

Economics of Natural Farming: Low Cost, High Sustainability

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INTRODUCTION

1.1 Background

Natural farming has emerged as a transformative agroecological paradigm that challenges the input-intensive model of conventional agriculture. Rooted in ecological principles, natural farming eliminates synthetic fertilizers, pesticides, and chemical growth regulators, instead relying on on-farm biological resources and ecological processes to maintain soil fertility and crop productivity. In India, the approach gained national prominence through the concept of Zero Budget Natural Farming (ZBNF), later mainstreamed under the National Mission on Natural Farming (NMNF). ZBNF emphasizes four core components: Beejamrit (seed treatment), Jeevamrit (microbial culture), Acchadana (mulching), and Waaphasa (soil aeration).



The economic logic behind natural farming rests on reducing dependence on costly external inputs and enhancing farm self-reliance. As fertilizer subsidies rise and ecological degradation intensifies, policymakers and researchers increasingly explore whether natural farming can simultaneously deliver profitability and sustainability. This debate is particularly relevant for smallholder farmers who face rising input costs, soil degradation, and climate vulnerability.



1.2 Problem Statement

Conventional agriculture, shaped by the Green Revolution, significantly increased food production but also led to ecological imbalances, including soil nutrient depletion, groundwater contamination, biodiversity loss, and greenhouse gas emissions. Farmers often incur high costs for fertilizers, pesticides, irrigation, and hybrid seeds, which increase indebtedness and financial risk.

Natural farming proposes a low-cost alternative by eliminating purchased inputs. However, its economic viability remains contested. Critics question whether yields can match conventional systems, especially during transition years. Others argue that reduced costs and improved soil health compensate for moderate yield reductions. Therefore, a comprehensive economic assessment must evaluate:

- Cost structures
- Yield performance
- Profitability indicators
- Risk resilience

- Long-term sustainability

1.3 Objectives

This study aims to:

1. Analyze the economics of natural farming systems.
2. Compare costs and returns with conventional agriculture.
3. Assess sustainability outcomes.
4. Identify key challenges and policy implications.

2. Theoretical Framework

2.1 Defining Natural Farming

Natural farming is an agroecological production system that enhances biological activity and ecological balance using indigenous resources. Unlike certified organic farming, it emphasises localised, low-cost inputs prepared on-farm. Key components include:

- **Beejamrit**- microbial seed treatment
- **Jeevamrit**- fermented microbial culture
- **Ghanjeevamrit**- solid microbial formulation
- **Acchadana (Mulching)**- soil moisture conservation and weed suppression



The system promotes living soils rich in microbial biomass and organic carbon, thereby enhancing nutrient cycling and plant resilience.

2.2 Economic Sustainability in Agriculture

Economic sustainability refers to a farming system's ability to:

- Generate stable income
- Minimize production risk
- Reduce dependency on volatile input markets
- Maintain long-term productivity

In natural farming, sustainability arises not only from financial savings but also from ecological services such as improved soil structure, pest regulation, and moisture retention.

2.3 Conceptual Model

The economic outcomes of natural farming depend on five interacting variables:

1. **Input Costs** – elimination of chemical fertilizers and pesticides reduces variable costs.
2. **Labour Intensity** – higher manual labor for preparation and application of bio-inputs.

3. **Yield Levels** – may decline during transition but stabilize over time.

4. **Market Access** – premium prices for chemical-free produce.

5. **Ecosystem Services** – improved soil health, biodiversity, and resilience.

A simplified profit function:

$$\pi = P \times Y - (C_v + C_f)$$

Where:

π = Profit

P = Output price

Y = Yield

C_v = Variable cost

C_f = Fixed cost

Natural farming seeks to increase π primarily by reducing C_v rather than maximizing Y alone.

3. Economic Costs in Natural vs Conventional Farming

3.1 Variable and Fixed Costs

Empirical evidence from sugarcane cultivation in Karnataka indicates substantial cost reduction under natural farming:

Cost Component	Natural Farming (₹/ha)	Conventional Farming (₹/ha)
Total cost of cultivation	224,544.71	255,587.89
Cost of inputs	Lower	Higher
Cost per tonne	1,715	1,696
Returns per ₹ spent	1.92	1.71

Although cost per tonne is marginally higher under natural farming, overall profitability improves due to lower total expenditure and higher returns per rupee invested.

3.2 Labour and Operational Costs

Natural farming often requires:

- Preparation of bio-inputs
- Manual weeding
- Mulching

Studies from maize cultivation in the North Eastern Hill Region show lower total cost but higher labor share in total cost. This shift implies greater employment generation but may increase opportunity cost of labor.

4. Economic Returns and Profitability

4.1 Net Returns and Benefit-Cost Ratio

Crop System	Yield (kg/ha)	Net Returns (₹/ha)	BCR
Natural Farming	2,249	Higher by ₹3,123	2.14
Conventional	2,425	Baseline	1.83

Although yields were slightly lower in natural farming, higher BCR indicates better economic efficiency.

4.2 Paddy Farming Comparison

Studies in Tamil Nadu report that despite slightly lower gross returns, natural farming recorded higher net income and returns per rupee due to cost savings.

4.3 Revenue from Price Premium

Natural produce may fetch a price premium in urban and niche markets. However, premium realization depends on:

- Certification systems
- Market linkages
- Consumer awareness

Without premium access, profitability relies primarily on cost reduction.

5. Economic Resilience and Risk Management

Natural farming enhances resilience by:

- Reducing input price volatility risk
- Improving soil organic carbon
- Increasing moisture retention
- Lowering dependency on credit

Reduced chemical dependency also minimizes crop failure risk from pest resistance and soil degradation.

6. Sustainability Aspects

6.1 Soil Health and Biological Activity

Natural farming improves:

- Soil organic carbon
- Microbial biomass
- Earthworm population
- Nutrient cycling

Long-term soil regeneration enhances productivity stability.

6.2 Biodiversity and Ecosystem Services

Large-scale ZBNF implementation in Andhra Pradesh has demonstrated enhanced biodiversity, including increased bird populations that contribute to natural pest control.

6.3 Climate Change and Environmental Footprint

Eliminating synthetic fertilizers reduces nitrous oxide emissions and fossil fuel usage in production. Natural farming thus contributes to climate mitigation and adaptation goals.

7. Challenges and Limitations

7.1 Yield Variability

Yield reduction during the initial transition period remains a concern. Long-term trials are required to establish stability.

7.2 Labour Intensity

Higher labor requirements may limit adoption in regions with labor scarcity.

7.3 Knowledge and Skill Gaps

Successful implementation requires:

- Training programs
- Extension services
- Demonstration plots

8. Policy and Institutional Support

The **National Mission on Natural Farming (NMNF)** promotes:

- Farmer training
- Cluster development
- Input support
- Market linkage

Effective policy must ensure:

- Certification and branding
- Supply chain development
- Research-based validation

9. Case Studies

9.1 Sugarcane in Karnataka

Natural farming showed higher net returns despite slightly lower yields due to reduced cultivation cost.

9.2 Maize in NE Hill Region

Higher BCR and profitability compared to conventional farming.

9.3 Paddy in Tamil Nadu

Farmers reported improved net income and reduced dependency on chemical inputs.

10. Future Research Directions

- Long-term yield performance analysis
- Carbon sequestration valuation
- Comparative cost-benefit across agro-climatic zones
- Integration of natural farming with digital agriculture

CONCLUSION

Natural farming presents a compelling economic proposition centered on cost minimization and ecological regeneration. While yield gaps may exist during transition phases, reduced input expenditure and improved benefit-cost ratios often compensate for output differences. Sustainability gains in soil health, biodiversity, and climate resilience further strengthen its long-term viability.

However, its success depends on effective extension support, market integration, and continued scientific evaluation. With appropriate policy backing and farmer capacity building, natural farming can evolve into a low-cost, high-sustainability alternative within India's agricultural landscape.

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