shoot after shoot grew out until the ground was covered. Then the trouble started, for as soon as it had no more ground

to grow over, the weed started to grow up on itself and on top of everything it could, including the tea. It liked plenty of sun and moisture and made its most prolific growth in the pruned areas, where the tea prunings formed an ideal trellis work support for it to spread over. Heavy shade or sunless weather limited its growth to a reasonable rate and it was found that a good thick cover of tea in its third or fourth year from pruning, when it was well manured and carried adequate leaf, was an excellent controlling factor.

As it ceased to grow after three weeks of drought and died back after six weeks of drought, its control was easy in the dry weather and during the early part of the monsoon. This was because it is a slow starter after rain. The *Oxalis* sprang up first and formed a thick cover rapidly and it was not until some weeks later that the *Drymaria* commenced to appear and eventually to cover the *Oxalis*.

The two major periods of growth occur in Uva in normal climatic seasons, during November and during March and April. This has an important bearing on the control methods adopted, as very few estates in Uva can spare the 15 coolies an acre necessary to clean weed the whole property monthly during flushing periods without loss of crop.

For the first year or two after establishment, it appeared to possess enormous vitality and quite phenomenal powers of growth. This proved, however, to be a passing phase, the duration of which would seem to depend to a large extent on the degree of richness of the soil in particular fields, as the weed settled down after some years into quite a good cover crop capable of being kept in reasonable control.

During the initial urge of growth it thrived on hard treatment, and clean weeding at 15 coolies an acre produced an even thicker cover of *Drymaria* at the next weeding round. It was decided, therefore, to concentrate on keeping it out of the bushes by scraping it monthly out of the tea lines into the cultivation lines, where it was left undisturbed. This method of control was started in 1938 and continued until 1944, when it became obvious that the continual removal of soil from round the bushes and its deposit into the middle of the cultivation lines, was having unforeseen effects on cultivation.

EFFECTS OF CULTIVATION

This continual scraping round the base of the bushes in the tea rows, tended to remove earth from round the bole and to push it into the cultivation lines which caused the ground level to rise in the cultivation lines and to sink in the tea lines. Moreover, a certain proportion of the *Drymaria* in the cultivation lines was rooted up and killed in the process, and this, together with the prunings and other litter from the tea, shade trees and green manure, collected in the cultivation rows decayed under the thick layer of unmolested *Drymaria*. This layer of *Drymaria* died during each period of drought and further increased the height of the mound running down the cultivation lines.

Since cultivation was done when *Drymaria* was growing strongly, the forker, unless he were exceptionally conscientious and was using a nearly new fork, never penetrated to the true soil that lay beneath the ridge of matted *Drymaria*, *Drymaria* roots and decayed vegetation. These ridges were about 4 inches high in 3rd and 4th year fields, and in 1st and 2nd year fields sometimes increased to nine inches. The bulk of the tea roots lay beneath this surface mat.

It proved unsatisfactory to spread the artificial manure on top of this heap of *Drymaria,* particularly when insoluble fertilisers were used, as a large part of the manure stuck to the *Drymaria,* which was usually damp at the time of application ; so the forkers could not push it down into the soil. The portion sticking to the *Drymaria* washed off eventually in the next shower of rain, but it had to penetrate the heap of *Drymaria* and *Drymaria* roots along the cultivation lines before it could reach the tea feeding roots below. It is reasonable to assume that the *Drymaria* got the first share and that the tea got only what the *Drymaria* could not absorb. This was considered to be the cause of the decline in yield in 1942 and it was decided that the mound in the cultivation lines must be levelled off before manuring in future.

This was done in 1943 by special coolies equipped with mamoties, who scraped away the mound and levelled off the cultivation rows. The manure was then spread on top of the ground and forked in, along with all *Drymaria* and decaying vegetable matter that the mound contained. The amount of material so collected and buried was astonishing and although the work was expensive and needed about 6 coolies an acre, the *Drymaria* took 2 months to recover from the treatment, and the expenditure was saved on the next 2 weeding rounds. This method of manure application was followed by an immediate comparative improvement in yield. The decline of the previous three seasons had been arrested.

The method, however, required additional labour at inconvenient times and as the *Drymaria* had lost its initial urge by this time and had settled down to a quieter existence, thereby reducing the necessity for such energetic scraping into the cultivation lines monthly, it was decided to dispense with the removal of the *Drymaria* mounds before manuring and to adopt a different method of manure application.

The system decided upon was as follows : Each forker was issued with his own hand sack of manure and each row was envelope-forked. The forker was made to put his own manure into the bottom of each envelope well below ground level and to envelope in the usual manner when forking the next envelope. This system, when properly carried out, got the manure into the ground below the root level of the *Drymaria* and other shallow-rooted weeds.

It proved to be satisfactory in practice and was further modified last season to annual alternate row forking. This appears to be the cheapest and most efficient method of ensuring that the tea gets its fair share of the manure.

EFFECTS ON THE APPEARANCE OF THE TEA

There can be no dispute that the tea in clean weeded areas looks healthier and shows up darker green in colour than the tea in surrounding areas with a cover of *Drymaria* on them. The tea in the *Drymaria* areas has the yellow appearance of Nuwara Eliya tea in February.

This property, situated at 4,500 feet elevation, gets the N. E. Monsoon more severely than do most estates in Uva, and the tea together with the green manure and *Grevilleas* experience a definite "wintering" period during the N. E. Monsoon. The tea sheds a lot of its leaf during this wintering period in the fields more than 2 years from pruning, unless it has had the stimulus to growth provided by the application of artificial manure about 2 months previously.

Fields carrying a heavy cover of *Drymaria,* particularly if the soil is not good, have tended to winter more severely than clean fields and to take longer to come into full leaf again. The burying of large masses

of *Drymaria*, when manuring, undoubtedly caused a temporary falling off in appearance, although the tea made a quick enough recovery afterwards.

EFFECT OF WEEDING COSTS

Drymaria did not produce any immediate or appreciable rise in weeding cost, when it first came in, and when control was effected by scraping it into the cultivation lines only; for the cover that it produced hid all the small creeping weeds and grasses, which remained undetected and showed up only when the *Drymaria* died back in dry weather.

Young weed seedlings germinated in reduced number under the *Drymaria* cover and were not easily seen by the weeders. These seedlings might have been as much as several inches high and would have been removed under a normal system of clean weeding. They tended to be overlooked under the cover of *Drymaria* and to seed before the next weeding round was due. These two factors, plus a certain laxness in weeding, difficult to combat, and engendered by the dirty appearance of the estate when covered by *Drymaria*, tended to raise weeding costs gradually from year to year.

This rise in weeding cost has been a substantial one. For years before *Drymaria* became established on this property, the whole estate had been weeded on the contract system, with the rate based on an allowance of just over 3 coolies an acre; but with the spread of *Drymaria*, more and more contractors have found that this allowance is insufficient.

Gang weeding the division on which *Drymaria* first appeared took an average of 10.7 coolies an acre a round last season. Even when allowance is made for the reduced tasks now prevailing, compared with pre-war days, for the more expensive nature of gang weeding, compared with contract weeding, and for the fact that monthly rounds were not always kept up the substantial nature of the rise in costs is apparent.

ERADICATION

In 1943 it was decided to attempt to clean weed certain fields in order to observe the effects of clean weeding on appearance and yield.

The cleaning up started in July and the average monthly labour taken for clean weeding is given in Table 3.

TABLE III

Average Number of Labourers required for weeding per acre per round.

1943/44	(12 months)	15·04
1944/45	(12 ,,)	8·00
1945/46	(10 ,,)	6·49

The soil in the poorer parts of these fields is free of *Drymaria* seed now, but it is subject to constant re-infection from surrounding areas, which have not been cleaned up. The soil in the good hollows still contains *Drymaria* seed, which germinates whenever the ground is disturbed by forking or after prolonged spells of wet weather, but the cost of weeding is falling steadily and indications are that it will have returned to normal in another 2 seasons' time.

When the costs are compared with the figure of 10.7 coolies an acre given previously for gang weeding the ordinary fields during season 1944-45 by drawing the *Drymaria* into the cultivation lines, there is every indication that the policy of clean weeding will prove to be the cheaper policy, provided always that the labour to keep up regular monthly rounds is available.

Drymaria seeds very rapidly and regular monthly weeding rounds are essential for success. As weeding these fields took

as many as 24½ coolies an acre in some months during the first season of clean weeding, it is important to start in a small way and not to try to clean up a larger area than can be completed monthly.

During 1944, when it became apparent that *Drymaria* could be weeded out, once its initial vitality had spent itself, it was decided to treat it as a weed and to get it out of all the fields wherein its growth was diminishing, whenever labour permitted. This was done from 1945 onwards and is the present policy with regard to *Drymaria*.

It was realised that labour would not be available at all times of the year to keep up monthly weeding rounds under this policy, and that we could never hope to eradicate it completely that way, when the soil is often infected with fresh seed between weeding rounds. As rounds have seldom gone longer than 2 months, however, it has the advantage that at least half the estate is reasonably free of *Drymaria* at any given time. I believe, too, that this decision is hastening the natural decline of the *Drymaria* in the old areas and that in the course of time it will have no more nuisance value than any other weed and there will be a consequent fall in weeding costs.

EFFECT ON EROSION

Erosion occurs to a marked extent during 3 periods of the year in Uva. The first period is the dry season during the July-September drought, when dry erosion causes considerable loss of top soil on all steep fields. The second period occurs in October, when the heavy inter-monsoon thunderstorms that break the drought can do a lot of damage. The third period occurs in March and April, when the inter-monsoon thunderstorms again are capable of a lot of damage.

Drymaria is valuable for stopping wash in the March-April period and very little occurs in fields carrying a good cover of *Drymaria*. *Drymaria* also makes new soil very rapidly by holding up all leaf-fall, small prunings and other refuse that would otherwise be washed away by rain or blown into the drain by wind, or helped down the hill by gravity and coolies' feet. This new soil is black in colour and full of humus and must help the soil considerably to withstand the erosive effects of wind and rain during the other two periods of the year when drought has killed off the *Drymaria* cover.

EFFECT ON DISEASE

The litter that accumulates under *Drymaria* may form an ideal medium for the spread of the fungus *Rosellinia* and all known disease patches should be clean weeded.

EFFECT ON DRAINING

Drymaria is very fond of drains and ravines and grow profusely in them. At the end of April, it was quite common to see the field drains full to the top with the weed. The run-off from rain percolated through this, which acted as a filter and trapped most of the soil, fallen leaf and other particles usually carried off by flood water. This was all to the good and certainly the work of cleaning silt-pits in the clean weeded fields was far more expensive than in the fields with *Drymaria*, in spite of the growth of weed in the drains.

Drymaria growing in the ravines holds up a lot of silt too, causing the soil level to rise constantly and necessitating periodical deepening operations.

SUMMARY

It is impossible to deny that *Drymaria* is expensive. There is little doubt that it causes initial loss of crop and that from the short term point of view, it should be prevented from establishing itself on an estate at all cost.

It is not possible to say yet whether the new soil that it makes and the loss of top soil that it prevents will restore fertility sufficiently in the course of a long term of years to result in an eventual gain of crop. This is still a matter for conjecture and those in charge of estate policy must decide for themselves whether such a problematical gain in crop at some future date is worth the price that must be paid in the meanwhile.

These notes are produced in the hope that they will be of use to those who will be faced with this problem at some future date, should *Drymaria* continue to spread at its present rapid rate through the tea plantations of Uva.

REFERENCE

Eden, T. (1944). Report of the Agricultural Chemist for 1943 —. *T.R.I. Bull.* 25, pp. 38-45

BLISTER BLIGHT

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"Blister Blight" disease of tea has been known in North India for nearly ninety years, but apart from two severe outbreaks in the first decade of this century, does not appear to have become economically serious. The import of tea seeds into Ceylon was prohibited mainly to prevent the entry of this disease, and it remained unknown in South India and Ceylon until 1946. In October, specimens were received from Dolosbage, and in the ensuing fortnight isolated reports were received from six other districts on the western face of the central range of hills. Thereafter, reports have multiplied until it is now (18th December) known on 68 such estates at elevations between, 5,000 to 1,500 feet. It has not so far been reported from Uva. Its frequency is highest in tipping fields and decreases with the age of the field from pruning.

The disease is most easily recognised during the later stages of infection. It is almost entirely confined to the younger leaves, occasionally spreading to the young stem causing the shoot to dieback. Infections of the leaves are local, and do not result in the death of the leaf. The first visible sign of its presence on a leaf is the formation of a slightly yellowish translucent area, which later becomes shiny and depressed on the upper surface. This produces a swelling or 'blister' on the lower surface of the leaf, from ⅛ in. to ½ in. or more across, which becomes white a few days later. In sunny weather these blisters rapidly become brown and dry up, but in wet weather they remain white for some days. The cause of the disease is a species of *Exobasidium*, probably *E. vexans*.

The future course of the disease in Ceylon is unpredictable. It is undoubtedly capable, as is the case with many other diseases, of causing serious damage if conditions for its epidemic multiplication occur over a long period, or recur at frequent intervals. Fortunately, in North India at least, the fungus has proved extremely susceptible to changes in climatic conditions, which in nature occur sufficiently frequently to prevent the disease causing serious damage.

Managers are requested to keep the Institute advised of the occurrence of this disease on their estates, the extent of the damage, and of the weather conditions during the attack.