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NATURAL RUBBER

A Commercially Important Forest Species

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The rubber tree, Hevea, became known to the scientific community when the French Botanist Aublet described the genus from material collected from French Guiana. He not only described the genus and its first species, Hevea guianensis, but detailed the native method of exploiting it for rubber and appended numerous ethnobotanical data on the use of the seeds by the natives as food. Twenty-six years later, K. L. Willderow, a German Botanist, described a second species, Hevea brasiliensis, from material collected at the mouth of the Amazon River basin. Subsequent botanical exploration of the Amazon Valley-notably that carried out by the British Botanist Richard Spruce-continued to add new species to the genus, which now comprises 10 species and three varieties.

Not all the species yield a latex capable of producing rubber: only Hevea guianensis, Hevea benthamiana, and Hevea brasiliensis have sufficient latex to give economic quantity of rubber; and of these Hevea brasiliensis supplies the best product.

The natural distribution of Hevea is in the forests of Amazon Valley and spreads over Brazil, French Guiana, British Guiana, Venezuela, Colombia, Peru, Equadator and Bolivia. The import of Hevea seeds, first to Kew Gardens and then to Ceylon and other South-East Asian countries was arranged by Henry Wickham in 1876. All of the earlier shipments had been sent on sailing vessels. The few days saved by using a steamboat ensured successful germination in Kew's hothouses. Of the 70,000 seeds, 2,800 germinated. Young trees from this introduction were sent to Ceylon, where several of the original trees still are living in botanical gardens. From Ceylon some went to Singapore and other parts of the empire in the tropics. The domestication of this tree, has in one century drastically changed life around the world.

India ranks as fifth largest in area and fourth in production in the world. In order to achieve self sufficiency it is essential to expand rubber cultivation.

Rubber for afforestation

In none of the other rubber producing countries rubber is classified as a non-forest tree. There is no law in any of these countries against using Hevea brasiliensis for afforestation purposes. This natural forest tree, besides providing an excellent and thick tree cover to the land serves other forests objectives as well. The rubber tree is the major source of fuel wood in South India and most of the rubber growing countries. The timber, after borax treatment and seasoning, can be used for furniture making and construction purposes. After treatment, the value of the timber is comparable to the timber of other country woods. The rubber estates are used to produce honey and a major part of the honey produced in this country comes from rubber plantations. The rubber seed is used for extraction of oil which is a good substitute for linseed oil. Further, rubber seed can be used for animal feed. In China, the South China Academy of Tropical Crops has claimed that rubber seed oil can be upgraded for edible purposes also. Under domestication, this tree is cultivated on properly built contour terraces and is grown usually in association with a leguminous cover crop, Pueraria phaseoloides. Because of these cultural practices, a Hevea plantation provides excellent soil and water conservation and prevents erosion.

Biomass Production

Studies conducted on biomass production by rubber plantations revealed that Hevea brasiliensis is comparable with

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Table I
Biomass production (Tonnes/ha/year)

Vegetation	Production
Rain forest	10-25
Bamboo	27.8
Eucalyptus	27.1
Alnus	19.0
Poplar	14.0
Rubber	23-35

Table II
Comparison of Albedo of different surfaces

Vegetation Type	Albedo (%)
Deciduous forest	0.15 – 0.18
Coniferous forest	0.09 – 0.15
Tropical rain forest	0.07 - 0.15
Broad leaved forest	0.15 – 0.20
Rubber forest	0.14 - 0.16

Table III
Ratio of transpiration to potential evapotranspiration in few clones of Rubber

Clone	Wet season	Dry season
RRII 105	0.898	0.111
RRII 118	1.030	0.226
GI I	1.139	0.151
Tjir I	1.171	0.227
Mean	1.058	0.179

Table IV
Mean soil temperature (°C) at 10 cm depth under Rubber

Time	Open	Under Rubber	Difference
14.30 hrs	37.4	29.4	8.0

Table V
Addition of organic matter and nutrients (kg/ha) through litter fall in Hevea

Stage	Biomass dry weight	N	P	K	Mg
Immature + Cover crop					
24 months	6038	140	11	31	19
60 months	–	226-353	18-27	85-131	15-27
Mature	3860-7860	47-92	3.2-7.2	12-22	9.2-18.2

Table VI
Rainfall interception by Hevea and other species

Species	Percent
Eucalyptus	11.5
Shorea lubusta	25.3
Teak	20.8
Acacia catechu	28.5
Hevea	2 .6

any fast growing tropical forest species in regard to biomass production (Table 1). An annual biomass production of 35 tonnes has been reported for rubber plantations. Being a deciduous tree, rhe tree adds to the soil leaf litter, estimated to be to the tune of 4 to 7 tonnes. In addition, the leguminous cover crops that is grown in association with rubber adds another 4 tonnes of dry matter per hectare.

Evapotranspiration from rubber plantations

The energy budget of rubber canopy is comparable to that of different forests (Table 2). The Hevea species has adaptations to moisture stress. The crop coefficient values of rubber tree is reported to be lower during summer seasons (Table 3) compared to many other forest species. Even under wet conditions the transpiration rate is lower as compared to that of many other forest species. In summary, therefore, a plantation of rubber will conserve soil moisture more efficiently and its watar use efficiency is of a higher order as compared to these attributes of most of the forest species. The amount of radiant energy reaching the soil surface is low which results in lowered soil temperature of the order of 8° C compared to open (Table 4). This helps in reduced oxidation of organic matter The build up in organic matter improves the soil texture reduces evaporation loss of moisture from soil surface and also volatalization of Nitrogen.

Nutrient cycle

Around 7 tonnes of dry matter is added to soil every year through wintering of leaves (Table 5). Removal of nutrients through the economic product, i.e. latex, is negligible. It has good micorrhizal association helping it to grow well in acid soils.

Soil erosion

The well developed surface root system gives good soil binding and minimizes soil erosion. The rain fall interception is comparable to teak and around 50% more than that of eucalyptus Table 6). This also helps considerably in reducing soil erosion.

Flora and Fauna

A good number of forest herbs and shrubs also grow well under he Hevea canopy. More than 100 species are commonly seen. Such growths are not seen with other plantations crops. Many shade-loving medicinal herbs also grow very well in the plantation. The studies being conducted for commercialising intercropping of promising medicinal herbs are so far very successful. The important species under trial are Stryoilanthus haenianus, Adathoda bedomii, Rawolfia serpentia, Phaseolus indica, Plumbago rosea, Kemferria galanga, Alpinia rotunda, etc.

Various kinds of animals ranging from mites to elephants are seen in rubber plantations. Common pests of rubber are white ants, Boring beettles, Cockchafer grubs, moths, bugs, grass hoppers, crickets, weevil and mite. The animal pests attacking rubber are elephants, wild deer, wild sambar, wild pig, goats. squirrels, rats, spiders, slugs and snails and monkeys. In addition to these specific pests, other domesticated animals like cattle, duck, dog, hen, cock, etc. also thrive in rubber plantations. Varieties of insects like ants, cockroaches, crickets, earwigs, butterflies, moths, bugs, etc. also thrive in rubber plantations, as it is a long duration crop of about 30 years. Many species of frogs, toads, slugs and snails, millipeds, centipeds, nematodes, worms etc. survive in rubber plantations. Poisonous and nonpoisonous snakes in large number are usually seen in immature plantations and to a lesser extent in mature plantations.

The birds like Barred jungle owlet - Glaucidium radiatum, Golden backed woodpecker - Ninopium bengalensis, Crow-phesant - Centropus sinensis, Indian Tree Pie, Jungle Babbler, Jungle Mynah, Small Green Barbit, Common Mynah, House Crow, Jungle Crow, etc. have adapted fairly well to rubber plantations. In plantations situated near forests like Ranny and Karikkattoor some forest birds may also be seen. Certain migratory Warblers may also be seen. Certain doves were observed on shade trees (Gliricidia). In the open patches cleared for nursery dry open country birds like Rollers may be found.

A plantation of rubber thus provides a high rate of biomass production, it efficiently conserves soil moisture, prevent soil erosion and enriches the organic and mineral nutrient value of the soil. The domestication of this forest species has not changed its beneficial effects in these attributes as the cultural practices in rubber plantations is basically aimed at conserving forest conditions. A comparison of soil characteristics, water uptake, etc. in areas intensively planted with rubber with those in denuded forests or where afforestation has been attempted by exotic species such as Eucalyptus, etc. would reveal that Hevea brasiliensis is certainly a very suitable candidate for effective afforestation. □