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**COFFEE GROWING IN INDONESIA:
A BUILT-IN AND ENVIRONMENTALLY-FRIENDLY SYSTEM**

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COFFEE GROWING IN INDONESIA

A built-in and environmentally-friendly system *)

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I. HISTORICAL BACKGROUND.

Throughout the nineteenth century coffee was still mainly cultivated in Java Island, which was referred to as Java coffee and had got a good reputation for its high quality in the world market.

Arabica was the only coffee species planted in Indonesia until Robusta was introduced in 1900, when Arabica had been almost totally devastated by leaf rust disease.

Over the decades, mainly due to its resistance to the leaf rust, Robusta coffee has spread from Java onto other major islands of the archipelago, mainly to Sumatra, Sulawesi, and to a lesser extent Bali and Nusa Tenggara.

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Coffee growing had flourished after World War Two, especially by the smallholders.

The annual production is currently varying around 7 million bags of 60 kg, from a total planted areas of about 1,1 million ha (including immature trees of about 15 %).

Smallholders coffee accounts for about 94 % of the total production, the balance being produced by coffee estates, which are mainly located in Java Island.

Although more than 90 % of the coffee production consists of Robusta, a substantial amount of Arabica is also available.

Arabica coffee is grown at several highlands throughout the country, e.g. at Gayo Mountain (Aceh), Linthong, Mandailing (North Sumatra), Ijen (East Java), Toraja (South Sulawesi), and Kintamani (Bali).

II. THE USE OF SHADE TREES.

In its natural habitat coffee has been growing as an understory plant, sustaining under the shade of various taller trees.

In Indonesia, ever since its introduction to this country, coffee has been cultivated nearly always under shade trees.

Regardless the controversy, the use of shade trees for coffee growing in this country -- given its tropical condition -- has been found advantageous.

The benefits are not only related to the subsequent micro-climatic condition of the coffee trees, but also to the environmental condition of the coffee areas as a whole.

1. Temporary and permanent shade trees.

Shade trees are grown some time before coffee seedlings are planted in the field: 1 year before the coffee planting for permanent shade trees, and 3 - 4 months before coffee planting for temporary shade trees.

The commonly used temporary shade trees are Moghania macrophylla, and to a lesser extent Tephrosia vogelii, esp. for higher altitudes.

Temporary shade trees are normally required in hot low-land areas, to protect the young coffee trees from the high temperature and strong wind.

These trees should be cut-down and removed -- normally after 3 years -- whenever the permanent shade trees have fully grown to provide appropriate shading.

In coffee estates the permanent shade trees commonly used is invariably the Leucaena leucocephala, a deep-rooted and fast growing legume locally known as lamtoro.

In the smallholders coffee areas lamtoro is now getting more widely adopted, where the majority are still using Erythrina and Albizia for the shade trees.

2. Management of shade trees.

The growth of the temporary shade trees should be controlled by slashing the side branches, to avoid any eventual disturbances to the young coffees. The slashings will provide substantial volume of organic matter, which will improve the physical condition of the coffee soils.

At the beginning of the rainy season, the stem of the permanent shade trees should be cut to a certain height above the coffee trees, to reduce the relative humidity in the coffee plantings. High humidity during the rainy season is detrimental to the growth of the young coffee cherries, resulting in potentially tremendous fruitsheds.

The topped trees will have regained their full growth by the end of the rainy season, and meanwhile have also produced a good quantity of organic matter for soil improvement.

In the case of lamtoro trees, normally used in coffee plantations, the cuttings of the shade trees have provided enough firewood for coffee drying produced in the estates.

At the end of the rainy season the fully grown shade trees should be trimmed, by cutting smaller side branches, in order to provide appropriate sun light for the

initiation of the coffee flower buds, and in the case of Robusta coffee to facilitate wind movement for their cross fertilizations.

These trimmings will again produce ample organic matter for the soil.

3. Shade trees and environment.

3.1 Soil improvement.

Leaf falls and cuttings from the legume shade trees have contributed significantly to the organic matter improvement of the coffee soils.

By recycling the soil nutrients through their leaf falls, the use of shade trees is undoubtedly advantageous in sustaining the soil condition of the coffee areas.

The shade trees also protect the soil from direct sunlight, which might be detrimental to the soil microorganisms and the upper layer of the humus.

3.2 Hydrological impact.

In its combination with shade trees, a coffee plantation is comparable to a secondary forest in protecting the soil from erosion, and in conserving the soil water.

The trees will also protect the land terraces, on which coffee are planted in mountainous regions, so that the low-lying areas will obtain a more favourable hydrological condition.

4. Shade trees as fuel crops.

In a coffee plantation the periodic toppings and trimmings of the lamtoro shade trees have provided firewood, which is more than enough for the mechanical drying of the coffee produced in the plantation.

The shade tree density varies between 200 - 400 trees/ha, and assuming that each tree will produce 0,10 - 0,20 m³ of firewood, the total firewood obtained will vary between 20 - 80 m³/ha.

Since it will normally require less than 4 m³ firewood for the drying of 1 ton coffee beans, the firewood production from one ha coffee planting will provide fuel for 5 - 20 ton of coffee beans.

In coffee estates the cherries are normally wet-processed, and dried in mechanical dryers on the same day of the harvesting, by using firewood for fuel.

The use of *Leucaena* shade trees has rendered a built-in system in the fuel requirement for the bean drying in coffee plantations.

The trees provide a renewable source of fuel crop for the estate coffee industry in this country.

III. PRUNING SYSTEM.

1. Single-stem pruning system.

The pruning system used in coffee estates is the single-stem system, while in the smallholders coffee the multiple-stem system is more common.

Nevertheless the single-stem system is now getting more popularity among the coffee farmers, especially where labour force is easily available.

This system is more elaborate, but provides better access to selective harvesting of the coffee cherries, and to the control of pests and diseases.

Single-stem system is essentially a coffee branches management, to provide each tree successively with a certain number of productive primary branches.

2. Removal of soil nutrients.

Since the pruning is only limited to the side branches -- leaving the main stem intact -- the removal of soil nutrients by this pruning system is considerably lower as compared to multiple-stem system.

The system does not deprive the soil much of its mineral nutrients, and gives more comfortable condition for the plantation operational works.

3. Labour intensive.

Single-stem system is more labour intensive, and the labour requirement may reach 40 - 50 % higher as compared to multiple-stem pruning.

The system is consequently more applicable to regions where labour force is easily available, as it is in Java, where the system is commonly used in coffee plantations.

It gives more employment to the people from the surrounding villages, resulting in a better socio-economical environment for the plantation industry, which is mostly located at rural and isolated area.

IV. PEST CONTROL.

Berry borer (Stephanoderes hampei) is the major pest of coffee in Indonesia, especially in Robusta coffee.

This insect is not only reducing the production, but also damaging the coffee bean quality.

1. Agronomical control.

Stephanoderes nampei is a monophagous insect, living and reproducing only in the coffee fruits.

This important knowledge has lead the planters to apply the agronomical control to break the life cycle of the insect.

By the end of the harvesting period all the remaining young cherries with diameters of 5 mm or more should be stripped from the trees, so that no mature coffee fruits are available to the insect to live and reproduce.

In addition to the young cherry stripping, all the fallen coffee fruits -- which have been shed unintentionally during the harvesting operation -- should be regularly collected from the ground, and submerged into boiling water.

At the beginning of the harvesting period, almost all the ripened and red colored cherries are infested by these insects.

These cherries should be seperately collected, and submerged into boiling water, to kill the eggs and larvae of the insects.

2. Biological control.

The agronomical control is apparently unsuitable for regions with high rainfalls, where the rainy and dry seasons are not significantly separated from each other.

Harvesting pattern of the coffee in this region is more or less continuous, so that stripping of young cherries will be uneconomical, due to the higher loss of the cherries to be stripped.

In such wet regions the use of a Beauveria fungi, which grows and feeds on the larvae of this berry borer, has been found to be quite effective and unexpensive.

This biological control is now getting more applied by the coffee farmers in Sumatra, where the climatic condition is mostly favourable for the growth of the fungi.

It is save for the operators and the coffee consumers, and presumably compatible with the environmental condition of the coffee regions.

V. CONCLUSION.

The use of shade trees provides a built-in system in the fuel requirement for coffee drying, and to some extent in sustaining the soil fertility.

Hydrologically the system is comparable to secondary forest in protecting the soil from erosion, and in conserving the soil water of the region.

Single-stem pruning system, commonly adopted in coffee estates in Java, is environmentally more friendly, and socio-economically more preferable for the business environment of a coffee estate industry.

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