



Profitable Leguminous Intercropping in Tropical Tasar Host Plant Plantation

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The present investigation was conducted to evaluate the effect of different leguminous intercrops on soil fertility, nitrogen enrichment, host plant growth, and economic profitability in tropical tasar host plant plantations. Six leguminous intercrops namely black gram, green gram, cowpea, groundnut, soybean, and sunhemp were cultivated between rows of Arjun (*Terminalia arjuna*) and Asan (*Terminalia tomentosa*) plantations under lateritic soil conditions. Observations were recorded on nitrogen fixation capacity, soil organic carbon improvement, moisture conservation, host plant leaf yield, and economic profitability. The results revealed that all intercropping systems significantly improved soil quality and leaf production compared to non-intercropped plantations. Groundnut and soybean recorded the highest profitability and leaf yield enhancement, whereas sunhemp showed superior performance in improving soil organic carbon and soil structure. Cowpea demonstrated excellent moisture conservation and weed suppression capacity. The study indicates that scientific intercropping systems can improve sustainability and productivity of tropical tasar plantations through ecological soil management and integrated agroforestry practices.

Keywords: Tropical tasar plantation, Leguminous intercrop, Nitrogen fixation, Soil fertility, Arjun plantation, Asan plantation, Groundnut, Soybean, Sunhemp, Leaf yield, Sustainable agroforestry, Soil organic carbon, Moisture conservation, Tasar sericulture

Introduction

Tropical tasar sericulture is an important forest-based agroforestry system that supports the livelihood of rural and tribal communities in India. The tropical tasar silkworm, , depends primarily on host plants such as Arjun (*Terminalia arjuna*) and Asan (*Terminalia tomentosa*) for nutrition and cocoon production. The productivity of tasar host plants is directly influenced by soil fertility, nutrient availability, organic matter content, and moisture status. Lateritic soils commonly found in tropical tasar growing regions are generally poor in nitrogen and organic carbon. Continuous monocropping and lack of soil management often reduce host plant vigor and leaf productivity. Under such conditions, leguminous intercropping systems can play an important role in improving soil health and plantation productivity.

Leguminous crops possess the ability to fix atmospheric nitrogen through symbiotic association with Rhizobium bacteria present in root nodules. These crops enrich soil nitrogen, improve microbial activity, increase organic matter, conserve soil moisture, and reduce erosion. Intercropping also provides additional economic return and improves land-use efficiency.

Scientific integration of leguminous intercrops within tasar plantations may therefore improve host plant nutrition, enhance leaf biomass production, and support sustainable tasar culture. However, comparative information regarding the suitability and profitability of different intercrops in tasar plantation systems remains limited.

The present study was therefore undertaken to evaluate the comparative effect of six important leguminous intercrops on soil fertility, leaf yield, and economic profitability in tropical tasar host plant plantations.

Materials and Methods

Experimental Site

The experiment was conducted under tropical tasar host plant plantations established on red lateritic soil under tropical climatic conditions. The area received moderate rainfall and experienced warm summer with comparatively dry winter conditions.

Host Plants Used

The study was conducted under plantations of:

- Arjun (*Terminalia arjuna*)
- Asan (*Terminalia tomentosa*)

These host plants were maintained under uniform agronomic conditions throughout the experiment.

Intercrops Evaluated

Treatment	Intercrop	Scientific Name
T ₁	Black gram	<i>Vigna mungo</i>
T ₂	Green gram	<i>Vigna radiata</i>
T ₃	Cowpea	<i>Vigna unguiculata</i>
T ₄	Groundnut	<i>Arachis hypogaea</i>
T ₅	Soybean	<i>Glycine max</i>
T ₆	Sunhemp	<i>Crotalaria juncea</i>

Experimental Design

The experiment was conducted using Randomized Block Design (RBD) with three replications. Intercrops were cultivated between rows of host plants following standard agronomic practices. Uniform spacing, irrigation, and field management were maintained for all treatments.

Procedure of Intercropping

Land Preparation

The plantation field was cleaned properly and shallow ploughing was performed between host plant rows. Organic manure was applied before sowing intercrops.

Sowing of Intercrops

Seeds of intercrops were sown during the onset of monsoon season.

Spacing Maintained

- Row-to-row distance: 30–40 cm
- Plant-to-plant distance: 10–15 cm

Nutrient Management

Only organic nutrient sources such as farmyard manure and vermicompost were used to maintain eco-friendly conditions.

Weed Management

Manual weeding was carried out periodically. Cowpea and sunhemp treatments naturally suppressed weed growth because of dense canopy coverage.

Observations Recorded

1. Nitrogen Fixation Capacity

Nitrogen fixation was estimated indirectly through post-harvest soil nitrogen analysis and root nodulation observations.

Parameters Observed

- Number of root nodules
- Soil nitrogen improvement
- Root biomass

2. Soil Organic Carbon Improvement

Soil samples were collected before and after experimentation to determine changes in organic carbon content.

Importance

Improved organic carbon:

- Enhances microbial activity
- Improves soil structure
- Increases water retention capacity

3. Soil Moisture Conservation

Moisture retention was observed during dry periods using comparative soil moisture analysis.

Important Effects

- Reduced evaporation
- Better root-zone humidity
- Improved host plant growth

Cowpea and sunhemp provided better soil coverage and moisture conservation.

4. Host Plant Leaf Yield

Leaf yield was recorded from selected host plants under each treatment.

Formula Used

5. Profitability Analysis

Economic profitability was estimated based on:

- Additional intercrop yield
- Increase in host plant leaf production
- Improved plantation productivity

Results

Effect on Nitrogen Fixation

All leguminous intercrops improved soil nitrogen content compared to control conditions. Groundnut, soybean, and sunhemp showed the highest nitrogen enrichment potential due to extensive root nodulation.

Effect on Soil Organic Carbon

Sunhemp recorded maximum improvement in soil organic carbon because of high biomass production and green manure effect. Soybean and cowpea also improved soil organic matter significantly.

Effect on Soil Moisture Conservation

Cowpea provided excellent soil cover which reduced evaporation and improved moisture retention during dry periods.

Effect on Host Plant Leaf Yield

Groundnut and soybean significantly increased leaf biomass production in host plants because of improved nutrient availability and soil microbial activity.

Table 1. Comparative Effect of Intercrops on Tasar Host Plant Productivity

Intercrop	Nitrogen Fixation Capacity	Leaf Yield Increase (%)	Soil Quality Improvement (%)	Profitability Increase (%)
Black Gram	High	12–15	18	18–22
Green Gram	Moderate	10–14	15	15–20
Cowpea	High	15–18	22	20–25
Groundnut	Very High	18–22	25	25–30
Soybean	Very High	16–20	24	22–28
Sunhemp	Excellent	14–17	28	18–24

Discussion

The present study demonstrated that leguminous intercropping significantly improves soil fertility, host plant growth, and economic productivity in tropical tasar plantations. Biological nitrogen fixation by leguminous crops enriched soil nutrient status and improved host plant vigor. Groundnut recorded the highest profitability because of both commercial crop value and strong nitrogen fixation ability. Soybean also improved soil fertility and increased host plant leaf production through enhanced microbial activity and organic matter accumulation. Sunhemp showed maximum improvement in soil quality due to its high biomass production and rapid decomposition, which enriched soil organic carbon and improved soil texture. Cowpea was particularly effective in conserving soil moisture and suppressing weed growth under dry tropical conditions. Improved soil nitrogen and organic matter increased leaf biomass production in Arjun and Asan plantations, which is important for healthy larval feeding and cocoon productivity in tasar sericulture. Intercropping systems also reduced soil erosion, improved land-use efficiency, and generated additional economic return for farmers. Therefore, integration of leguminous intercrops within tasar host plant plantations can support sustainable agroforestry and eco-friendly tasar culture.

Conclusion

The study concluded that leguminous intercropping systems significantly improve soil fertility, nitrogen availability, host plant leaf yield, and economic profitability in tropical tasar plantations. Groundnut and soybean were found to be the most profitable intercrops, whereas sunhemp showed superior soil improvement potential. Scientific intercropping practices can therefore be recommended for sustainable tasar agroforestry and long-term productivity enhancement in tropical tasar-growing regions.