Review

Livestock-Based Natural Farming as a Boon for Changing Soil Microbiology

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ABSTRACT

Livestock has been an integral component of farming systems, especially in small land holder farmers, by providing manure, draught power, and a sustainable source of organic inputs. The rising concerns of soil degradation, declining fertilityand microbial imbalance under conventional farming practices have brought renewed attention to natural farming systems that integrate livestock resources. Livestock-based natural farming (LBNF) utilizes cow dung, urine, milk derivatives and farmyard manure as essential bio-inputs for enriching soil microbial life. Preparations such as *Jeevamrutha* and *Beejamrutha*, derived from livestock products, act as microbial inoculants, stimulating beneficial bacteria, fungi, and actinomycetes in the soil."Livestock-derived formulations such as *Jeevamrutha* and *Beejamrutha* act as effective microbial inoculants that enhance beneficial soil microbial populations, nutrient cycling and enzyme activities. This review highlights the role of livestock-based natural farming in improving soil health, microbial diversity, ecological resilience and long-term agricultural sustainability. Case studies, comparative insights, challenges and future prospects are presented to highlight how livestock-based natural farming can be a boon for sustaining soil health and ecological resilience.

Keywords: Cow dung, Jeevamrutha, Livestock, Microbial diversity, Natural farming, Soil microbiology, Sustainable agriculture

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INTRODUCTION

Soil is a living entity that harbours billions of microorganisms per gram, contributing to nutrient cycling, organic matter decomposition and suppression of plant pathogens. The sustainability of farming systems depends heavily on the health and diversity of soil microbiota. However, conventional agriculture, dominated by heavy use of chemical fertilizers and pesticides, has severely impacted microbial communities, leading to reduced microbial biomass, decline in soil enzymes and imbalanced nutrient cycles (Smith *et al.,* 2016). Livestock has historically been a cornerstone of integrated farming systems, providing manure, urine, draught, and organic residues that nurture soil biology (Nagarjuna *et al.,* 2025).

In natural farming, livestock is not merely a source of food or income but acts as a biological engine powering soil rejuvenation. Livestock-derived inputs serve as carriers of diverse microbial populations and substrates that stimulate native microbial growth. Natural farming practices have emerged as sustainable alternatives to conventional agriculture, addressing concerns about soil degradation, biodiversity loss, and environmental pollution. By integrating organic and natural inputs, these practices enhance soil fertility and microbial diversity while reducing dependency on chemical fertilizers and pesticides (Kamal and Ravi, 2025). Organic farming is a sustainable option to reduce soil degradation (Pinto *et al.,* 2023). Significantly improve soil physical properties under natural and conventional farming in kharif crops (Korat and Mathukia, 2022). Natural farming is the most practical and simple farming method that produces healthy crops without endangering the environment to address this issue (Badiyal *et. al,* 2024). Several modified *Vedic i.e.* Indian ancient natural farming inputs *i.e. Panchgavya, Jeevamruth, Beejamruth, Amritpani, Vermiwash*, and their microbes were being used to enhance the agricultural outputs and nutrients in the French bean (*Phaseolus vulgaris* L.) under controlled and field conditions (Pandey *et. al*., 2025). Thus, livestock-based natural farming (LBNF) offers a promising pathway for restoring soil microbiology and ensuring ecological sustainability.

Concept of livestock based natural farming

Livestock based natural farming revolves around the idea that cattle, particularly indigenous breeds, are central to soil fertility management. Their dung, urine and dairy by-products are harnessed to prepare microbial bio-stimulants and soil amendments. Key practices include:

1. *Beejamrutha*: A microbial seed treatment made from cow dung, cow urine, lime and soil, protecting seeds from fungal and bacterial infections (Palekar, 2019).
2. *Jeevamrutha*: A liquid microbial inoculant prepared from cow dung, cow urine, jaggery, pulse flour, and soil. Rich in beneficial microbes, it activates the rhizosphere and enhances nutrient availability (Nagarjun *et al.,* 2025).
3. *Farm Yard Manure (FYM):* A traditional livestock based amendment that improves soil organic matter stimulates microbial activity and enhances cation exchange capacity.
4. *Mulching with livestock residues:* Using livestock bedding, fodder waste, and dung cakes contributes to organic carbon and microbial proliferation.

Table 1: Nutrient composition and microbial characteristics of major formulations obtained from livestock-based natural farming.

Formulation	N (%)	P (%)	K (%)	Organic Carbon (%)	Microbial Load
Beejamrutha	0.4-0.6	0.05-0.10	0.4-0.5	8-12	High bacterial and fungal population
Jeevamrutha	0.8-1.2	0.1-0.2	0.5-0.8	10-15	Very high beneficial microbial count
Ghana-jeevamrutha	1.0-1.5	0.2-0.3	0.8-1.0	12-18	High microbial biomass
Panchagavya	0.6-0.9	0.1-0.2	0.5-0.7	8-10	Rich in Lactobacillus, yeasts and actinomycetes

Thus, livestock serves as the biological base of natural farming, making microbial enrichment self-sustaining and locally resource-driven (Government of India, 2021).

Role of livestock-based inputs in soil microbiology

Cow dung as a microbial reservoir

Cow dung is a rich source of bacteria, fungi and actinomycetes. It contains cellulolytic and lignolytic microbes that aid in decomposing crop residues and improving humus formation (Palekar, 2019). Studies have shown higher populations of nitrogen-fixing bacteria (*Azotobacter*), phosphate-solubilizing bacteria and beneficial fungi in soils amended with cow dung-based formulations compared to synthetic fertilizers (Nagarjun *et al.,* 2025).

Cow urine as a bio-enhancer

Cow urine contains nitrogen, potassium, and a variety of antimicrobial compounds. When used in Jeevamrutha or foliar sprays, it provides a substrate for microbial multiplication and also exerts biocontrol against pathogens (Smith *et al.,* 2016).

Jeevamrutha and soil enzyme activities

Application of *Jeevamrutha* significantly increases soil enzyme activities such as dehydrogenase, urease, and phosphatase (Nagarjun *et al*., 2025). These enzymes reflect microbial metabolic activity and play a direct role in nutrient cycling. Enhanced enzymatic activity indicates rejuvenated soil microbiology and nutrient availability.

Farm yard manure and carbon sequestration

Well decomposed FYM improves soil organic carbon, which is the key energy source for soil microbes. Livestock based amendments increase microbial biomass carbon, thereby contributing to long-term carbon sequestration and climate mitigation.

Microbial suppression of soil pathogens

Livestock-based inputs promote beneficial microbes such as *Trichoderma* spp. and *Pseudomonas fluorescens* that suppress soilborne pathogens. Competitive

Table 2: Comparative insights: livestock-based natural farming vs. conventional farming.

S. No.	Aspect	Conventional Farming	Livestock-Based Natural Farming
1	Nutrient Source	Synthetic fertilizers	Livestock-derived bio-inputs (cow dung, urine, FYM)
2	Soil Microbes	Reduced diversity, chemical suppression (Smith *et al.,* 2016)	Enriched microbial diversity (Nagarjun *et al.,* 2025)
3	Enzyme Activity	Declining trends	High activity due to *Jeevamrutha* and FYM
4	Organic Carbon	Depleted	Enhanced via manure and mulching
5	Pathogen Control	Chemical pesticides	Microbial antagonism (Palekar, 2019)

colonization, antibiosis and induced systemic resistance are mechanisms through which microbial diversity nurtured by livestock inputs protects plant health (Nagarjun *et al.,* 2025).

Impact of livestock-based natural farming on soil health

Physical properties

Livestock-based natural farming significantly improves soil aggregation, porosity, water infiltration, water-holding capacity and bulk density. Organic matter derived from cow dung, FYM and mulches enhances soil structure and reduces erosion.

Chemical properties

Regular application of livestock-derived inputs increases soil organic carbon, improves nutrient availability, enhances cation exchange capacity and maintains balanced soil pH. Several studies have reported higher availability of nitrogen, phosphorus and potassium under natural farming systems compared to conventional practices.

Biological properties

Livestock-based formulations stimulate the beneficial microbial populations including nitrogen-fixing bacteria, phosphate-solubilizing microorganisms, fungi and actinomycetes. Increased microbial biomass and enzyme activities such as dehydrogenase, phosphatase and urease contribute to efficient nutrient cycling and improved soil fertility.

Case studies and evidence

India (Andhra Pradesh)

The Community Managed Natural Farming program observed higher microbial biomass carbon and better soil respiration in farms adopting livestock-based *Jeevamrutha* compared to chemical inputs (Government of India, 2021).

Kenya

Incorporation of livestock manure in natural farming systems improved drought resilience by enhancing microbial activity and soil water retention.

Mexico

Cow dung based microbial consortia improved maize productivity by promoting nitrogen-fixing and phosphate-solubilizing bacteria (Smith *et al.,* 2016).

Challenges in livestock based natural farming

Labor and management: Preparing *Jeevamrutha* and *Beejamrutha* requires regular inputs of cow dung, urine and farmer effort.

Yield gap during transition: Farmers shifting from chemical to livestock-based systems may experience reduced yields in early years (Nagarjun *et al.,* 2025).

Scientific standardization: Microbial composition of livestock-based inputs varies depending on breed, feed, and preparation methods (Palekar, 2019).

Policy support: Adoption depends on government schemes and training support (Government of India, 2021).

Future prospects

Metagenomic studies: Advanced molecular techniques can profile microbial communities enriched by livestock inputs.

Standardization of formulations: Scientific protocols for *Jeevamrutha* and FYM can improve reliability and adoption.

Livestock integration models: Mixed farming systems with dairy, poultry, and small ruminants can further enrich soil microbiology.

Policy incentives: Linking livestock-based natural farming with carbon credits and ecolabelling may encourage adoption.

Institutional support and government initiatives for livestock-based natural farming in India

The Government of India has launched several initiatives to promote livestock-based natural farming. These include

1. *National Mission on Natural Farming (NMNF)*: Promotes cow-based natural farming practices through capacity building and financial support.
2. *Bharatiya Prakritik Krishi Paddhati (BPKP)*: Encourages the use of indigenous cow-based formulations such as *Jeevamrutha* and *Beejamrutha.*
3. *Paramparagat Krishi Vikas Yojana (PKVY)*: Supports organic and natural farming clusters across India.
4. *Rashtriya Gokul Mission (RGM)*: Conserves and promotes indigenous cattle breeds essential for natural farming systems.
5. *ICAR and Krishi Vigyan Kendras (KVKs)*: Conduct demonstrations, training programs and validation trials on livestock-based natural farming technologies.

Several state governments, including Andhra Pradesh, Himachal Pradesh, Gujarat and Uttar Pradesh, have incorporated cow-based natural farming into their agricultural development programs. These institutional frameworks are accelerating the adoption of sustainable livestock-integrated farming systems while improving soil health and environmental sustainability.

CONCLUSION

Livestock based natural farming is a boon for soil microbiology, transforming cattle into key drivers of soil health. Through dung, urineand manure-based formulations, livestock enrich microbial diversity, enhance soil enzyme activities, stimulate nutrient cycling, and suppress pathogens. Unlike conventional farming, which depletes microbial life, livestock-based systems foster resilience, sustainability, and ecological balance. With stronger scientific backing and policy support, livestock-based natural farming holds immense potential to revitalize degraded soils and secure sustainable food systems for future generations.

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