

RUBBER LAND SUITABILITY EVALUATION

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Climate forms the first major part of any land evaluation exercise and therefore the evaluation of climate should be used in combination with the evaluation of the soils and landscape features in the selection of land for any agricultural purposes.

Rubber (*Hevea brasiliensis*), a native of Amazon tropical forests, can grow in a wide range of climate and soils. Nevertheless, in order to achieve the best possible results the land selected for planting should conform to acceptable standards.

Physiography

Most of the world's commercially grown rubber occurs within 10° of the equator at altitudes of less than 500m. With increasing distances to the north and south of the 10° latitude, prospects for successful rubber cultivation diminish. The Sri Lanka rubber plantations lie within 7° of the equator and is situated between 80°09' and 81°04' E longitudes and 6°50' and 7°38' N latitudes

Rubber is normally grown in Sri Lanka on land varying from flat to very steep. Between these two extremes, most of the rubber are grown in Sri Lanka on conditions ranging from undulating to moderately steep land. Rubber grows and yields reasonably well on these steep and usually stony slopes. Nevertheless, the period of immaturity can be shortened and yield capacity enhanced by providing contour terraces or individual tree platforms with linking paths. There are very few drainage problems on rubber plantations in Sri Lanka

Climate

There are three major climatic zones in Sri Lanka, viz. wet, dry and intermediate zones. Rubber is grown in almost the entire wet zone and certain regions of the intermediate zone. Climatic factors of importance for the successful establishment of rubber are rainfall, temperature, evaporation, relative humidity and wind.

Rainfall

The ideal annual rainfall for rubber should fall within the range of 1650 mm - 3000 mm and be reasonably uniformly distributed throughout the year. Both foliage and panel diseases are favoured by high rainfall and growth and yield tend to be depressed if rainfall is low. The time required for low rainfall to influence tree growth

rate and yield performance depends on the soil moisture retention properties, this may be less than one month in free draining sandy soils and upto two months in well structured clay soils which permit satisfactory root development to depth. Although precise limits have not been established, it is generally accepted that tree performance will be severely affected if rainfall over a six month period is less than 500 mm, especially when it is not uniformly distributed throughout that period. The distribution of rainfall also influences the quantity and quality of latex harvested by interfering with tapping operations and by contact with latex. Ideally, rainfall should occur in the late evening and should cease before 03.00 hours to permit tapping from dawn, trees yielding best during the cool of the morning. Unless special guards are provided, heavy rain after tapping will reduce total crop by preventing completion of tapping and by displacement of latex from cups. The tapping of wet trees is known to spread bark rot or black stripe, a phytophthora disease.

Hence, the main climatic factor affecting rubber cultivation in Sri Lanka is incidence of rainfall, with the wettest rubber growing districts receiving significantly more rain than the generally accepted annual 1650 - 3000 mm and two districts receiving less. The wetter districts can benefit from both the south-west and the north - east monsoons whilst the two drier districts have to rely on the north - east monsoon, which can be irregular.

Temperature and altitude

The temperature conditions in different physiographic regions do not show much variation. The annual average temperature in the plantation surface of the lower peneplain is very similar in value, approximately 27.8°. In the transitional area, somewhat cooler conditions are found; with temperature lower by about one or two degree celsius. The mean annual temperature in the wet zone is about 28°C ± 2°C. The temperature ranges from 20°C - 25°C in the night to 30°C - 35°C during the day in the months of December - February.

The ideal mean annual temperature for rubber should be within the range 23°C - 28°C and temperatures should not fall below 20°C for more than few weeks. The temperature decreases at about 0.6°C per 100 m in height. In such conditions, *Hevea* will grow most rapidly below 200 m, and trees require approximately 3 - 6 months longer to reach tappable size with each rise of 200 m above sea level, so that plantings above 600 m are not normally advisable. Moreover, at lower temperatures potentially damaging diseases, such as phytophthora secondary leaf fall and oidium leaf disease, are more common. Very high temperatures, in excess of 30°C over a prolonged period, also adversely affect tree performance by increasing evapotranspiration to the extent that physiological processes are impaired.

Relative humidity

The relative humidity ranges are generally similar except in the high elevation area with the afternoon values being generally less than the morning values.

High relative humidity favour crop growth by allowing the crops to absorb moisture and also reduce the evapotranspiration and consumptive use of water. However, high incidence of diseases can be a problem for rubber production under high humidity conditions.

Sunshine

The duration and intensity of sunshine should have a significant influence on latex sucrose levels. An increase in sunshine duration towards the end of the rainy season is often associated with an increase in latex production. Also, lower latex production during rainy season can be attributed to reduced sunshine hours. High radiation and its long duration from December to April cause scorching of bark in young rubber plants. The optimum sunshine requirement is about 2000 hours, at the rate of six hours per day in all months.

Wind

Rubber trees are susceptible to damage by strong winds and Clones differ in their susceptibility. The most wind prone clones may suffer severe damage in gales of over 40 knots, but even the most wind resistant clones suffer severe damage in windstorms of force exceeding 10 on the Beaufort scale (upto 56 knots). The extent of wind damage depends on the timing of winds; trees devoid of foliage suffer least damage whilst trees bearing dense canopies of moisture laden foliage shortly following refoliation are at greatest risk.

Recognizing that climate forms the first major part of any land evaluation exercise, a method to assess the suitability of climate for rubber is shown in Table 1. The evaluation of climate should be used in combination with the evaluation of the soils and landscape features.

Table 1. *Climatic requirements for Hevea cultivation*

Climatic characteristics	Degree of limitation*				
	0	1	2	3	4
Mean temperature (°C)	28 - 25	24 - 22	21 - 20	19 - 18	< 18
Mean daily maximum temp. (°C)	34 - 29	29 - 30	31 - 32	33 - 34	> 34
Mean daily minimum temp. (°C)	> 20	20 - 19	18 - 17	16 - 15	< 15
Mean annual rainfall (mm)	>2000	2000 - 1750	1749 - 1500	1499 - 1250	< 1250
Expected total rain interference (days/yr)	0 - 30	31 - 60	61 - 90	> 90	
Sunshine (hours/yr)	2100	2100 - 1800	1799 - 1400	1399 - 1000	> 1000
Mean annual R.H. (%)	< 80	80 - 100			
Length of dry season (months/yr)	0 - 1	2 - 3	4	5 - 6	6 >

*0 - No limitation, 4 - very serious limitation

Soil type

Many soils of different origin as well as morphological characteristics can support a viable rubber plantation. The important criteria for selection are soil pH, soil depth, soil structure, soil water holding capacity, its permeability and drainage.

In Sri Lanka, those soils that satisfy the primary requirement of an acid soil fall into three major soil groups. The largest of these extents are in red yellow podzolic soils, followed by reddish brown latosolics soils and then the immature brown loams.

A land suitability evaluation system for rubber cultivation is made up of a framework of soil and physiographic features which are considered to be desirable for optimal growth of rubber.

On the other hand, the poorer soils have properties which limit the optimal growth and performance of rubber and these limitations are graded as minor, moderate or serious in their degree of limiting crop performance.

The criteria considered in the evaluation system are as follows :

Desirable physical properties

- Soil depth up to 100 cm, free of pan/rock outcrop hindrance
- Well drained
- Good soil aeration
- Good soil structure (strong, moderately strong and moderate medium and fine subangular blocky structure)
- Friable to firm consistency
- Good water-holding capacity
- No peat or acid peat deeper than 20 cm
- Soil texture with sufficient clay (preferably a minimum amount of 35% clay to retain sufficient moisture and nutrients and about 30% sand to allow for expression of good physical soil properties like aeration and drainage).

Desirable environmental and physiographic features

- Gently sloping or rolling terrain between 2 - 9° slopes (4 - 20%) with minimal soil erosion and surface run-off.
- Water-table should be deeper than 100 cm.

Desirable chemical properties

- At least medium levels of total nutrient contents of nitrogen (N), phosphorus (P), potassium (K), and magnesium (Mg) with no deficiency of trace elements

- A pH of around 4.5
- Absence of saline/acid sulphate conditions.

Limitations are properties which limit good crop performance and can be graded as minor, moderate and serious in accordance to its degree of severity on affecting crop performance.

Minor limitations

- Weak soil structure within 90 cm.
- Moderate drainage conditions.
- Massive thick hard-pan below 50 cm from the surface or loosely packed gravels within 50 cm from the surface.
- Less than 50% rock outcrop in a unit area
- Susceptibility to soil erosion
- Sub-optimal soil nutrient status, reflected by low contents of nitrogen, phosphorus, potassium and magnesium.

Moderate limitations

- Slopes steeper than 9⁰ (20%) but less than 16⁰ (45%)
- Massive thick hard-pan between 20 and 50 cm of the surface
- Between 50% and 75% of rock outcrop in a unit area
- Permanent water-table between 20 and 50 cm of the surface
- Strong compaction influencing permeability and infiltration
- Poor structure (too sandy resulting in no structure or massive due to heavy clay in waterlogged conditions)
- Susceptible to moisture stress as reflected by textural and structural qualities
- Poor nutrient status.

Serious limitations

- Slopes steeper than 16⁰ (45%)
- Massive thick hard-pan at or very close (within 20 cm) to the surface
- More than 75% of rock outcrop in a unit area
- Permanent water-table at or near (within 20 cm) the surface
- Acid peat layer thicker than 20 cm at or near the surface
- Land disturbed by mining activities and very sandy deposits, with more than 90% sand.
- Very poor nutrient status.

Land preparation

When a land is cleared, especially if it is cultivated, the closed nutrient cycle is broken, the water regime is changed and the productive potential of the site can deteriorate rapidly unless it is carefully managed. Exposure of the bare soil to the sun and to the impact of rainfall results in accelerated decomposition of the organic matter, leaching of the nutrients, breakdown of the aggregate structure of the surface soil, diminished infiltration of the rainfall and, except on flat land, much runoff of water and erosion of the nutrient-rich surface soil. To avoid these ill effects as far as possible, exposure of the bare soil should be minimized and the clearing and cultivation methods employed should disturb or compact the soil as little as possible and thus do the least damage to its structure. At the earliest opportunity after clearing, terraces or other soil conservation works should be constructed on sloping land and either a ground cover of controlled naturally regenerating vegetation established or leguminous cover plants sown between the rubber tree rows.

The importance of employing appropriate clearing methods and other, well-tried measures designed to conserve soil and water is nowadays generally appreciated, but, partly because of the cost, the required procedures are not always fully implemented. However, avoidance of the capital loss represented by the erosion of valuable, and irreplaceable, surface soil is normally well worth the initial expenditure on effective soil conservation.

Another essential preliminary is to prepare a schedule of the time, labour and equipment required for clearing and planting the area. Strict adherence to a time schedule is essential for the efficient conduct of operations in field and nursery. In most places the various operations have to be timed to fit in with seasonal variations in the rainfall.