CROP PROTECTION BY MODIFIED AGRICULTURAL METHODS.

PART I. THE CONTROL OF SHADE.

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The practice of cutting out shade trees as a blister blight control measure, which is unfortunately so widespread and which has been particularly noticeable during the recent wet weather, seems to have arisen from two misconceptions — the first based on a misunderstanding of the Institute's early advice that "shade should be controlled," and the second on the common fallacy that the yields will be increased as a result. I have heard it said that "by getting more sunshine on to my tea I can not only considerably reduce blister blight, but increase yields by as much as 150 lbs. per acre, thus deriving a double benefit by cutting out the shade." In fact the only increase derived is in the amount of soil erosion suffered, and it is unfortunately equally true that the harm done in a few days by such ill-considered destruction can only be undone over a period of years, by restoring the original stand.

Taking each of these points separately, some degree of "shade control" may be desirable where the overhead canopy is exceptionally heavy, and in areas where mist hangs about for most of the day, but it is doubtful whether the incidence of blister blight will be reduced to any material extent. Areas which are particularly liable to attack on account of the locality factors being favourable to blister blight will most certainly be badly attacked whether shade trees are present or not, and no amount of clearing will let in the sun if it is blotted out in any case by mist and clouds for weeks on end. Further, it should be pointed out that our recommendation with regard to shade control was made in the early days soon after the appearance of blister blight in this country, and in the absence of anything better this line was suggested as a palliative measure, the importance of which has since been greatly exaggerated. Control measures along other lines (by spraying and dusting) have been developed to such an extent that the contribution made by shade control in conjunction with these methods is a negligible factor.

With regard to the effect of shade trees on yield, tea is a shade-loving crop, and it is impossible to improve on the environmental factor to which it is accustomed in its natural habitat, where it grows in all pure Albizzia forests. This hypothesis is amply borne out by the results of recent experiments at the Indian Tea Association's Research Station, Tocklai in Assam, which have shown that yields from areas under a normal shade density are in fact higher than unshaded areas at all manurial levels up to 100 lbs. nitrogen per acre. Actual figures for yield increases due to shade at various nitrogen levels are set out in the table which is reproduced here with acknowledgment to the Tocklai Research Station, to which I am much indebted for this information.

This table shows that the response to shade varies between a maximum of 19.1 per cent increase in yield for areas with no nitrogen added, and 2.5 per cent increase in yield for areas with between 60 and 90 lbs. Nitrogen per acre.*

	% Increase per acre			
	No Nitrogen.	1st 30 lbs. N.	2nd 30 lbs. N.	3rd 30 lbs. N.
Increase due to shade.	19.1	6.8	3.3	2.5

* See reference at end.

Quite apart from this effect on yields—which is likely to be considerably more marked in the low-country — shade trees have a much more important function in helping to maintain the capital value of the soil. They should, in fact, be regarded as having a far more intimate relationship with the tea than their name "shade trees" implies, and their main functions can be summed up as follows :—

1. Their roots constantly break up the sub-soil physically, thus hastening the chemical processes necessary for its weathering and subsequent replacement of lost top-soil.
2. Plant food is brought up from the sub-soil and returned to the top layers of the soil in the form of leaf droppings.
3. Wind velocity is considerably reduced.
4. Light intensity, and hence soil temperature, are reduced; thus the harmful effects of insolation on the humus content of the soil is minimised. I would add that although these effects may appear to be largely of academic interest, they are of considerable practical importance, especially in new clearings in the low-country, where a combination of high wind and overheated soil often causes collar rot on a large scale.
5. Water conservation is increased and soil erosion correspondingly reduced owing to the following :—
   (a) their canopy breaks the violence of the rain,
   (b) their roots bind the soil together, thus increasing crumb formation of the soil particles and reducing surface run-off,
   (c) the porosity of the sub-soil is increased by the roots penetrating and breaking it up,
   (d) the water holding capacity of the top-soil is greatly increased by additional humus produced by leaf fall,
   (e) evaporation of moisture is reduced not only by the overhead canopy but by the layer of dead leaves on the ground.

These factors are of prime importance on the steep slopes typical of most up-country tea districts, where soil and water conservation measures are obviously essential if it is desired to prevent the loss of the thin layer of top soil on which is based such a large proportion of the country's economy, and to minimise the perennial danger of floods in the lower reaches of the rivers.

What then is recommended in regard to shade trees and how can these recommendations be correlated with "shade control" for blister blight purposes? These can be summed up as follows :—

1. *Control of Shade.*—The only method of effecting shade control that is permissible on any grounds whatsoever, is by lopping (large Albizzias are a different problem and will be dealt with shortly). Lopping should, of course, be done as far as possible just before the monsoon, so that the loppings can be forked in with manure at the most effective time and so that shade during the early part of the monsoon is at its minimum. Comparatively few estates lop

their grevilleas but observations show that this is quite feasible; it should not, however, be done at less than 15-20 feet from the ground.

2. *Cutting down and replacement of old Albizzias.*—The huge old specimens of *Albizzia moluccana* common in all the mid and upcountry tea districts must be regarded as a separate problem, since they have obviously outgrown their usefulness and must come out. In the first place they should of course never have been allowed to reach these gigantic proportions, but that is by the way. There are, however, (as always) several right and wrong ways of dealing with them but undoubtedly the most wrong of all is to cut them all out at once. Unfortunately this is the method usually adopted, and it is common to see whole "forests" of old albizzias all ringed at the same time, their vast gaunt skeleton presenting a most pitiful appearance; the practice is not, however, condemned for reasons of appearance, but on more solid sylvicultural and agricultural grounds.

The two basic principles on which the growing of *Albizzia moluccana* in tea estates depend should be the following:—

(i) a 10-year rotation (approximately).

(ii) an *un*even-aged stand.

A 10-year rotation is of course desirable as being the most economic, since the trees when 10 years old will provide timber of sufficient size for utilization in tea chests without being so excessively large as to cause widespread damage to the tea on felling. An uneven-aged stand is essential if it is desired to avoid getting into the same awkward situation every ten years which an even-aged stand inevitably causes, the wrong method of clear felling will then presumably again be adopted and any given area is thus perpetually in a vicious circle in which it has either by comparison to much shade (when the trees are all old) or too little shade (when the trees are young), and supplies of timber are intermittent and irregular. By adopting the nearest approximation to the natural selection sylvicultural system, however, a continuous supply of timber for tea chests is assured, besides controlled even shade and maximum soil protection. Thus, estates which have removed all their shade trees and now intend replanting with Albizzias are advised to make out a replanting programme in which each year the *whole* estate is planted to a proportion of the eventual stand, which should be complete and ready for removal of 1/10th of the trees in ten years time; estates with a good cover of albizzias which are now at, or approaching, the most economical size are advised to break up these even-aged stands gradually over a period of years and replant each year so as to form an un-even-aged stand. A further sound modification is to avoid as far as possible having large stands of the same species.

In conclusion, I would add that the principles I have outlined for the growing of *Albizzia moluccana* are equally applicable to other species of shade trees, except of course that the rotation has to be adjusted for each species according to its rate of growth and eventual size.

REFERENCE.

Indian Tea Association Scientific Department, Tocklai Experimental Station. Quarterly Report for first Quarter ending March, 1950 (p. 4).