Hevea brasiliensis (Willd. ex Adr de Juss.) Muell. et Arg.

Euphorbiaceae

LOCAL NAMES
Amharic (yegoma zaf); Arabic (lastik barâ); Burmese (kyetpaung); English (rubber,caoutchouc tree,hevea,para rubber tree,rubber wood); French (caoutchouc de para,hévéa,caoutchouc); German (heveakautschukbaum,Parakautschukbaum); Indonesian (kayu getah,pokok getah para,kayu karet); Italian (evea,albero del caucciu); Khmer (kausuu); Lao (Sino-Tibetan) (jaang); Malay (kayu getah,pokok getah para); Spanish (hule,jebe,hevea,caucho,siringa); Swahili (mpira); Thai (yang phara,katoh); Vietnamese (cao sau)

BOTANIC DESCRIPTION
Hevea brasiliensis is a quick-growing tree, rarely exceeding 25 m in height in plantations, but wild trees of over 40 m have been recorded. Bole usually straight or tapered, branchless for 10 m or more, up to at least 50 cm in diameter, without buttresses; bark surface smooth, hoop marked, grey to pale brown, inner bark pale brown, with abundant white latex; crown conical, branches slender. Root system with a well-developed taproot and far-spreading laterals.

Leaves alternate, palmate and each leaf with 3 leaflets. Leaflets elliptic petiolated, with a basal gland, pointed at the tip with lengths varying up to 45 cm; glabrous, with entire margin and pinnate venation.

Inflorescence in the form of pyramidal-shaped axillary panicles produced simultaneously with new leaves and arranged in cymose form. Flowers small, greenish-white, dioecious, female flowers usually larger than the male ones. In the female flower, gynaecium composed of 3 united carpels forming a 3-lobed, 3-celled ovary with a single ovule in each cell.

Seeds large, ovoid, slightly compressed, shiny, 2-3.5 x 1.5-3 cm, testa grey or pale brown with irregular dark brown dots, lines and blotches. The testa being derived from the female parent and the seed shape being determined by the pressures of the capsule, it is possible to identify the female parent of any seed by its markings and shape; this is the most reliable method of identifying clonal seed. Endosperm white in viable seeds, turning yellow in older seeds. Seeds weigh 2-4 g.

The generic name is derived from a local word in the Amazon, ‘heve’ meaning rubber.

BIOLOGY
Male and female flowers are produced on the same inflorescence in the ratio of 1:60-80. Flowering lasts about 2 weeks. Some male flowers open first, then drop after a day, followed by female flowers, which are open for 3-5 days, after which the rest of the male flowers then open. Neither male nor female flowers secrete nectar, but much is secreted by the extra-floral nectaries (on young leaf petioles and fleshy scales of young shoots). The flowers are pollinated by insects such as honeybees and midges (genera Atrichopogon, Dasyhelea, Forcipomyia). Only a few clones are self-incompatible, but most benefit from cross-pollination or from hand pollination. After pollination, fruits mature in 6-7 months and dehisce explosively, scattering seeds some distance away (e.g. 33 m) from the mother trees.

Showing the rubber tapping knife which is also used to hammer in the metal gutter at Bebeka, S-West Ethiopia. (Griffee P.)

Side view of a plastic rain guard covering the cup and its latex at Bebeka, S-West Ethiopia. (Griffee P.)

Smoked and fresh rubber sheets hung on galvanized wire for drying and smoking respectively; a temporary solution. (La Shwe U.)

ECOLOGY
Rubber in the wild grows in the tropical evergreen rainforest of the Amazon Basin, often in periodically flooded areas, but larger trees are found on the well-drained plateaux. In its natural habitat, it forms part of the middle storey of the tropical forest.

Rubber is successfully cultivated under humid lowland tropical conditions, roughly between 15 deg. N and 10 deg. S, with comparatively little variation in temperature. Planting above 400-500 m is not recommended because trees at higher altitudes tend to be smaller, with less vigorous growth, and with reduced production of both latex and timber. In high-rainfall areas, good internal drainage of the soil is important. In some areas, rubber can tolerate a 2-3 month period of drought. Strong winds may snap trunks and branches; however, more wind-resistant clones do exist.

BIOPHYSICAL LIMITS
Altitude: 300-500 m, Mean annual temperature: 23-35 deg. C, Mean annual rainfall: 1500-3000 (max. 4000) mm

Soil type: Tolerates some waterlogging and a wide pH range (4-8) but does better in acid soils. Lime is harmful, and shallow or poorly drained or peaty soils should be avoided. Thrives best in deep, well-drained loamy soil covered by natural undergrowth or a leguminous cover crop and protected from erosion.

DOCUMENTED SPECIES DISTRIBUTION

Native: Bolivia, Brazil, Colombia, Peru, Venezuela

Exotic: Brunei, Cambodia, China, Ethiopia, India, Indonesia, Laos, Liberia, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Thailand, Uganda, Vietnam

The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

PRODUCTS
Food: Although poisonous, seeds of rubber can be eaten as a famine food after processing, which involves prolonged soaking or boiling to remove the cyanic poisons. Some of the denser wild stands of rubber in the Amazon are said to be due to artificial enrichment by indigenous peoples to increase food supply. Seeds contain 40-50% oil, which dries well and is suitable for use as food and for technical purposes.

Fodder: Seeds are sometimes eaten off the ground by cattle. Press cake or extracted meal can be cautiously used as feed for stock.

Apiculture: So much nectar is secreted by the extra-floral nectaries that rubber is an important source of honey.

Fuel: Rubberwood was formerly regarded as a byproduct of the rubber plantations and used for the production of charcoal or as fuelwood, for brick making, tobacco drying and rubber drying.

Fibre: Offcuts and other rubberwood residues have been used successfully in Malaysia for the production of particle board, wood-cement board, and medium-density fibreboard.

Timber: Heartwood pale cream, often with a pink tinge when fresh, darkening on exposure to pale straw-coloured or pale brown, not clearly demarcated from the sapwood. Grain straight to shallowly interlocked. Texture moderately coarse but even; sawn rubberwood often shows black stripes with the inclusion of bark material, the result of poor tapping practices with damaged or removed cambium; in freshly sawn wood there is a characteristic and distinct smell of latex. The importance of the timber from the rubber plantations is now fully recognized, and in Southeast Asia it is planted solely for timber production. Most of the timber is used to manufacture furniture. Other uses include interior finish, moulding, e.g. for wall panelling, picture frames, drawer guides, cabinet and other handles, parquet flooring, many household utensils, blockboard cores, pallets, crates, coffins, veneer, and glue-laminated timber, e.g. for staircases and door and window components. Since the timber is only moderately durable when exposed to the elements, it should not be used for exterior purposes.

Latex or rubber: Latex, the source of hevea or para rubber, is obtained by tapping the trunks of the trees. The latex coagulates with the aid of acetic acid, formic acid and alum. Cured rubber is used for all types of rubber products.

Lipids: Seeds are the source of para rubber seed oil. Boiling removes the poison and releases the oil, which can be used for illumination. Kernels (50-60% of the seed) contain semi-drying pale yellow oil used in soap making, paints and varnishes.

Poison: Kernel oil is effective against houseflies and lice.

Other products: Rubberwood waste is an excellent medium for the growing of mushrooms, especially oyster mushrooms (Pleurotus spp.). The mottled seeds of H. brasiliensis are still used for fish bait by rural folk along the Amazon River.

SERVICES
Soil improver: Press cake or extracted meal can be used as fertilizer.

Intercropping: Intercropping with coffee or cocoa, perhaps in conjunction with ipecac, is possible. A fodder crop such as Cajanus might be tried for lac production instead of the usually recommended cover crops (e.g. Calopogonium, Centrosema, Flemingia, Psophocarpus, Pueraria). After a few years under legumes, no nitrogen fertilizer may be needed, but phosphorus, magnesium and potassium may be limiting in some areas.

TREE MANAGEMENT
The area to be planted with rubber is cleared, lined and marked for roads and drainage. Planting pits are dug, 75 x 75 x 75 cm, or 90 x 90 x 90 cm, and filled with surface soil and manure. Weed control is a must in rubber plantations. It is preferable to establish a legume cover after transplanting in the field. Pruning to shape the trees and removal of the unwanted lateral suckers is essential. Mulching should be carried out just before the end of the late rains. Recommended fertilizers must be applied at the right time and at the recommended doses. The economic life cycle of a rubber plantation is 30-35 years, after which replanting is necessary.

GERMPLASM MANAGEMENT
Seed storage behaviour is recalcitrant; viability can be maintained for 3 months in moist storage with moist charcoal and sawdust in a perforated polythene bag at 7-10 deg. C. Whole seed moisture content is 36%; lowest safe moisture content is 20%, and no seeds survive further desiccation to 15% mc.

Seeds are killed on exposure to -5 deg. C for 3-4 hours. Commercial clonal seed are stored in cold storage at about 4 deg. C, which often gives reduced but tolerable germination.

PESTS AND DISEASES
Pests include plant parasites such as Loranthus spp., nematodes such as Helicotylenchus cavenessi, H. dihystera, H. erythrinae and Meloidogyne incognita acrita.
Insect pests include scale insects (Aspidiotus cyanophylli and Parasaissetia nigra) and white ants. Snails can be serious pests of young trees, and various animals can damage the trunks. Three types of root disease, classified as white, red and brown, are controlled by cutting away diseased tissue and applying prophylactic coatings. Panel diseases, classified as black stripe, mouldy rot and panel necrosis, are minimized by spraying or coating specific fungicides. Stem disease, consisting of pink disease, stem canker and die-back, is reduced by brushing on specific fungicides. Leaf disease, consisting of abnormal leaf fall, Gloeosporium leaf disease, powdery mildew and bird’s-eye spot, is controlled by a variety of sprays, including copper oxychloride and sulphur dust, applied by spray or dusting techniques.

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SUGGESTED CITATION

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