

D. Silvipasture Systems

Integrating Trees with Grazing: Combine tree planting with livestock grazing to improve soil structure and provide forage for livestock while reducing erosion on slopes.

Enhances soil health through organic matter inputs from both trees and animal manure, and helps reduce runoff. Plant fodder trees like *Leucaena* or *Acacia* along grazing areas to improve soil quality and provide animal feed.

4. Benefits of Nutrient Management and Agroforestry in High Rainfall Hill Regions

Soil Fertility: Organic inputs and balanced fertilization reduce nutrient loss from leaching and improve soil fertility.

Reduced Soil Erosion: Agroforestry practices like contour planting and terracing protect against soil erosion in sloped areas.

Water Retention: Improved soil structure and organic content enhance the soil's ability to retain moisture, reducing waterlogging and the need for irrigation.

Sustainability: Combining nutrient management with agroforestry systems promotes long-term soil health, biodiversity, and farm resilience to changing rainfall patterns.

Success stories of INM of rice cultivation of the Akole tehsil

A study on soil quality under various nutrient management systems for rice cultivation is currently underway in Akole Tehsil, focusing on different landscape positions. In the first year, the integrated nutrient management (INM) system-comprising the application of 6 t ha⁻¹ farmyard manure (providing 25 kg N of the recommended dose) and 75 kg N ha⁻¹ through urea, which has shown a very promising results. This system has significantly improved rice growth, development, and yield, achieving 3.2 t ha⁻¹, which is 1.8 times higher than the yield obtained using traditional farmer practices in the region (1.7 t ha⁻¹). While no immediate changes in soil properties have been observed, it is anticipated that these impacts will become more noticeable over time as the cultivation continues.



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Nutrient Management Systems and Agroforestry Models for Improving Soil Quality in High Rainfall Hill Regions



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Introduction

Soil quality refers to the soil's ability to sustain agricultural productivity, support plant growth, and maintain environmental health. High rainfall and steep slopes make soils in hill regions prone to erosion, nutrient leaching, and degradation. Maintaining good soil quality is crucial for preventing landslides, sustaining crop productivity, and preserving natural resources.

Nutrient Management Systems for Hilly Regions

Nutrient management is the efficient and responsible application of nutrients to crops to improve soil fertility while reducing the risk of nutrient loss in steep, high-rainfall areas.

A. Organic Nutrient Management

Use of Compost and Animal Manure: Organic matter like compost, farmyard manure, and vermicompost helps in improving soil structure, especially in hilly regions where soil can become compacted. It increases organic content, enhances water retention, and stabilizes soil on slopes. Apply composted organic matter before the monsoon season to enhance the soil's ability to absorb water and prevent runoff.

B. Integrated Nutrient Management (INM)

Combining Organic and Chemical Fertilizers: INM is key in hilly regions, where nutrient loss from leaching is a common issue. Combining organic inputs with judicious use

of chemical fertilizers ensures sustained soil fertility. It provides balanced nutrition, reduces nutrient runoff, and prevents soil degradation. Application of fertilizers should be in smaller, split doses during the growing season to minimize leaching, especially after heavy rains.

C. Green Manuring

Grow Legumes or Cover Crops: Plant leguminous cover crops (e.g., cowpea, pigeon pea) or green manures to fix nitrogen and improve soil quality. It adds organic matter, protects against erosion, and enhances soil fertility naturally. Use fast-growing cover crops during the fallow period to prevent soil erosion and improve nutrient availability.

D. Mulching

Using Crop Residues or Mulch: Apply organic mulch (e.g., leaves, straw) to cover the soil, reduce erosion, and conserve moisture. It helps control soil temperature, minimizes evaporation, and reduces the impact of heavy rainfall on soil erosion. Spread mulch around crops and tree bases, especially on sloped land, to reduce runoff and soil loss.

Agroforestry Models for Soil Quality Improvement in Hill Regions

Agroforestry integrates trees and shrubs into agricultural systems, which is particularly beneficial in hill regions for controlling erosion, improving water retention, and enhancing soil

fertility.

A. Contour Planting with Trees

Contour Hedgerows and Trees: Plant trees, shrubs, or grasses along contour lines to slow down water runoff, reduce soil erosion, and improve water infiltration.

It helps prevent soil erosion, improves water absorption, and stabilizes steep slopes. Plant nitrogen-fixing trees like Gliricidia or Leucaena along contour lines for additional soil fertility benefits.

B. Alley Cropping

Growing Crops with Trees: Grow crops between rows of trees or shrubs that protect the soil and improve its structure. It reduces erosion, improves water retention, and adds organic matter to the soil through leaf fall. Planting of trees such as Grevillea, Moringa, or indigenous fruit trees between crop rows to reduce runoff and increase soil stability.

C. Terracing with Agroforestry

Terrace Farming with Tree Crops: Terrace slopes and plant tree crops like fruit trees (e.g., mango, guava) or agroforestry species on the terrace edges to reduce water runoff and improve soil retention. It reduces soil erosion, conserves water, and adds organic matter to the soil through leaf litter. Incorporate fruit trees or multipurpose tree species in terraced land to diversify farm income while protecting the soil.