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Research Article

Influence of Geographical Diversity, Climate, and Soil on the Rasa-Based Distribution of Medicinal Plants of India

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Abstract

India is characterized by remarkable geographical diversity, encompassing varied landforms, climatic conditions, and soil types that have shaped its natural environment and agricultural systems. Located in the Northern Hemisphere, the country is bordered by the Himalayas in the north and the Indian Ocean in the south, with the Arabian Sea and the Bay of Bengal on either side. Its extensive geographical extent contributes to significant variations in temperature, rainfall, vegetation, and topography. India's climate is predominantly tropical and is broadly classified into tropical wet, tropical dry, subtropical humid, and mountain climates, each influencing regional ecosystems and agricultural practices. Likewise, differences in geology, relief, and climate have resulted in the formation of diverse soil types, including alluvial, black, red, laterite, desert, mountain, alkaline, and peaty soils. Among these, alluvial soils are the most widespread and agriculturally productive. This article provides an overview of India's geographical location, tropical climate, and major soil types, emphasizing their characteristics, distribution, and significance in supporting agriculture, biodiversity, and socio-economic development. The diversity of India's climate and geological history has also led to the development of a wide variety of soils, each possessing distinct physical and chemical characteristics that influence agricultural productivity and land use. Soil formation in India has been shaped by factors such as parent rock material, climate, relief, vegetation, and time. The major soil groups include alluvial, black (regur), red, laterite, desert (arid), mountain or forest, saline and alkaline, and peaty and marshy soils. Among these, alluvial soils are the most extensive and agriculturally productive, covering vast stretches of the Indo-Gangetic-Brahmaputra Plains and supporting the cultivation of staple crops such as rice, wheat, sugarcane, and pulses. Black soils are renowned for their high moisture-retaining capacity and suitability for cotton cultivation, whereas red and laterite soils support a variety of crops under appropriate management. Desert and mountain soils, although limited in fertility, sustain unique ecosystems and specialized agricultural practices suited to their environmental conditions. *Vrikshayurveda* describes various aspects of plant management, including selection and preservation of seeds, propagation methods, plantation techniques, irrigation practices, nutrient management, protection from environmental stresses, diagnosis of plant diseases, and their treatment through natural methods. The principles outlined in this traditional text demonstrate a holistic approach in which soil, plants, water, climate, and ecological balance are considered interconnected factors essential for sustainable cultivation.

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INTRODUCTION

India, the seventh-largest country in the world, is located entirely in the Northern Hemisphere in the south-central part of Asia. It extends from 8°4′N to 37°6′N latitude and 68°7′E to 97°25′E longitude, with the Himalayas in the north and the Indian Ocean in the south. Bordered by the Arabian Sea and the Bay of Bengal, India has a coastline of 7,516.6 km and a land boundary of about 15,200 km. India's vast geographical extent contributes to its diverse landscapes, soils, and tropical climate, which greatly influence agriculture, biodiversity, and human life. India is a country of immense geographical diversity, with varied landforms, climatic conditions, and soil types that have significantly influenced its natural environment, agriculture, and socio-economic development. Stretching from the snow-covered Himalayas in the north to the tropical coasts in the south, and from the arid Thar Desert in the west to the humid forests of the northeast, India exhibits remarkable variations in temperature, rainfall, vegetation, and topography. These physical features create diverse ecological regions that support a rich variety of flora, fauna, and agricultural practices.

The country's climate is predominantly tropical and is greatly influenced by the monsoon system, latitude, altitude, and proximity to the sea. Based on the Köppen climate classification, India experiences four major climatic regions: tropical wet, tropical dry, subtropical humid, and mountain climate. These climatic variations determine the distribution of rainfall, temperature patterns, and the types of crops grown across different regions.

Similarly, India's diverse geological formations and environmental conditions have led to the development of a wide range of soils. The Indian Council of Agricultural Research (ICAR) classifies Indian soils into eight major types, including alluvial, black, red, laterite, desert, mountain, alkaline, and peaty and marshy soils. Each soil type possesses unique physical and chemical properties that influence agricultural productivity and land use. Among these, alluvial soils are the most extensive and fertile, supporting a large share of the country's agricultural production. India is characterized by extraordinary variations in topography, altitude, rainfall, temperature, and natural vegetation. Elevation ranges from sea level along the coasts to some of the world's highest mountain peaks in the Himalayas.

Consequently, climatic conditions vary from the cold alpine climate of the Himalayan region to the hot and humid tropical climate of the southern peninsula. Rainfall also exhibits considerable regional variation, exceeding 10,000 mm annually in parts of Meghalaya while remaining below 100 mm in the arid regions of western Rajasthan. These contrasts have resulted in the development of diverse ecosystems, including tropical rainforests, deciduous forests, thorn forests, mangroves, alpine meadows, grasslands, wetlands, and deserts. Together, these ecosystems support one of the richest biodiversities in the world, making India one of the globally recognized megadiverse countries.

The country's climate is predominantly tropical and is governed by a complex interaction of latitude, altitude, topography, pressure systems, ocean currents, and the seasonal monsoon winds. The monsoon system is the defining characteristic of India's climate and has profound implications for agriculture, water resources, ecosystems, and economic activities. The southwest monsoon, arriving during June to September, provides nearly three-fourths of the country's annual rainfall and serves as the lifeline of Indian agriculture. The retreating or northeast monsoon brings additional rainfall to the southeastern coast, particularly Tamil Nadu and adjoining regions, during October and November. Seasonal variations result in four distinct climatic periods: the cold weather season, the hot weather season, the southwest monsoon season, and the retreating monsoon season.

According to the Köppen climate classification…., India is broadly divided into four major climatic regions: tropical wet**,** tropical dry**,** subtropical humid**,** and mountain climate. Each climatic region exhibits distinct temperature and precipitation patterns that determine natural vegetation, water availability, agricultural practices, and patterns of human settlement. The diversity of climatic conditions enables India to cultivate a wide range of crops, including rice, wheat, maize, cotton, tea, coffee, sugarcane, spices, fruits, and pulses, making the country one of the world's leading agricultural producers. India's diverse climate, geology, and topography have resulted in the formation of a wide range of soils. Soil development is influenced by factors such as parent rock material, climate, relief, vegetation, and weathering processes, leading to variations in texture, fertility, mineral content, drainage, and moisture-holding capacity. The Indian Council of Agricultural Research (ICAR) classifies Indian soils into eight major groups: alluvial, black, red, laterite, desert, mountain, saline and alkaline, and peaty and marshy soils. Alluvial soils are the most widespread and fertile, supporting major crops in the Indo-Gangetic Plains and river deltas. Black soils are ideal for cotton cultivation due to their high moisture-retention capacity, while red, laterite, desert, mountain, saline, and peaty soils support different crops and ecosystems according to their regional conditions. These diverse soil types play a crucial role in agriculture, biodiversity, and sustainable land management in India. The interaction between India's geographical location, climate, and soil resources forms the foundation of its agricultural economy, ecological diversity, and human development. Variations in rainfall, temperature, relief, and soil fertility determine cropping patterns, irrigation practices, land-use systems, and the distribution of natural vegetation across the country. These natural factors also influence water resources, biodiversity conservation, rural livelihoods, industrial development, and regional economic growth. As climate change, land degradation, soil erosion, and water scarcity increasingly threaten sustainable development, understanding India's geographical features, climatic conditions, and soil resources has become more important than ever. Scientific knowledge of these natural systems provides the basis for effective environmental management, sustainable agriculture, natural resource conservation, disaster risk reduction, and climate-resilient development.

The relationship between soil characteristics, plant growth, and environmental conditions has been recognized in Indian traditional agricultural literature since ancient times. *Vrikshayurveda*, the traditional science of plant life, provides a

comprehensive understanding of plant cultivation, soil management, and ecological relationships. The classical text of *Vrikshayurveda* describes various aspects of plant science, including selection of suitable land, seed selection and preservation, propagation methods, plantation techniques, irrigation, nutrient management, plant protection, disease identification, and therapeutic measures for plant disorders.

Among the twelve chapters of *Vrikshayurveda*, *Bhoomi Nirupanam* specifically deals with the assessment and classification of land suitable for cultivation. *Surapala* emphasizes that proper evaluation of land is essential for successful plantation and agricultural productivity. The suitability of soil is assessed based on characteristics such as *Varna* (colour), *Rasa* (taste), *Guna* (properties), fertility, texture, moisture content, and climatic conditions. The classification of land into *Prashasta Bhoomi* (fertile and suitable land) and *Dusta Bhoomi* (unsuitable land) reflects an early scientific approach toward soil evaluation and sustainable land management.

Geographical Locations of India [1]

India is a large nation situated entirely in the Northern Hemisphere, occupying the south-central region of the Asian continent. The Indian mainland stretches between 8°4′N and 37°6′N latitudes and 68°7′E and 97°25′E longitudes, covering a significant portion of the Earth's land surface.

As the seventh-largest country in the world, India has a unique geographical identity. It is naturally separated from the rest of Asia by the lofty mountain ranges in the north and surrounded by the sea on three sides, giving it distinct physical boundaries.

The country has an international land border of approximately 15,200 km, while its total coastline, including the mainland and the island groups of the Andaman and Nicobar Islands and Lakshadweep, extends to about 7,516.6 km.

India is enclosed by the young fold mountains of the Himalayas in the north, northwest, and northeast. South of around 22°N latitude, the land gradually narrows into a peninsula that projects into the Indian Ocean, with the Arabian Sea lying to the west and the Bay of Bengal to the east.

Although the country's north–south and east–west extents are each close to 30 degrees, the east–west distance appears comparatively shorter. Because there is nearly a two-hour difference in local time between Gujarat in the west and Arunachal Pradesh in the east, 82°30′E longitude, passing through Mirzapur in Uttar Pradesh, has been adopted as the Standard Meridian of India for maintaining a uniform time across the country. In addition, the wide latitudinal extent causes noticeable variations in the length of day and night from the southern to the northern parts of India. The Tropic of Cancer passes through eight Indian states, namely Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura, and Mizoram. It crosses specific locations within these states, including Jasdan in Gujarat, Kalinjarh in Rajasthan, Shajapur in Madhya Pradesh, Sonhat in Chhattisgarh, Lohardaga in Jharkhand, Krishnanagar in West Bengal, Udaipur in Tripura, and Champhai in Mizoram. This important latitude, located at 23°30′ North, divides the country into tropical and subtropical climatic regions and significantly influences India's climate and seasonal variations.

Size and Extent: India extends between 8°4′ N and 37°6′ N latitudes and 68°7′ E and 97°25′ E longitudes. The country's southernmost point is Indira Point (formerly known as Pygmalion Point), situated at 6°45′ N latitude. The total north–south distance, measured from Indira Col in Kashmir to Kanyakumari, is approximately 3,214 km. The east–west extent of India, stretching from the Rann of Kachchh in the west to Arunachal Pradesh in the east, is approximately 2,933 km. Covering a total geographical area of 3,287,263 square kilometres, India occupies nearly 2.4% of the Earth's total land surface.The Tropic of Cancer passes through the central part of the country, dividing it into northern and southern latitudinal regions. The area located north of the Tropic of Cancer is almost twice as large as the area lying to its south. Beyond 22° N latitude, the Indian mainland gradually narrows and extends for about 800 km into the Indian Ocean, forming a distinctive peninsular landmass.[1]

India is bordered by the sea on three sides, giving it a long coastline of about 7,516.6 km. The country's coastal plains are located along its eastern and western coasts and are classified into two major regions: the Eastern Coastal Plains and the Western Coastal Plains.

Eastern coastal plains of India [1]

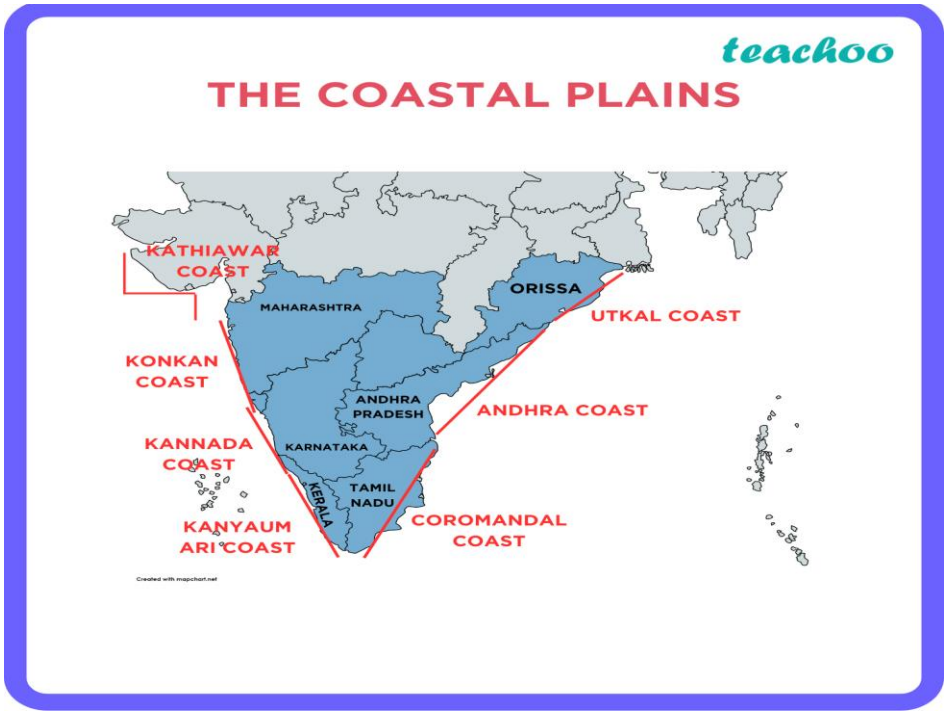
The Eastern Coastal Plains extend from West Bengal in the north to Tamil Nadu in the south, passing through Odisha and Andhra Pradesh. Several major rivers, including the Mahanadi, Godavari, Krishna, and Cauvery, form fertile deltas along this coast. These deltas are highly productive for agriculture, and the Krishna River delta is often referred to as the "Granary of South India" because of its rich agricultural output.

The Eastern Coastal Plains are further divided into three sections:

Utkal Coast: This region stretches between *Chilika* Lake and *Kolleru* Lake. It is broader than the Western Coastal Plains and receives heavy rainfall. Rice, coconut, and bananas are the main crops grown here.

Andhra Coast: Located between Kolleru Lake and Pulicat Lake, this coastal belt forms the deltaic basin of the Krishna and Godavari rivers. The fertile land supports extensive farming.

Coromandel Coast: Extending from Pulicat Lake to Kanyakumari in Tamil Nadu, the Coromandel Coast experiences relatively dry summers and receives most of its rainfall during the winter season from the northeast monsoon. Two important geographical features of this coast are *Chilika* Lake and *Pulicat* Lake, the latter being a lagoon.



Tropical Climate of India [2]

India's climate is classified into four major groups based on the Köppen climate classification system. Among them, the Tropical Wet and Tropical Dry climates are the most widespread.

Tropical Wet (Humid) Climate: This includes the tropical monsoon and tropical wet-and-dry (savanna) climates. The tropical monsoon climate is found in the Western Ghats, Malabar Coast, southern Assam, Lakshadweep, and the Andaman and Nicobar Islands, where heavy seasonal rainfall occurs from May to November. The tropical wet-and-dry climate is common across the interior Peninsular region and is characterized by hot summers and rainfall from June to September.

Tropical Dry Climate: This climate includes semi-arid (steppe) and arid (desert) regions. Semi-arid conditions occur in parts of Karnataka, Maharashtra, Tamil Nadu, and Andhra Pradesh, with low and uncertain rainfall. The desert climate is found mainly in western Rajasthan, while surrounding areas of Punjab, Haryana, and Kathiawar experience a semi-arid climate with hot summers and irregular monsoon rainfall.

Subtropical Humid Climate: This climate is found across most parts of North and Northeast India. It is characterized by hot summers and cold winters, with temperatures sometimes falling to 0°C. Most rainfall occurs during the summer monsoon, while some regions also receive winter rain or snowfall. May and June are generally the hottest months.

Mountain Climate: The Himalayan region experiences mountain climate, where the temperature decreases by about 0.6°C for every 100 m increase in altitude. Climatic conditions vary from tropical at lower elevations to tundra at higher altitudes. The Trans-Himalayan region is cold, dry, and windy. Windward slopes receive heavy rainfall, whereas leeward areas remain comparatively dry. Most snowfall occurs between December and February.[2]

VRIKSHAYURVEDA [3]

Vrikshayurveda is the traditional science of plant life that encompasses all aspects of plant cultivation and management. It provides knowledge about plant propagation, growth, development, physiology, pathology, productivity, and the diverse uses of plants as sources of food and medicine.

Vrikshayurveda is organized into twelve chapters, each focusing on a specific aspect of plant science, cultivation, and conservation.

- **Bhoomi Nirupanam (Assessment of Land):**

Bhoomi Nirupanam, the third chapter of *Vrikshayurveda*, deals with the assessment and classification of land for agriculture, horticulture, and tree plantation. The chapter emphasizes that the success of cultivation depends primarily on the proper selection of land. It describes various methods for evaluating soil based on its physical, chemical, and environmental characteristics.

- The chapter classifies land according to ***Varna*** (colour), ***Rasa*** (taste), ***Guna*** (properties), fertility, texture, moisture, and climatic conditions. These characteristics help determine the suitability of land for cultivating different plant species. The text also distinguishes between ***Prashasta Bhoomi*** (fertile and suitable land) and ***Dusta Bhoomi*** (infertile or unsuitable land). Fertile land is described as soft, well-drained, rich in nutrients, and capable of supporting healthy plant growth, whereas unsuitable land is characterized by excessive salinity, dryness, stoniness, poor fertility, or waterlogging.

- The chapter further explains that the selection of appropriate land according to the ecological requirements of plants improves their growth, productivity, and longevity. This demonstrates an early understanding of soil science and sustainable land management. Many of the principles described in *Bhoomi Nirupanam*, such as soil evaluation, site selection, and the relationship between soil quality and plant health, remain relevant to modern agronomy, horticulture, and environmental conservation.

Classification of Bhoomi [3]

According to *Bhoomi Nirupanam*, land is classified into different categories based on several characteristics:

- **Varna (Colour):** Soil colour is considered an indicator of fertility and mineral composition. Black, red, white, and yellow soils are described, each possessing distinct properties and suitability for different crops.
- **Rasa (Taste):** The taste of the soil, determined through traditional methods, indicates the predominance of different elemental qualities. Soil may possess sweet (*Madhura*), sour (*Amla*), salty (*Lavana*), pungent (*Katu*), bitter (*Tikta*), or astringent (*Kashaya*) characteristics, each influencing plant growth differently.
- **Guna (Properties):** The text describes soil according to qualities such as heaviness (*Guru*), lightness (*Laghu*), dryness (*Ruksha*), unctuousness (*Snigdha*), softness (*Mridu*), hardness (*Kathina*), and moisture-retaining capacity. These properties determine water availability and root penetration.
- **Climatic Conditions:** The suitability of land also depends upon rainfall, temperature, sunlight, wind direction, and local environmental conditions. The text recommends selecting land compatible with the ecological requirements of the intended plant species.

Prashasta Bhoomi (Suitable Land)

Surapala describes **Prashasta Bhoomi** as fertile, well-drained, soft, friable, and rich in organic matter. Such land possesses adequate moisture, good aeration, and balanced nutrient content, promoting healthy root development and vigorous plant growth. The presence of earthworms, grasses, and naturally growing vegetation is considered an indicator of fertile soil. Land that produces healthy crops consistently without excessive effort is regarded as ideal for cultivation.

Dusta Bhoomi (Unsuitable Land)

In contrast, ***Dusta Bhoomi*** is considered unsuitable for agriculture and plantation due to unfavorable physical or chemical characteristics. Such land may be excessively dry, saline, rocky, marshy, sandy, compact, or deficient in nutrients. Waterlogged soil, land with foul odor, excessive gravel, or poor drainage is also classified as unsuitable because it restricts root development and reduces crop productivity. The text advises avoiding such land or improving it through appropriate soil management practices before cultivation.

Importance of Soil Examination

The chapter recommends examining the soil before planting by observing its colour, texture, smell, moisture content, and natural vegetation. The presence of healthy grasses, shrubs, insects, and earthworms indicates fertile soil, whereas barren land with poor vegetation suggests infertility. These observational methods represent some of the earliest documented techniques of soil evaluation and land suitability assessment.

Scientific Significance

Many concepts described in *Bhoomi Nirupanam* correspond closely with modern principles of soil science. Soil colour is associated with mineral composition and organic matter content; texture determines water-holding capacity and aeration; fertility influences nutrient availability; and climate affects plant adaptation and productivity. Thus, *Surapala's* recommendations demonstrate a remarkable understanding of ecological interactions long before the development of modern agronomy.

Types of soil in India [3,4,5]

Alluvial Soils

Alluvial soils are mainly found in the Indo-*Ganga-Brahmaputra* Plains, the valleys of the *Narmada* and *Tapi* rivers, and the eastern and western coastal regions**.** These soils are formed from sediments brought by rivers from the Himalayas or deposits left behind by receding seas. They are the most widespread soil type in India, covering about 46% of the country's area.

Alluvial soils, distributed mainly across river plains and deltaic regions, are among the most productive soils of India. Their formation through continuous deposition of river sediments contributes to their favourable structure and agricultural importance. These soils generally possess good aeration, moderate water-holding capacity, and a balanced mineral composition.

Considering the characteristics described in *Vrikshayurveda*, alluvial soils can be related to *Prashasta Bhoomi* due to their ability to sustain diverse crops. They contain appreciable quantities of *potassium*, calcium, and magnesium**,** which support physiological processes such as water balance, enzyme activation, and structural development in plants. However, repeated cultivation may reduce nitrogen and available phosphorus levels because of low organic matter content. Addition of organic manures and sustainable nutrient management practices help maintain their productivity.

Red and Yellow Soils [3]

Red and yellow soils are widely distributed across the Peninsular region of India and derive their characteristic colour mainly from iron compounds. These soils are generally porous, well-drained, and light in texture, but their fertility varies depending on environmental conditions.

Their properties resemble the *Laghu* (light) and *Ruksha* (dry) qualities described in *Vrikshayurveda*. Due to extensive leaching, these soils generally contain lower levels of nitrogen, phosphorus, potassium, calcium, magnesium, and organic matter. However, their iron content contributes to their reddish

appearance. Appropriate application of organic matter and balanced nutrient supplementation improves their agricultural potential.

Black Soil [3]

Black soils, also known as regur soils, originate mainly from basaltic rocks and are recognized for their excellent moisture-retention capacity. Their clay-rich structure allows them to store water for extended periods, making them suitable for crops such as cotton.

The characteristics of black soil correspond with the *Guru* (heavy) and *Snigdha* (moisture-retaining) qualities described in *Vrikshayurveda*. These soils are naturally rich in calcium**,** magnesium**,** potassium, iron, and other mineral elements, contributing to their fertility. However, they commonly show limitations in nitrogen availability due to reduced organic matter content, and phosphorus may become less available because of fixation processes. Incorporation of organic residues and balanced fertilization improves nutrient availability.

Desert Soil

Desert soils are formed under arid and semi-arid conditions and are mainly deposited by wind action. They are found in Rajasthan (west of the Aravalli range), northern Gujarat, Saurashtra, Kutch, and parts of western Haryana and south-west Punjab.

Desert soils are generally poor in organic matter and nitrogen (N) because sparse vegetation and low microbial activity limit the accumulation and decomposition of organic residues. Available phosphorus (P) is usually low to moderate, as much of it is fixed in insoluble calcium phosphate compounds under alkaline conditions. In contrast, potassium (K) is often adequate to high, owing to the presence of potassium-bearing primary minerals that undergo limited weathering in arid climates. Calcium (Ca) is typically high because of the accumulation of calcium carbonate (caliche), while magnesium (Mg) is generally adequate to high.

Laterite Soil [3]

Laterite soils develop in regions receiving heavy rainfall and high temperatures, where intense weathering results in the removal of soluble nutrients. These soils are characterized by accumulation of iron and aluminium oxides.

The properties of laterite soils show similarities with the *Tikta Rasa* concept described in *Vrikshayurveda* due to their lightness, dryness, porous nature, and nutrient leaching characteristics. They are generally deficient in nitrogen, phosphorus, potassium, calcium, and magnesium, although they contain considerable amounts of iron and aluminium. Application of organic manure, compost, and proper nutrient management enhances their fertility.

Mountain Soil in India

Mountain soils are influenced by altitude, climate, vegetation cover, and parent rock material. Their fertility varies considerably according to ecological conditions. Forest-associated mountain soils often contain higher organic matter due to continuous decomposition of plant residues. These soils generally contain higher nitrogen levels under forest vegetation but may have reduced phosphorus availability because acidic conditions promote phosphorus fixation. Potassium, calcium, and magnesium levels depend upon the degree of weathering and mineral composition. The variation of mountain soils highlights the importance of selecting plant species according to environmental suitability, a principle emphasized in *Vrikshayurveda*.[4]

Saline and Alkaline Soils [5]

Saline and alkaline soils contain excessive soluble salts, particularly sodium salts, which negatively influence plant growth by affecting water uptake and nutrient absorption. These soils represent conditions similar to *Dusta Bhoomi* described in *Vrikshayurveda*.

Such soils generally exhibit reduced availability of nitrogen and phosphorus due to poor microbial activity and unfavourable chemical conditions. Although potassium may be present, excessive sodium interferes with its uptake by plants. Improvement of these soils requires reclamation practices such as drainage management, gypsum application, addition of organic matter, and cultivation of salt-tolerant plant species.

Soil Profile [6]

A soil profile is a vertical section of the ground that reveals the different layers of soil beneath the Earth's surface. It can be observed by digging a deep trench, usually between 2 and 6 metres. This cross-sectional view helps identify the arrangement of soil and rock layers and provides information about their characteristics. The different layers that appear parallel to the ground surface are known as soil horizons.

Soil Horizons

Soil horizons are distinct layers within a soil profile, and each layer differs in composition, texture, colour, age, and other physical and chemical properties. These horizons provide valuable information about the process of soil formation. Broadly, they are grouped into the topsoil, subsoil, and bedrock layers.

Major Horizons of a Soil Profile

A typical soil profile consists of several horizons identified by the letters O, A, E, B, C, and R. While some soil profiles include all these horizons, others may lack the E horizon depending on local environmental conditions. The A, B, and C horizons can also be divided into smaller sub-horizons such as A1, A2, A3, B1, B2, and B3 for more detailed soil classification.

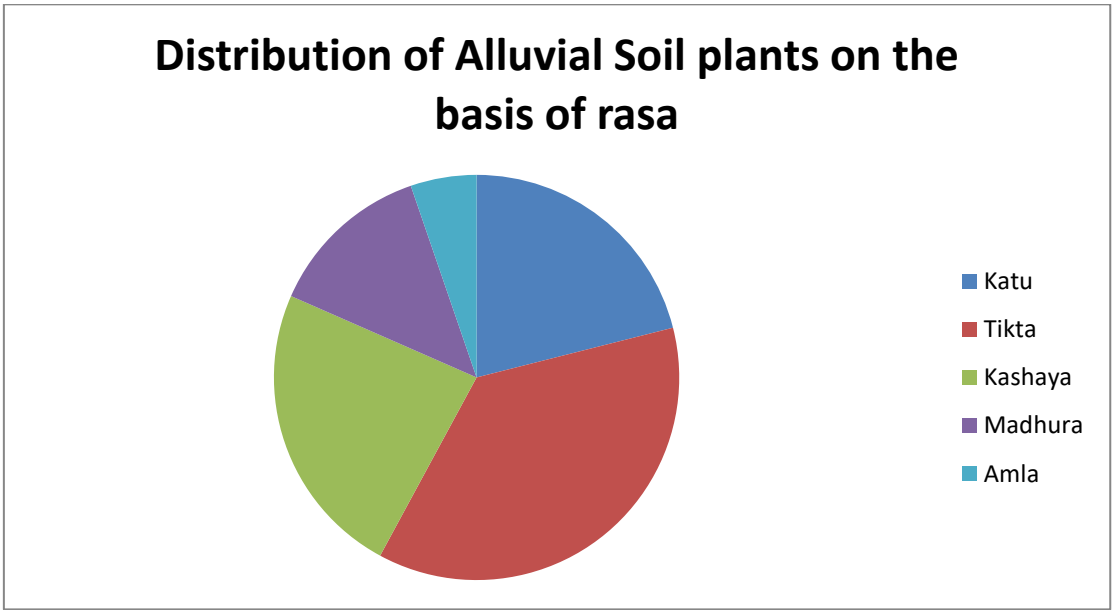
The thickness of soil horizons varies from one location to another and is influenced by factors such as climate, parent material, vegetation, and land use. Human activities like intensive farming, construction, and soil erosion may remove or alter certain horizons. Soil depth is measured from the surface downward. Deep soils generally develop over loose, clay-rich sedimentary deposits, whereas shallow soils are commonly found over limestone or chalk bedrock. Thick soil profiles support better root development and plant productivity, particularly in dry forests and woodlands where vegetation

depends on deep root systems extending into weathered rock. Soil thickness is commonly measured using soil penetration techniques such as tile probes.[6]

Ayurvedic medicinal plants grown in particular soil

1. Plants grown in Alluvial soil [7]

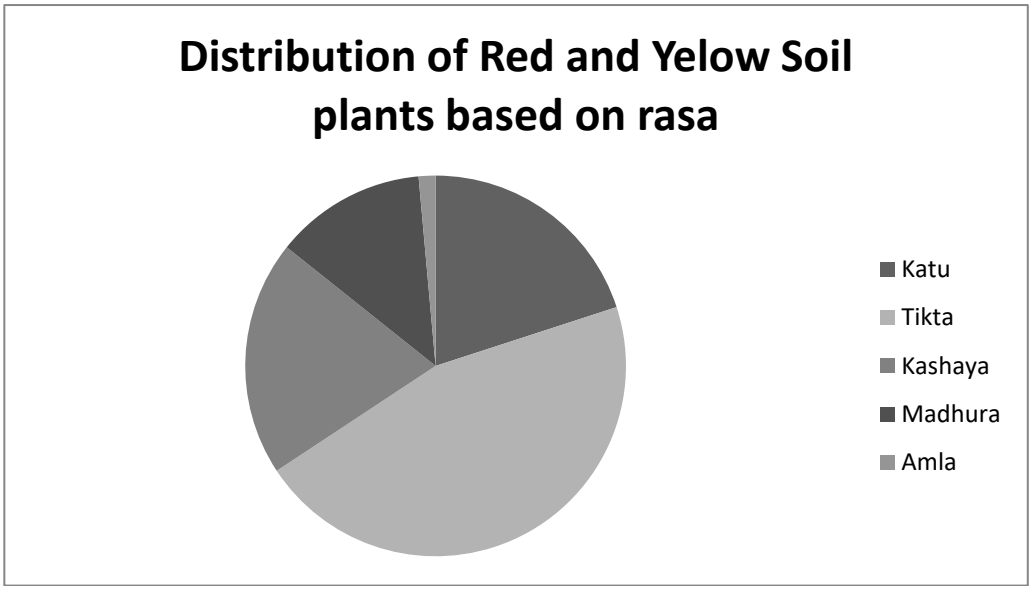
Plant	Botanical Name	Family	*Rasa*	*Guna*	Virya	Vipaka	Soil Type
Ashwagandha	Withania somnifera	Solanaceae	Katu, Tikta, kashaya	Snigdha, Laghu	Ushna	Madhura	Well drained sandy loam to alluvial soil.
Tulasi	Ocimum sanctum	Lamiaceae	Katu, tikta	Laghu, Ruksha, Teekshna	Ushna	Katu	Fertile well-drained alluvial soil
Aloe vera	Aloe barbadensis Mill.	Liliaceae	Tikta	Guru, snigdha, picchila	Sheeta	Katu	Sandy alluvial soil with good drainage
Kalmegh	Andrographis panniculata	Acanthaceae	Tikta	Laghu, ruksha	Ushna	Katu	Most fertile alluvial soil.
Shatavari	Asparagus racemosus	Liliaceae	Madhura, tikta	Guru ,snigdha	Sheeta	Madhura	Sandy loam and alluvial soil
Safed musli	Asparagus adscendens	Liliaceae	Madhura, tikta	Guru, snigdha	Sheeta	Madhura	Well-drained alluvial soil rich in organic matter
Brahmi	Bacopa monnieri	Scrophulariaceae	Tikta, kashaya	Laghu	Sheeta	Madhura	Moist alluvial soil near wetlands
Guduchi	Tinospora cordifolia	Menispermeaceae	Kashaya, tikta	Laghu, snigdha	Ushna	Madhura	Grows well in fertile alluvial soil
Isabgol	Plantago ovata	Plantaginaceae	Madhura	Snigdha, Guru, picchila	Sheeta	Madhura	Light alluvial and sandy loam soil.
Senna	Cassia augustifolia	Leguminaceae	Katu, tikta, madhura	Laghu, ruksha	Ushna	Katu	Well-drained alluvial soil.
Amla	Emblica officinalis	Euphorbeaceae	Amla pradhan panchrasa	Guru, sheeta	Sheeta	Madhura	Deep alluvial soil with good drainage.
Bael	Aegle marmelos	Rutaceae	Katu, Tikta, kashaya	Snigdha	Ushna	Katu	Fertile alluvial soil
Arjuna	Terminalia arjuna	Combretaceae	Kashaya	Ruksha, laghu	Sheeta	Katu	Riverbanks and alluvial soil
Neem	Azadirachta indica	Meliaceae	Tikta, kashaya	Laghu, ruksha	Sheeta	Katu	Deep alluvial soil
Mulethi	Glycyrhhiza glabra Linn.	Fabaceae	Madhura	Guru, snigdha	Sheeta	Madhura	Deep fertile alluvial soil
Haridra	Curcuma longa	Zingiberaceae	Tikta, katu	Ruksha, laghu	Ushna	Katu	Sandy loam, alluvial soil rich in organic matter
Bibhitaki	Terminalia bellirica	Combretaceae	Kashaya	Ruksha, laghu	Ushna	Madhura	Moist,loam fertile alluvial soil
Pippali	Piper longum	Piperaceae	Katu	Laghu, Teekshna	Ushna	Madhura	Humus-rich loam moist alluvial soil
Vidanga	Embelica ribes	Myrsinaceae	Katu	Laghu, Ruksha, teekshna	Ushna	Katu	Loamy fertile alluvial soil
Bhringraja	Eclipta alba	Asteraceae	Katu, tikta	Ruksha, laghu	Ushna	Katu	Silty-loam alluvial soil
Vasa	Adhatoda vasica	Acanthaceae	Tikta, kashaya	Ruksha, laghu	Sheeta	Katu	Clay-loam fertile alluvial soil
Haritaki	Terminalia chebula	Combretaceae	Kashaya pradhan Panchrasa Except lavana	Laghu, ruksha	Ushna	Madhura	Deep-loam, well drained alluvial soil



Plants grown in red and yellow soil [7]

Plant	Botanical name	Family	Rasa	Guna	Virya	Vipaka	Soil type
Ashwagandha	Withania somnifera	Solanaceae	Katu, Tikta, kashaya	Snigdha, laghu	Ushna	Madhura	Well drained sandy-loam to alluvial soil
Kiratikta	Swertia chirayata	Gentianaceae	Tikta	Laghu, ruksha	Sheeta	Katu	Red loamy soil
Bhringraj	Eclipta alba	Asteraceae	Katu, tikta	Ruksha, laghu	Ushna	Katu	Fertile red soil with sufficient moisture
Shankhapushpi	Convolvulus pluricaulis	Convolvulaceae	Tikta	Snigdha, picchila	Sheeta	Madhura	Well drained red sandy soil
Punarnava	Boerhavia diffusa Linn.	Nyctaginaceae	Madhura, tikta, kashaya	Laghu, ruksha	Ushna	Katu	Light textured red soil with moderate fertility
Shatavari	Asparagus racemosus	Liliaceae	Madhura, tikta	Guru, snigdha	Sheeta,	Madhura	Sandy loam and alluvial soil
Guduchi	Tinospora cordifolia	Menispermaceae	Kashaya, tikta	Laghu, snigdha	Ushna	Madhura	Thrives in fertile red soil
Vasa	Adhatoda vasica	Acanthaceae	Tikta, kashaya	Laghu, ruksha	Sheeta	Katu	Red loam soil under warm climatic conditions
Ushira	Vetivera zizanioides	Graminae	Tikta, madhura	Ruksha, laghu	Sheeta	Katu	Red sandy loam soil with moderate moisture
Lemongrass	Cymbopogon citratus	Poaceae	Katu, tikta	Teekshna, laghu	Ushna	Katu	Well drained red soil
Sarpagandha	Rauwolfia serpentina	Apocynaceae	Tikta	Ruksha	Ushna	Katu	Red loamy soil rich in organic matter
Kalmegh	Andrographis panniculata	Acanthaceae	Tikta	Laghu, ruksha	Ushna	Katu	Well drained red soil with moderate moisture
Kumari	Aloe barbadensis Mill.	Liliaceae	Tikta	Guru, snigdha, picchila	Sheeta	Katu	Sandy red soil with low to moderate fertility
Gudmar	Gymnema sylvestre	Asclepiadaceae	Kashaya, tikta	Laghu, ruksha	Ushna	Katu	Well drained red soil in tropical region
Bhumyamalaki	Phyllanthus niruri Linn.	Euphorbeaceae	Tikta, Kashaya, madhura	Laghu, ruksha	Sheeta	Madhura	Sandy red loam
Patha	Cissampelos pareira	Menispermeaceae	Tikta	Laghu, teekshna	Ushna	Katu	Well drained red-loam
Apamarg	Achyranthes aspera	Amaranthaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Sandy red soil
Kantkari	Solanum xanthocarpum	Solanaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Dry red sandy loam
Vidanga	Emblica ribes	Myrsinaceae	Katu, kashaya	Laghu, Ruksja, teekshna	Ushna	Katu	Lateritic red soil rich in humus
Haritaki	Terminalia chebula	Combretaceae	Panchrasa except	Laghu, ruksha	Ushna	Madhura	Red loam lateritic soil

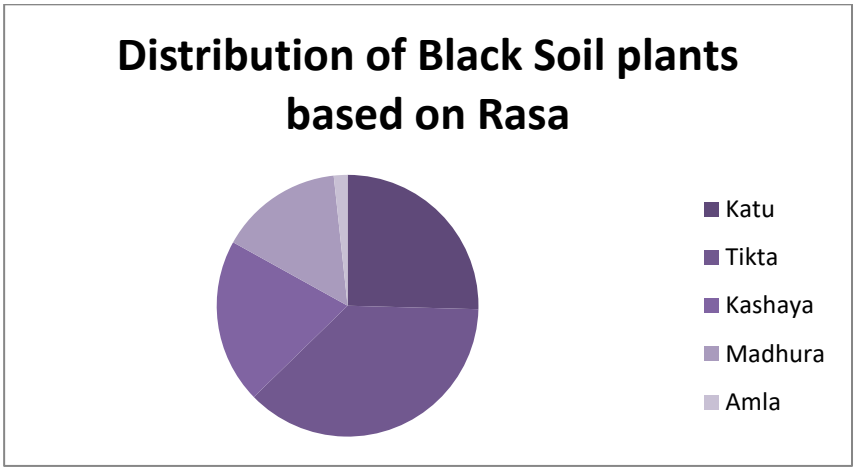
			lavana				
Bilva	Aegle marmelos	Rutaceae	Katu, Tikta, kashaya	Snigdha	Ushna	Katu	Adapted red and yellow soils under tropical climate
Brihati	Solanum indicum	Solanaceae	Katu, tikta	Laghu, ruksha	Ushna	Katu	Red-loam soil
Gokshura	Tribulus terrestris	Zygophyllaceae	Madhura	Guru, Snigdha	Sheeta	Madhura	Sandy red soil
Sadabahar	Vinca rosea	Apocyanaceae	Tikta, kashaya	Laghu, ruksha	Sheeta	Katu	Red loam soil
Lemongrass	Cymbopogon citratus	Poaceae	Katu, tikta	Teekshna	Ushna	Katu	Red loam, lateritic soil
Kaidrya	Murraya koenigii	Rutaceae	Kashaya, Tikta, madhura	Laghu, snigdha	Sheeta	Katu	Red loam
Shigru	Moringa oleifera	Moringaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Red sandy loam
Bala	Sida cordifolia	Malvaceae	Madhura	Guru, Snigdha, picchila	Sheeta	Madhura	Red loam
Atibala	Abutilon indicum	Malvaceae	Madhura	Laghu, snigdha	Sheeta	Madhura	Red loam
Kasamarda	Cassia occidentalis	Caesalpinaceae	Tikta, madhura	Laghu, ruksha	Ushna	Katu	Red sandy soil
Agaru	Aquilaria agallocha	Thymelaeceae	Katu, tikta	Laghu, teekshna	Ushna	Katu	Well-drained red loam (high rainfall)
Bhallataka	Semicarpus anacardium	Anacardaceae	Katu, Tikta, kashaya	Laghu, Teekshna, snigdha	Ushna	Madhura	Red lateritic soil
Patala	Stereospermum suaveolens	Bignoniaceae	Tikta, kashaya	Laghu, ruksha	Anusna	Katu	Red loam
Rasna	Pluchea lanceolata	Asteraceae	Tikta	Guru	Ushna	Katu	Sandy red loam
Kutaja	Holarrhena antidysenterica	Apocynaceae	Tikta, kashaya	Laghu, ruksha	Sheeta	Katu	Red loam
Arka	Calotropis procera	Asclepiadaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Red sandy soil



Plants grown in black soil [7]

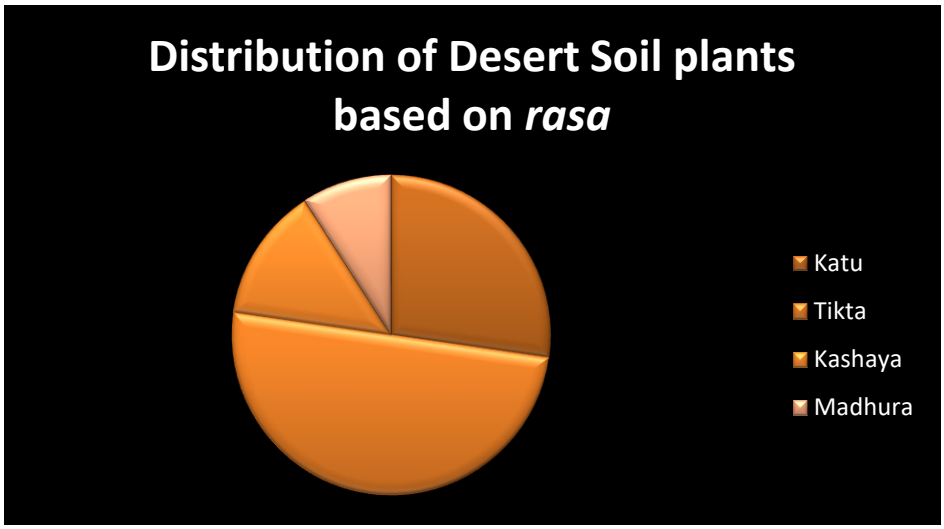
Plant	**Botanical name**	**Family**	***Rasa***	***Guna***	***Virya***	***Vipaka***	**Soil type**
Sariva	Hemidesmus indicus	Asclepiadaceae	*Madhura, Tikta*	*Guru, snigdha*	*Sheeta*	*Madhura*	Well drained black loam
Bala	Sida cordifolia	Malvaceae	*Madhura*	*Guru, picchila*	*Sheeta*	*Madhura*	Black clay loam
Atibala	Abutilon indicum	Malvaceae	*Madhura*	*Laghu, snigdha*	*Sheeta*	*Madhura*	Fertile black loam
Erand	Ricinus communis	Euphorbeacea	*Madhura, Katu, kashaya*	*Snigdha, Teekshna, sookshma*	*Ushna*	*Madhura*	Deep black cotton soil

Nirgundi	Vitex nigundo	Verbenaceae	*Katu, tikta*	*Laghu, ruksha*	*Ushna*	*Katu*	Black clay loam
Agnimantha	Premna mucronata	Verbenaceae	*Tikta, Katu, Kashaya, madhura*	*Laghu, ruksha*	*Ushna*	*Katu*	Black loam with good drainage
Arka	Calotropis procera	Asclepiadaceae	*Katu, tikta*	*Laghu, Ruksha, teekshna*	*Ushna*	*Katu*	Dry black soil
Shankhapushpi	Convolvulus pluricaulis	Convolvulaceae	*Tikta*	*Snigdha, picchila*	*Sheeta*	*Madhura*	Light black loam
Lodhra	Symplocos racemosa	Styraceae	*Kashaya, tikta*	*Laghu, ruksha*	*Sheeta*	*Katu*	Black loamy soil
Karanja	Pongamia pinnata	Fabaceae	*Tikta, katu*	*Laghu, teekshna*	*Ushna*	*Katu*	Black soil clay loam
Palash	Butea monosperma	Fabaceae	*Katu, Tikta, kashaya*	*Laghu, ruksha*	*Ushna*	*Katu*	Black cotton soil, red loam
Kanchnara	Bauhenia variegata	Caesalpinioideae	*Kashaya*	*Laghu, ruksha*	*Sheeta*	*Katu*	Black cotton soil
Patola	Trichosanthes dioica	Cucurbitaceae	*Tikta, katu*	*Laghu, ruksha*	*Ushna*	*Katu*	Black soil, fertile loam
Kakamachi	Solanum nigrum	Solanaceae	*Tikta*	*Laghu, snigdha*	*Anushna*	*Katu*	Black soil, loam
Nagarmotha	Cyperus rotundus	Cyperaceae	*Tikta, Katu, kashaya*	*Laghu, ruksha*	*Sheeta*	*Katu*	Black clay soil
Erand	Ricinus communis	Euphorbiaceae	*Madhura, Katu, kashaya*	*Snigdha, Teekshna, sookshma*	*Ushna*	*Madhura*	Deep black cotton soil
Chitraka	Plumbago zeylanica	Plumbaginaceae	*Katu*	*Laghu, Ruksha, teekshna*	*Ushna*	*Katu*	Black soil, sandy loam
Kapikacchu	Mucuna pruriens	Fabaceae	*Madhura, tikta*	*Guru, snigdha*	*Ushna*	*Madhura*	Black loam
Apamarg	Achyranthes aspera	Amaranthaceae	*Katu, tikta*	*Laghu, Ruksha, Teeshna, sara*	*Ushna*	*Katu*	Light black soil
Gudmar	Gymnema sylvestre	Asclepiadaceae	*Kashaya, tikta*	*Laghu, ruksha*	*Ushna*	*Katu*	Black loam
Neem	Azadirachta indica	Meliaceae	*Tikta, kashaya*	*Laghu, ruksha*	*Sheeta*	*Katu*	Black cotton soil
Mandukaparni	Centella asiatica	Apiaceae	*Tikta*	*Laghu*	*Sheeta*	*Madhura*	Moist black loam
Bhumyamalaki	Phyllanthus niruri Linn.	Euphorbiaceae	*Tikta, Kashaya, madhura*	*Laghu, ruksha*	*Sheeta*	*Madhura*	Black loam
Dronapushpi	Leucas cephalotes	Lamiaceae	*Katu*	*Guru, ruksha*	*Ushna*	*Katu*	Black loam
Kokom	Garcinia indica	Guttiferae	*Amla, madhura*	*Ruksha, guru*	*Ushna*	*Amla*	Well drained black lateritic soil
Dudhi	Euphorbia hirta	Euphorbiaceae	*Katu, tikta*	*Guru, Ruksha, kshara*	*Ushna*	*Katu*	Black loam
Devadaru	Cedrus deodara	Pinaceae	*Tikta, Katu, kashaya*	*Ruksha, laghu*	*Ushna*	*Katu*	Well-drained black loam
Varuna	Crataeva nurvala	Capparidaceae	*Tikta, kashaya*	*Laghu, ruksha*	*Ushna*	*Katu*	Black loam
Malkangni	Celastrus paniculatus	Celastraceae	*Katu, tikta*	*Teekshna*	*Ushna*	*Katu*	Black loam
Shankhapushpi	*Convolvulus pluricaulis*	Convolvulaceae	*Tikta*	*Snigdha, picchila*	*Sheeta*	*Madhura*	Light black soil



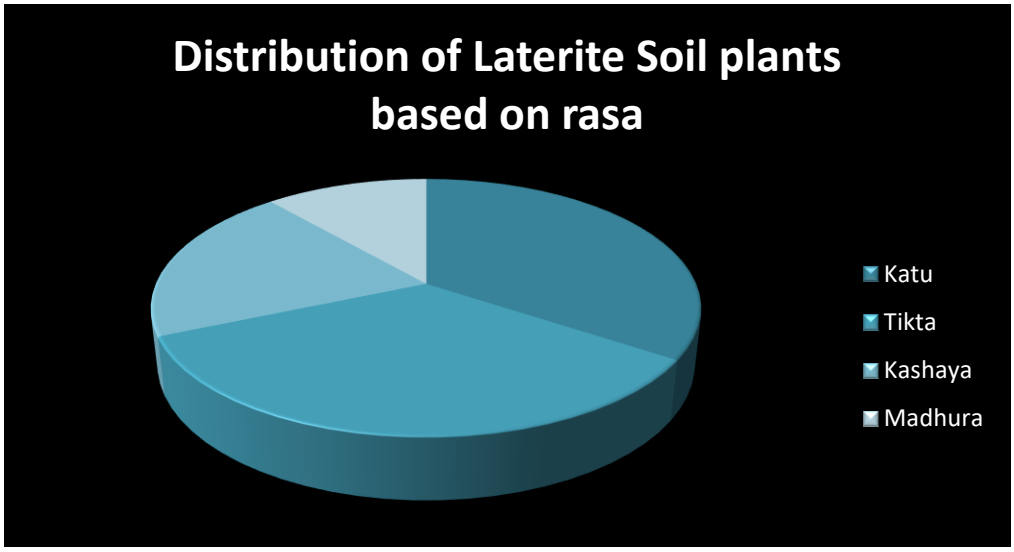
PLANTS GROWN IN DESERT SOIL [7]

Plant	Botanical Name	Family	*Rasa*	*Guna*	*Virya*	*Vipaka*	Soil Type
Parnabeeja	*Bryophyllum pinnatum*	Crassulaceae	*Kashaya*	*Laghu, ruksha*	*Sheeta*	*Madhura*	Sandy, gravelly
Chitrak	*Plumbago zeylanica*	Plumbaginaceae	*Katu*	*Laghu, Ruksha, teekshna*	*Ushna*	*Katu*	Sandy, well-drained
Guggul	*Commiphora mukul*	Burseraceae	*Tikta, katu*	*Laghu, Ruksha, Vishada, Sookshma, sara*	*Ushna*	*Katu*	Rocky, sandy desert
Kalmegh	*Andrographis paniculata*	Acanthaceae	*Tikta*	*Laghu, ruksha*	*Ushna*	*Katu*	Sandy loam
Karanj	*Pongamia pinnata*	Fabaceae	*Tikta, katu*	*Laghu, teekshna*	*Ushna*	*Katu*	Sandy loam
Sarpagandha	*Rauwolfia serpentina*	Apocynaceae	*Tikta*	*Ruksha*	*Ushna*	*Katu*	Sandy loam with organic matter
Neem	*Azadirachta indica*	Meliaceae	*Tikta, kashaya*	*Laghu, ruksha*	*Sheeta*	*Katu*	Sandy loam, calcareous
Shikakai	*Acacia concinna*	Fabaceae	*Tikta*	*Laghu*	*Sheeta*	*Katu*	Sandy loam
Usheer	*Vetiveria zizanioides*	Graminae	*Tikta, madhura*	*Ruksha*	*Sheeta*	*Katu*	Sandy loam
Babool	*Acacaia nilotica Linn.*	Leguminosea	*Kashaya*	*Guru, ruksha*	*Sheeta*	*Katu*	Sandy desert soil
Lemongrass	*Cimbopogon citratus*	Poaceae	*Katu, tikta*	*Laghu, Ruksha, teekshna*	*Ushna*	*Katu*	Sandy loam
Bhringraj	*Eclipta alba*	Asteraceae	*Katu, tikta*	*Ruksha, laghu*	*Ushna*	*Katu*	Sandy loam
Nirgundi	*Vitex nigundo*	Verbenaceae	*Katu, tikta*	*Ruksha, laghu*	*Ushna*	*Katu*	Sandy loam
Shatavari	*Asparagus recemosus*	Liliaceae	*Madhura, tikta*	*Guru, snigdha*	*Sheeta*	*Madhura*	Sandy loam
Guduchi	*Tinospora cordifolia*	Menispermeaceae	*Kashaya, tikta*	*Laghu, snigdha*	*Ushna*	*Madhura*	Sandy loam, Well-drained



Plants grown in laterite soil [7]

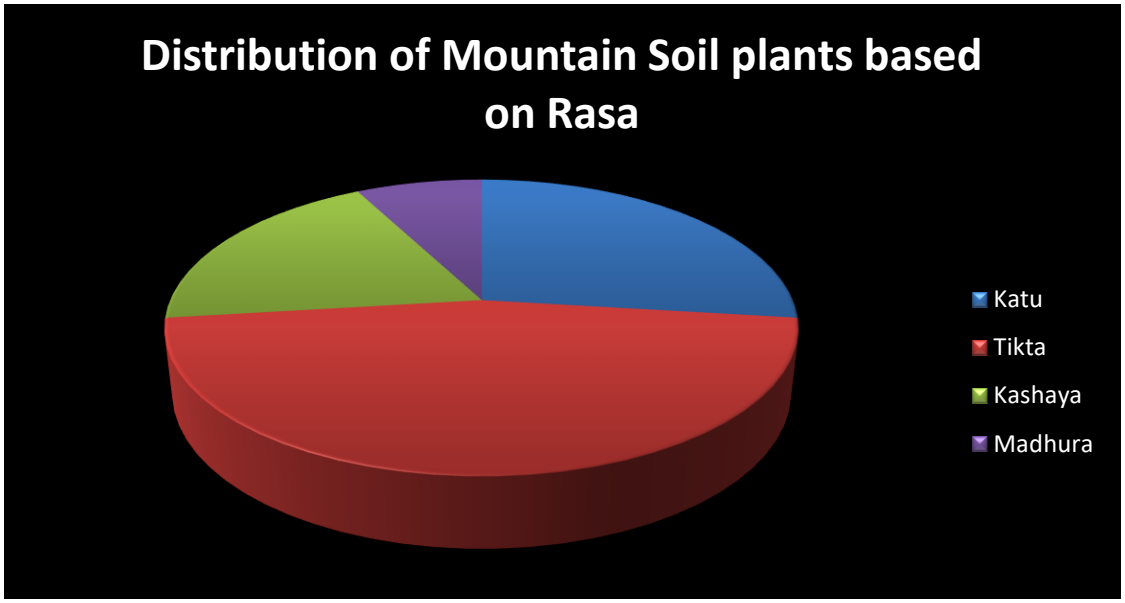
PLANT	BOTANICAL NAME	FAMILY	RASA	GUNA	VIRYA	VIPAKA	SOIL TYPE
Pippali	Piper longum	Piperaceae	Katu	Laghu, teekshna	Ushna	Madhura	Well-drained loamy laterite
Ela	Elettaria Cardemomum	Scitamineae	Katu, madhura	Laghu,ruksha	Sheeta	Katu	Laterite with high organic matter
Ginger	Zingiber officinale	Zingiberaceae	Katu	Guru, Ruksha, teekshna	Ushna	Madhura	Laterite loam
Haridra	Curcuma longa	Zingiberaceae	Tikta, katu	Ruksha, laghu	Ushna	Katu	Laterite loam
Lavanga	Syzygium aromaticum	Myrtaceae	Tikta, katu	Laghu, snigdha	Sheeta	Katu	Fertile lateritic soil
Nutmeg	Myristica fragrans	Myristicaceae	Tikta, katu	Laghu, teekshna	Ushna	Katu	Rich lateritic loam
Kantakari	Solanum xanthocarpum	Solanaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Well-drained lateritic soil
Parnayavani	Coleus amboinicus	Labiatae	Katu, Tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Well-drained lateritic soil
Bilva	Aegle marmelos	Rutaceae	Katu, Tikta, Kashaya	Snigdha	Ushna	Katu	Leteritic loam
Nagkesar	Mesua ferrea	Guttiferae	Kashaya, tikta	Ruksha, Teekshna, laghu	Ushna	Katu	Moist lateritic soil
Agnimantha	Premna mucronata	Verbenaceae	Tikta, Katu, Kashaya, madhura	Laghu, ruksha	Ushna	Katu	Lateritic sandy loam
Lodhra	Symplocos racemosus	Symplocaceae	Kashaya, tikta	Laghu, ruksha	Sheeta	Katu	Lateritic loam
Hibiscus	Rosa sinensis	Malvaceae	Kashaya, tikta	Laghu, ruksha	Sheeta	Katu	Lateritic loam
Kanchnar	Bauhinia variegata	Caesalpinoidae	Kashaya	Laghu, ruksha	Sheeta	Katu	Lateritic loam
Bakul	Mimosops elengi	Sapotaceae	Katu, kashaya	Guru	Sheeta	Katu	Lateritic loam
Kasamarda	Cassia occidentalis	Caselpinaceae	Tikta, madhura	Laghu, ruksha	Ushna	Katu	Lateritic sandy loam
Dhatura	Dhatura metel	Solanaceae	Tikta, katu	Laghu, ruksha	Ushna	Katu	Well-drained lateritic soil
Asthishrinkhala	Cissus quadrangularis	Vitaceae	Madhura	Laghu, ruksha	Ushna	Katu	Rocky lateritic soil



Plants grown in mountain soil [7]

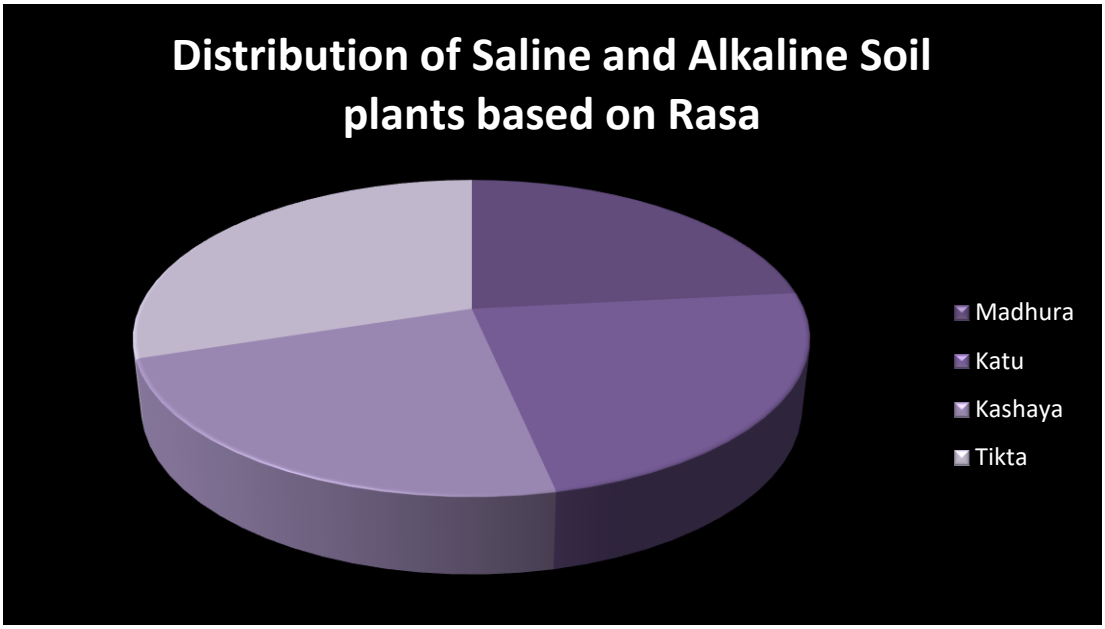
PLANT	BOTANICAL NAME	FAMILY	RASA	GUNA	VIRYA	VIPAKA	SOIL TYPE
Ratanjot	Arnebia nobilis	Boraginaceae	Tikta, kashaya	Laghu, ruksha	Ushna	Katu	Sandy mountain soil
Daruharidra	Berberis aristata	Berberidaceae	Tikta kashaya	Laghu, ruksha	Ushna	Katu	Well-drained mountain soil
Sea buckthorn	Hippophae rhamnoides	Elaeagnaceae	Amla, kashaya	Laghu, ruksha	Ushna	Katu	Sandy mountain soil

Vacha	Acorus calamus	Araceae	Katu, tikta	Laghu, teekshna	Ushna	Katu	Moist mountain wetlands
Mandukaparni	Centella asiatica	Apiaceae	Tikta	Laghu	Sheeta	Katu	Humus rich mountain soil
Banafsha	Viola odorata	Violaceae	Katu, tikta	Laghu, snigdha	Ushna	Katu	Humus rich mountain soil
Rasona	Allium sativum	Liliaceae	Madhura, Lavana, Katu, Tikta, kashaya	Guru,Snigdha, Sara, Teekshna	Ushna	Katu	Alpine mountain soil
Choraka	Angelica glauca	Apiaceae	Katu, tikta	Laghu, ruksha	Ushna	Katu	Mountain loam
Hapusha	Juniperus communis	Pinaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Mountain forest soil
Jangali ajwain	Thymus linearis	Apiaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Rocky mountain soil
Bichchu booti	Urtica dioica	Urticaceae	Amla, tikta	Laghu, ruksha	Ushna	Katu	Humus rich mountain soil
Himalayan rhubarb	Rheum emodi	Polygonaceae	Katu, tikta	Laghu, Ruksha, teekshna	Ushna	Katu	Alpine mountain soil
Kakoli	Roscoea purpurea	Zingiberaceae	Madhura	Guru, snigdha	Sheeta	Madhura	Moist mountain loam
Padmaka	Prunus cerasoides	Rosaceae	Kashaya, tikta	Laghu, snigdha	Sheeta	Katu	Mountain loam



Plants grown in saline and alkaline soils [7-8]

PLANT	BOTANICAL NAME	FAMILY	RASA	GUNA	VIRYA	VIPAKA	SOIL TYPE
Mahua	Madhuca longifolia	Sapotaceae	Madhura, kashaya	Guru, snigdha	Sheeta	Madhura	Slightly alkaline soil
Reetha	Sapindus trifoliatus Linn.	Sapindaceae	Tikta, katu	Laghu, teekshna	Ushna	Katu	Alkaline loam
Punarnava	Boerhavia diffusa Linn	Nyctaginaceae	Madhura, Tikta, kashaya	Laghu, ruksha	Sheeta	Madhura	Saline wasteland
Palash	Butea monosperma	Fabaceae	Katu, Tikta, kashaya	Laghu, ruksha	Ushna	Katu	Alkaline loam
Duralabha	Fagonia cretica Linn.	Zygophyllaceae	Madhura, Kashaya, katu	Laghu, snigdha	Sheeta	Madhura	Saline desert soil
Pilu	Salvadora persica Linn.	Salvadoraceae	Tikta, madhura	Laghu, Snigdha, teekshna	Ushna	Katu	Saline soil
Manjishtha	Rubia cordifolia	Rubiaceae	Tikta, Kashaya, madhura	Guru, ruksha	Ushna	Katu	Slightly alkaline loam
Ishwari	Aristolochia indica	Aristolochiaceae	Katu, Tikta, kashaya	Laghu, ruksha	Ushna	Katu	Mildly alkaline soil
Indian senna	Cassia augustifolia	Leguminosae	Katu, Tikta, madhura	Laghu, ruksha	Ushna	Katu	Alkaline wasteland
Erand	Ricinus communis	Euphorbeaceae	Madhura, Katu, kashaya	Snigdha, Teekshna, sookshma	Ushna	Madhura	Alkaline loam
Kareera	Capparis decidua	Capparidaceae	Katu, Tikta	Laghu, ruksha	Ushna	Katu	Alkaline desert soil
Shankhapushpi	Convolvulus pluricaulis	Convolvulaceae	Tikta	Snigdha, picchila	Sheeta	Madhura	Alkaline sandy soil



DISCUSSION

In Ayurveda, *rasa* (taste) is considered an important property of *Dravya* (substance), influencing its *Dosha* effects, therapeutic actions, and suitability for different applications. The six primary tastes described in Ayurveda are *Madhura* (sweet), *Amla* (sour), *Lavana* (salty), *Katu* (pungent), *Tikta* (bitter), and *Kashaya* (astringent). Among these, *Tikta Rasa* is associated with properties such as lightness (*Laghu*), dryness (*Ruksha*), purification, and reduction of *Kapha* and *Pitta* doshas. *Kashaya Rasa* possesses astringent, drying, and absorbent qualities and is mainly associated with reduction of *Kapha* and *Pitta* while promoting firmness and tissue contraction.

The comparison of Indian soil types with Ayurvedic *Rasa* classification suggests that variations in soil composition, mineral content, moisture availability, and environmental conditions may correspond with specific qualitative properties described in Ayurveda.

Alluvial Soil and *Tikta Rasa*

Alluvial soils, formed from river deposits, are rich in minerals such as potassium, calcium, and magnesium but often contain low organic matter and nitrogen. Their light texture, good drainage, and relatively dry nature conceptually align with the **Laghu** and **Ruksha** properties of **Tikta Rasa**. Thus, alluvial soil may be interpretively associated with *Tikta rasa.*

Red and Yellow Soil and *Tikta Rasa*

Red and yellow soils are characterized by abundant iron and aluminium oxides, a porous structure, and low levels of nitrogen, phosphorus, potassium, lime, and organic matter due to intense leaching. These features indicate reduced nutrient accumulation and relatively low natural fertility. Conceptually, these characteristics align with *Tikta Rasa*, which is described in Ayurveda as *Ruksha (dry), Laghu* (light), and *Shoshana (*absorbing or drying**).** Thus, the low levels of major nutrients (especially nitrogen and organic matter) and the dominance of mineral oxides may theoretically reflect the drying and nutrient-limited properties of *Tikta Rasa*. However, this is an interpretive analogy, not a scientifically established equivalence.

Desert Soil and *Tikta Rasa*

Desert soils develop under arid and semi-arid climatic conditions and contain low organic matter, low nitrogen, high soluble salts, and poor water-holding capacity. The dryness, lightness, and lack of moisture in these soils closely resemble the *Ruksha* and *Laghu* qualities of *Tikta Rasa*. Similar to bitter substances that reduce excessive moisture and metabolic accumulation, desert soils represent a dry ecological environment with limited biological activity.

Laterite Soil and Tikta Rasa

Laterite soils are formed under high rainfall and intense leaching, resulting in accumulation of iron and aluminium oxides while essential nutrients such as nitrogen, phosphorus, potassium, calcium, and magnesium are depleted. The acidic nature, low fertility, and strong leaching characteristics correspond with the cleansing and drying attributes of *Tikta Rasa*. The predominance of mineral oxides and reduced nutrient availability supports its comparison with bitter-quality substances.

Mountain Soil and *Tikta Rasa*

Mountain soils vary according to altitude, climate, and vegetation. Many high-altitude soils are acidic, low in available nutrients, and affected by heavy rainfall and erosion. Although forest-covered mountain soils may contain higher organic matter, the overall environment is influenced by leaching and nutrient limitations. These characteristics can be compared with *Tikta Rasa* due to its association with lightness, dryness, and reduction of excessive accumulation.

Black Soil and *Kashaya Rasa*

Black soil, also known as Regur soil, differs from the above soil types due to its high clay content, excellent moisture-retaining ability, and richness in minerals such as calcium, magnesium, and potassium. It develops deep cracks during dry periods and shows a strong absorptive capacity. These characteristics resemble *Kashaya Rasa*, which is known for its astringent, absorbent, and stabilizing properties. The ability of black soil to retain moisture and bind nutrients parallels the *Grahi* (absorbing) and *Stambhana* (constricting) actions attributed to astringent substances.

The comparison indicates that most light, porous, highly leached, and nutrient-depleted soils (alluvial, red and yellow, desert, laterite, and mountain soils) exhibit qualities comparable to *Tikta Rasa*, particularly due to their dryness, lightness, and mineral-dominant characteristics. In contrast, black soil demonstrates features similar to *Kashaya Rasa* because of its heavy texture, absorptive nature, moisture retention, and binding capacity.

However, this correlation represents a conceptual comparison between modern soil science characteristics and Ayurvedic qualitative principles rather than a direct chemical equivalence. Soil properties are determined by geological, climatic, and biological processes, whereas *Rasa* classification is based on Ayurvedic pharmacodynamic principles. Further interdisciplinary studies involving soil minerals, elemental composition, and Ayurvedic principles may provide deeper insights into the relationship between environmental factors and traditional classifications of substances. Overall, the present study highlights that the principles described in ***Bhoomi Nirupanam*** remain highly relevant in contemporary agriculture. The emphasis on appropriate land selection, soil quality, and sustainable cultivation demonstrates the scientific foresight of *Vrikshayurveda*. Integrating these traditional concepts with modern soil science may contribute to environmentally sustainable farming practices, improved soil health, and long-term agricultural productivity.

CONCLUSION

The comparative analysis suggests a conceptual relationship between Indian soil characteristics and an Ayurvedic *rasa* principles. Alluvial, red and yellow, desert, laterite, and mountain soils show similarities with *Tikta Rasa* due to their lightness, dryness, porosity, leaching, and low nutrient accumulation. Black soil resembles *Kashaya Rasa* because of its heavy texture, moisture retention, absorptive capacity, and binding properties. Although soil science and Ayurvedic concepts are based on different frameworks, this comparison provides an interdisciplinary understanding of environmental qualities. Further studies on mineral composition and Ayurvedic parameters are needed to establish deeper correlations. In *Surapala's Vrikshayurveda*, the importance of the plants & the information regarding the selection of seeds, saplings, the water supply, nutrients, measures to be followed if the plant is not flowering, the diseases & the treatment of the diseases are well explained. In the present era, as the crops & plantation we use more of dangerous chemicals which inturn harm the health of living beings as well as the environment. The principles described in *Bhoomi Nirupanam* continue to hold significance in the context of sustainable agriculture, soil conservation, and ecological management. By emphasizing careful land selection and the relationship between soil properties and plant health, *Vrikshayurveda* offers valuable insights that complement modern agricultural sciences. Further interdisciplinary research integrating Ayurvedic principles with contemporary soil science, mineralogical analysis, and environmental studies may help validate these traditional concepts and contribute to sustainable farming practices.

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