



AGRI MAGAZINE

(International E-Magazine for Agricultural Articles)

Volume: 02, Issue: 07 (July, 2025)

Available online at <http://www.agrimagazine.in>

© Agri Magazine, ISSN: 3048-8656

Best Practices for Betel Leaf Production in Odisha

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Betel leaf (*Piper betle* L.), commonly known as "paan," is a perennial, evergreen, shade-loving climber with significant cultural, economic, and medicinal importance in India, especially along the coastal regions of Odisha. The coastal districts of Odisha, including Puri, Balasore, Jagatsinghpur, Ganjam, and Khordha, are well-known for betel leaf cultivation due to favorable climate, high groundwater levels, and fertile soils.

Introduction to Betel Leaf Cultivation in Odisha

Betel leaf is a high-value horticultural crop integral to Indian traditions and ayurvedic practices. In Odisha, it is primarily cultivated in coastal districts, where it supports the livelihoods of millions of rural farmers through both direct and indirect employment opportunities. Approximately 15-20 million people consume betel leaves daily in India, generating significant economic activity. The crop's high profit margin makes it a viable source of income. Still, challenges such as water scarcity, pest infestations, disease outbreaks, and marketing inefficiencies necessitate the adoption of best practices to enhance productivity and sustainability.

Climatic and Soil Requirements

Betel vine thrives in warm, humid conditions typical of Odisha's coastal regions. The ideal temperature range is 15–40°C, with relative humidity of 60–80% and annual rainfall of 2250–4750 mm. Coastal areas benefit from high groundwater levels, facilitating irrigation through small-bore wells and diesel pump sets. The crop prefers well-drained, fertile sandy loam to clayey loam soils with a pH range of 5.6–8.2. Saline and waterlogged soils are undesired, as they hinder vine growth and leaf quality.

Varietal Selection

Odisha's betel leaf cultivation includes a range of varieties classified by shape, size, brittleness, and taste (e.g., pungent and non-pungent types). Common varieties include 'Simurali Deshi', 'Halisahar Sanchi', 'Karapaku', and 'Bangla'. Research indicates that 'Simurali Deshi', when fertilized with a 1:1 ratio of mustard oil cake and urea, yields the highest leaf count (86.45 leaves/vine/year) and quality parameters such as chlorophyll content (52.30 SPAD value), ascorbic acid (3.07 mg/100g), and essential oil content (65.50 mg/100g).

Propagation and Planting

Betel vine is typically propagated asexually using stem cuttings due to its dioecious nature. Cuttings should be 20–30 cm long, taken from healthy, high-yielding mother vines, and planted either directly in the field or as rooted cuttings in polybags filled with a mix of topsoil, cow dung, coir dust, and sand. In Odisha, farmers construct "baroj" structures—bamboo-framed enclosures covered with paddy leaves or coconut fronds—to provide shade and maintain humidity. Disease-free stem cuttings with 3–5 nodes, treating cuttings with fungicides or bioagents (e.g., *Trichoderma* spp.) to prevent fungal infections, is essential for propagation. For planting, the cuttings are planted in sunken beds (10–15 m long, 75 cm

wide, 75 cm deep) with a spacing of 30–45 cm between plants and rows. Ensure partial shade (50–60% light intensity) using natural or artificial covers.

Nutrient Management

Nutrient management is critical for maximizing leaf yield and quality. Studies show that a combination of organic and inorganic fertilizers, particularly a 1:1 ratio of mustard oil cake and urea, results in the highest benefit-cost ratio and leaf yield. Coastal soils in Odisha are often nutrient-rich but may require supplementation due to intensive cropping.

Fertilization: Apply 200–250 kg/ha of nitrogen (split doses of mustard oil cake and urea), 100 kg/ha of phosphorus, and 100 kg/ha of potassium annually. Use organic manures like farmyard manure (10–15 t/ha) to improve soil structure and microbial activity.

Foliar Application: Spray micronutrients like zinc and boron to enhance leaf size and quality, especially during the vegetative growth phase.

Soil Health: Practice crop rotation and incorporate plant residues to maintain soil fertility and reduce nutrient depletion.

Irrigation and Water Management

Coastal Odisha's high groundwater table supports betel cultivation, but only 12% of farmers face water shortages due to reliance on bore wells and diesel pumps. Over-irrigation or poor drainage can lead to root rot and fungal diseases, for which irrigation is done every 5–7 days during dry periods, ensuring consistent soil moisture without waterlogging. Use of drip irrigation for efficient water use and to minimize disease risk. Well-drained fields are necessary to prevent water accumulation, especially during monsoons.

Pest and Disease Management

Betel vines in Odisha's coastal regions are prone to pest infestations like aphids, red spider mites, mealy bugs and scale insects. Diseases such as bacterial leaf blight and *Phytophthora* leaf rot, powdery mildew and anthracnose can significantly reduce yield and quality. High humidity and poor ventilation exacerbate these issues. Best practices for pest and disease management include:

- **Integrated Pest Management (IPM):** Use natural predators, such as ladybugs for aphids, and organic pesticides like neem oil to control pests. Regular monitoring and early intervention are crucial to prevent infestations.
- **Disease Prevention:** Ensure proper ventilation in baroj structures to reduce humidity and fungal growth. Apply fungicides or bioagents like *Trichoderma* spp. to stem cuttings and soil to prevent diseases.
- **Crop Rotation:** Rotate betel vines with non-host crops to break disease cycles, especially for bacterial leaf blight, and avoid planting in fields with a history of infection for at least two years.
- **Sanitation:** Remove and destroy infected plant material promptly to prevent disease spread. Use clean, microbial-free water for washing leaves during post-harvest processing.

Pruning and Training

Pruning and training betel vines are essential for maintaining plant health, optimizing sunlight exposure, and maximizing yields. Overgrown or tangled vines reduce air circulation and increase disease risk.

Pruning: Regularly trim dead, damaged, or excessive growth at an angle above a node to encourage lateral branching and bushier plants. Frequent light pruning throughout the growing season is more effective than aggressive cuts.

Training: Guide vines along support structures like bamboo poles or trellises to promote upward growth and prevent tangling. This improves air circulation and reduces pest and disease incidence.

Health Benefits of Betel Leaf

1. **Antioxidant Power:** Packed with phenolic compounds and ascorbic acid, betel leaves fight free radicals, protecting cells and reducing oxidative stress.
2. **Anti-inflammatory Relief:** Eugenol and chavicol ease inflammation, helping with arthritis, sore gums, and oral discomfort.
3. **Digestive Aid:** Chewing betel leaves boosts saliva, improving digestion, relieving constipation, and reducing bloating.
4. **Antimicrobial Action:** Essential oils like eugenol combat bacteria and fungi, effective for oral health and skin infections.
5. **Oral Health Boost:** Fights bad breath and gum infections, making it a staple in natural oral care.
6. **Respiratory Support:** Acts as an expectorant, easing coughs and asthma symptoms.
7. **Wound Healing:** Antiseptic properties in leaf paste promote faster healing of cuts and wounds.
8. **Heart Health Potential:** Studies suggest it lowers cholesterol and supports cardiovascular health due to antioxidants.

Caution: Excessive use of areca nut or tobacco can increase oral cancer risk. Benefits are best when consumed alone.

Economic Benefits of Betel Leaf

1. **High Profit Margins:** Betel leaf farming yields significant income for Odisha's coastal farmers, supporting 15–20 million daily consumers across India.
2. **Livelihood Support:** Provides direct and indirect employment to millions in cultivation, harvesting, and marketing, especially in districts like Puri and Balasore.
3. **Export Potential:** High-quality leaves meeting size (20 cm long, 15 cm wide) and pungency standards fetch premium prices in foreign markets.
4. **Low Input Costs:** Uses locally available materials (e.g., bamboo for baroj) and minimal land, making it accessible for small-scale farmers.
5. **Year-Round Income:** Harvests every 15–25 days ensure steady cash flow, unlike seasonal crops.
6. **Market Demand:** Strong local demand at markets like Pipili Haat and growing interest in Ayurvedic products drive sales.
7. **Value-Added Opportunities:** Potential for processed products (e.g., herbal extracts, oral care items) leveraging health benefits.

Harvesting and Post-Harvest Practices

Harvesting betel leaves at the right time ensures quality and continuous production. In Odisha, leaves are typically harvested every 15–25 days, starting 2–3 months after planting when vines reach 1.2–1.8 meters in length.

Harvesting: Pick mature leaves with a portion of the petiole from the lower parts of the main and lateral stems. For export markets, harvest every three weeks to ensure larger, high-quality leaves; for local markets, harvesting is done every two weeks.

Post-Harvest Handling: Wash, clean, and grade leaves according to size and quality. Remove damaged leaves and cut excess petiole. Use clean, microbial-free water for cleaning of leaves.

Packaging: Pack leaves tightly to prevent wilting and store them at cool temperatures (10–15°C) to extend shelf life. Avoid chemical treatments unless necessary, and use eco-friendly packaging to appeal to sustainable markets.

Challenges and Policy Implications

Despite its economic potential, betel leaf cultivation in Odisha faces several constraints, including water shortages, high labour costs, lack of skilled labour, and insufficient access to credit and training. Natural calamities, such as cyclones common in coastal Odisha, also pose risks to production. Policy recommendations include:

Government Support: Provide subsidies for baroj construction, irrigation systems, and organic fertilizers to reduce initial costs. Training programs on modern cultivation techniques can enhance productivity.

Research and Extension Services: Increase investment in research for disease-resistant varieties and pest management. Extension services should focus on educating farmers about IPM, nutrient management, and market access.

Infrastructure Development: Develop storage facilities and improve transportation to reduce post-harvest losses and ensure timely market delivery.

Conclusion

Betel leaf cultivation along Odisha's coast is a lucrative enterprise with significant cultural and economic value. Best practices include selecting high-yielding varieties like Simurali Deshi, using organic and inorganic fertilizers in balanced ratios, maintaining proper irrigation and drainage, implementing IPM, and adopting efficient pruning, harvesting, and marketing strategies. Addressing challenges such as water scarcity, pest and disease management, and marketing inefficiencies through government support, research, and infrastructure development can enhance sustainability and profitability. By adopting these evidence-based practices, farmers can maximize yields, improve leaf quality, and strengthen their position in both local and export markets, contributing to rural livelihoods and economic growth in Odisha.

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