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TRADITIONAL METHODS FOR PLANT DISEASE MANAGEMENT

S Vasavi[1]*, M Anshida[1] and Arun P[2]

[1]PG Scholar, Department of Agricultural Extension and Rural Sociology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India- 641003.

[2]Subject Matter Expert(Botany), Tamil Nadu Government Schools, Perambalur

**Corresponding Author Mail ID: svasavi2002@gmail.com*

Introduction

Plant diseases are among the major constraints to global agricultural productivity. Fungi, bacteria, viruses, and nematodes contribute to significant crop losses every year, threatening food security and farmer incomes worldwide. According to the Food and Agriculture Organization (FAO, 2021), up to 40% of global crop production is lost annually due to pests and diseases, resulting in economic losses estimated at approximately $220 billion per year.

Long before the development of synthetic pesticides and modern diagnostic tools, indigenous farming communities across different cultures, especially in India, devised and implemented numerous traditional methods to prevent and manage plant diseases. Rooted in centuries of accumulated experience, these practices were often based on trial and error, careful observation, spiritual beliefs, and a profound ecological understanding of local agroecosystems. The traditional wisdom was passed orally through generations, reflecting a sustainable, cost-effective approach to crop protection using readily available natural resources.

These traditional methods commonly involved using plant extracts, cow-based formulations, ashes, soil treatments, and cultural rituals to enhance plant immunity or suppress pathogens. Being preventive and environment-friendly, these approaches remain relevant today, particularly within organic farming, integrated pest management (IPM), and low-input agricultural systems. Recently, rising concerns about pesticide resistance, chemical residues,

and climate change impacts have revived interest in traditional knowledge for sustainable plant disease management. Traditional methods offer valuable insights that complement modern Integrated Disease Management (IDM) strategies and align well with the principles of agroecology.

Classification of Traditional Methods of Plant Disease Management

Traditional disease management practices can be classified based on the principle or method of action. The major categories include cultural, mechanical/physical, botanical, biological, and spiritual/ritualistic methods.

Botanical Extracts and Herbal Preparations

One of the most prominent and widespread traditional methods involves the use of botanical extracts. Farmers across various cultures have used plant-based formulations to control pathogens due to their natural antifungal, antibacterial, and insecticidal properties. For example, neem (Azadirachta indica) is extensively used in the Indian subcontinent.

Neem leaf extract and oil are effective against powdery mildew, rust, and even insect-transmitted viral diseases. Farmers prepare neem extract by soaking crushed leaves in water, fermenting it for a few days, and filtering it before application. This is often sprayed on crops like beans, okra, and brinjal.

Similarly, mixtures of garlic (Allium sativum), ginger (Zingiber officinale), and chilli (Capsicum spp.) are used to manage bacterial wilt, damping-off, and leaf blight in vegetables. These are prepared as crushed paste diluted in water and applied using a hand sprayer. Scientific studies support these practices. For instance,

Sharma et al. (2021) found that garlic extract significantly inhibited *Pseudomonas syringae*, a common pathogen in tomato crops.

Use of Organic Inputs (Cow-Based Products)

In traditional Indian agriculture, cow-derived products like dung, urine, milk, curd, and ghee hold significant importance not only for soil fertility but also for pest and disease management.

The formulation known as Panchagavya, a mixture of these five cow products, is used as a foliar spray to enhance plant vigor and suppress pathogens. Another widely adopted preparation is Jeevamrutha, which is made by fermenting cow dung, cow urine, jaggery, pulse flour, and soil under aerobic conditions.

It is applied to the soil to boost microbial populations that suppress root pathogens such as *Fusarium*, *Rhizoctonia*, and *Pythium*. Cow urine alone is used as a spray in diluted form (1:10) to control fungal and bacterial infections. It is often mixed with neem extract for enhanced effectiveness. These practices are widely observed in organic farms across Maharashtra, Karnataka, and Tamil Nadu.

Soil Amendments and Physical Techniques

Several traditional soil practices are indirectly aimed at disease suppression. Use of wood ash, charcoal powder, burnt husk, and lime is a common method to modify soil pH, reduce fungal spore load, and improve seedling emergence. Wood ash is often sprinkled in nursery beds to prevent damping-off caused by *Pythium spp.*

Soil solarization, although a modern term, is based on traditional practices where farmers ploughed land during peak summer months and allowed it to remain fallow, exposing soil to high temperatures. This practice naturally reduces the viability of soil-borne pathogens.

In parts of Tamil Nadu, farmers apply charcoal powder and cow dung slurry in seedling trays to minimize fungal contamination. Burning crop residues also serves as a sanitation method in traditional systems.

Spiritual and Ritualistic Practices in Disease Management

In many indigenous farming systems, plant health is intertwined with spirituality. While some of these practices are symbolic, they often involve natural substances that contribute to pest and disease reduction. For example, in Odisha and Chhattisgarh, tribal farmers perform rituals involving turmeric, rice, and flowers to seek divine protection for crops. In southern India, neem and tulsi (Ocimum sanctum) are planted along field borders. While believed to protect spiritually, they also release volatiles that deter pests.

Farmers burn sambrani (resin), dried neem leaves, and cow dung cakes during sowing and flowering stages, which has fumigant properties. Scientific validation shows that the smoke from neem and resin has insecticidal effects on soft-bodied pests like aphids and whiteflies, indirectly reducing disease vectors.

Seasonal, Climatic, and Cultural Synchrony-Based Approaches

Traditional knowledge includes acute awareness of seasonal patterns and disease cycles. Farmers often time their sowing to avoid peak periods of pathogen activity. For example, in fog-prone areas of the Western Ghats, farmers delay planting blight-susceptible crops until after the high humidity season ends.

Crop rotation is practiced to reduce build-up of soil pathogens. Intercropping with marigold, mustard, or onion is used to repel nematodes and reduce fungal incidence.

Similarly, using plant-based mulches (e.g., eucalyptus or neem leaves) creates a hostile environment for disease-causing microbes.

These techniques reflect an ecological balance, reducing the risk of outbreaks without external inputs.

Key Traditional Methods and Applications

Traditional Method	Description and Mode of Action	Application Against Specific Plant Diseases
Crop Rotation	Rotating crops with non-host species reduces pathogen build-up in soil.	Reduces soil-borne diseases like *Fusarium wilt* in banana, *Clubroot* in crucifers.
Use of Ash and Cow Dung	Ash acts as a desiccant and pH modifier; cow dung contains antagonistic microbes.	Controls damping-off and root rots in seedlings of vegetables and pulses.
Neem Extract and Decoctions	Contains azadirachtin and limonoids with antifungal, antibacterial properties.	Effective against *powdery mildew* in pulses and *leaf spot* in vegetables.
Chilli-Garlic Extract	Pungent compounds act as repellents and mild biocides.	Used against *anthracnose*, *bacterial blight*, and *leaf curl* in chilli.
Panchagavya and Jeevamrutha	Fermented organic formulations rich in beneficial microbes.	Enhances plant immunity; used against *downy mildew* in cucurbits and grapes.
Mulching with Organic Waste	Suppresses weed and pathogen spores, retains soil moisture.	Reduces foliar diseases and wilt incidence in tomato and brinjal.
Soil Solarization (traditional covering with dry leaves/ash)	Using solar heat to reduce soil-borne pathogens.	Controls *nematodes*, *Pythium*, and *Phytophthora* in nurseries.
Use of Resistant Varieties Selected Traditionally	Farmers select and propagate disease-resistant landraces.	Local rice varieties resistant to *blast*, *tungro* virus are examples.
Smoke Fumigation in Storage	Smouldering herbs or dung cakes to reduce pest/pathogen infestation.	Prevents fungal diseases and aflatoxins in stored grains and pulses.
Intercropping and Mixed Cropping	Diversifies ecosystem and reduces disease transmission.	Reduces *rust* in cereals and *yellow mosaic* in legumes.

Sourcehttps://agriculture.institute/organic-production-system/traditional-organic-plant-disease management/

Case Studies and Regional Examples

Case 1: Turmeric Rhizome Treatment in Erode, Tamil Nadu

Farmers in turmeric-growing areas traditionally coat harvested rhizomes with turmeric powder mixed with slaked lime before storage. This protects against rhizome rot caused by *Pythium* and *Fusarium*. Farmers reported a 30–40% reduction in post-harvest losses.

Case 2: Fumigation Ritual in Sikkim's Cardamom Plantations

Large cardamom growers in Sikkim traditionally fumigate fields with pine resin and herbal smoke during flowering. This suppresses leaf streak and damping-off diseases. With government support, the method is now being documented under Sikkim Organic Mission.

Case 3: Use of Cow Urine Sprays in Karnataka's Arecanut Plantations

In Shivamogga district, traditional farmers spray fermented cow urine weekly to manage yellow leaf disease and root pathogens. Studies by UAS Bengaluru found significant improvement in leaf chlorophyll content and soil microbial activity.

Limitations of Traditional Methods and the Way Forward

While traditional methods are low-cost, eco-friendly, and culturally embedded, they face several limitations:

1. **Lack of standardization:** Dosages, preparation times, and application intervals vary widely, reducing repeatability.
2. **Limited curative power:** Most methods are preventive; they are less effective against severe, fast-spreading epidemics.
3. **Labour-intensive:** Methods like preparing Jeevamrutha or decoctions require time and manual effort.
4. **Scientific validation:** Often lacking or under-documented, leading to skepticism among modern agronomists.

Therefore, a hybrid model is needed where traditional practices are validated through research, improved with modern delivery systems, and scaled through farmer-participatory extension programs.

Integration with Modern Plant Protection Measures

The integration of traditional methods with modern plant protection strategies can result in integrated disease management (IDM) systems that are sustainable, culturally acceptable, and effective. For example, Panchagavya and Trichoderma-based biofungicides can be co-applied to improve root-zone protection. Traditional smoke fumigation can be paired with sticky traps or pheromone traps to manage insect vectors more effectively. Neem-based sprays can serve as a resistance management strategy to reduce overuse of synthetic fungicides. Research institutions like TNAU, ICAR-NBAIM, and ICRISAT are now documenting and evaluating these traditional practices to refine them for broader adoption.

Conclusion

Traditional plant disease management methods represent a rich repository of agro-ecological knowledge refined over centuries. While not a complete substitute for modern plant protection technologies, these practices offer low-input, environmentally conscious alternatives, particularly relevant to resource-poor and smallholder farmers. Preserving, validating, and integrating these traditional methods with modern tools and farmer education programs can play a crucial role in achieving sustainable, resilient, and culturally respectful agriculture.

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