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Organic Fertilizer Consumption and Production in India

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ABSTRACT

The rising concern about soil degradation, water pollution, and long-term sustainability of conventional farming has propelled interest in organic agriculture globally and in India. Among organic inputs, organic fertilizers play a vital role in enhancing soil health, supporting crop nutrition, and enabling sustainable farm systems. While India's overall fertilizer production and consumption have historically been dominated by chemical inputs, the organic fertilizer sector is gradually expanding due to policy support, farmer awareness, and market demand. This is a conceptual and descriptive nature paper. It is based on secondary data. This paper examines the current production and consumption patterns of organic fertilizers in India, explores their drivers and barriers, and outlines future prospects.

***Keywords**: Organic Fertilizer, Agriculture, Food Grains, Inorganic Agriculture.*

Introduction

Agriculture remains the backbone of the Indian economy, engaging nearly half of the workforce and contributing significantly to GDP. Traditionally, Indian agriculture was primarily organic, relying on **natural manures and composts**. However, the Green Revolution ushered in increased reliance on chemical fertilizers to boost yields. While this improved food security, excessive chemical inputs have contributed to soil nutrient imbalance and environmental stress. In response, organic farming and organic fertilizer use are gaining policy and market traction as sustainable alternatives.

In the context of Indian agriculture, **organic fertilizers** have emerged as a significant component of sustainable farming systems, reflecting a broader shift from intensive chemical input use toward ecological nutrient management. Historically, India's agricultural transformation was powered by the Green Revolution, which dramatically increased foodgrain production through high-yielding varieties and **chemical fertilizers**. However, intense reliance on synthetic inputs has led to **soil nutrient depletion**, reduced soil organic carbon, and environmental stress in many regions. Such concerns have catalysed interest in organic and bio-based nutrient sources that can improve soil health while supporting long-term crop productivity.

Organic fertilizers derived from natural materials such as compost, manure, plant residues, and other biodegradable sources contribute essential nutrients and enhance soil structure, microbial activity, and water retention. They are fundamental inputs for **organic farming**, a system that eschews synthetic chemicals in favour of ecological processes and nutrient cycling. India has among the largest organic farming groups internationally and expansive registered organic land, with a developing local market and international export potential for organically grown goods. This expansion underscores an increasing demand for organic inputs, including organic fertilizers, to sustain these systems.

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Despite these positive trends, the organic fertilizer sector in India confronts significant challenges. Production capacity and quality assurance mechanisms lag behind demand, and farmers often face higher costs and variable nutrient performance compared with conventional fertilizers. Moreover, policy and institutional frameworks are evolving to support commercialization, quality standards, and adoption incentives.

Understanding the **consumption and production patterns** of organic fertilizers in India is essential for assessing their role in supporting sustainable agriculture, addressing soil health challenges, and aligning agronomic practices with environmental and market objectives. This study aims to provide a comprehensive overview of these patterns, shedding light on trends, drivers, and constraints in the Indian context.

Review Literature

- **Pragati Tiwari (2024)** Paper focus on the Fertilizer production and consumption in India. The Porter's Five Forces model also use for analyse the fertilizer industry of India. Secondary data shall be obtain from public sources like websites (Govt. and Private), Different Reports and other information available in open market.
- **Rajesh Kumar Bishnoi & Abhijit Das (2020)** paper focuses on the growth rate of India's fertilizer sector, demand and supply side. The consumption patterns of fertilizers in Indian states are also discussed. Secondary data shall be obtained from publicly available sources and information provided in the open market.
- **Yudhishther Singh Bagal (2018)** in this study, an in-depth analysis is done with fertilizer consumption pattern at Kotli village in Jammu and Kashmir. A grand total of 79 farmers were random with no substitution chose and underwent interviews with the use of well- organised interview schedule. The findings showed that the majority of farmers were marginal.
- **Abhishek Pathak, Pushkar Dubey, Sanjay Pandey (2017)** provides an overview of the market, circumstances, range and overall situation of fertilizer marketing in India. Fertilizer marketing plays an essential role in order to meet the needs of farmers. The farmer class, academics, and marketers are included in its reach.
- **Jyotika Bahl (2015)** paper examines the role of research and development in the growth of productivity in the fertilizer and pesticide sector. It is empirical analysis of the firm level data of the Indian fertilizer and pesticide sector in order to estimate the total factor productivity.
- **Vijay Paul Sharma (2011)** paper suggests that priority should be given to the availability of fertilizers at affordable prices in order to ensure sustainable agricultural production in India. Fertilizer demand in the country is projected to increase with a higher growth rate in Eastern and Southern regions than North and West.

Objectives

- To study consumption of organic fertilizer in India.
- To know about fertilizers production of food grains.
- To analysis of the fertilizer industry using PESTLE analysis.

State Wise & Zone Wise Consumption of Fertilizer in India

The East Zone includes the states of Jharkhand, Assam, West Bengal, and Odisha. The states of Rajasthan, Madhya Pradesh, Gujarat, Goa and Maharashtra are part of the West Zone. States of the northern zone are Delhi, J&K, Punjab, Haryana, Uttarakhand, Himachal Pradesh and Uttar Pradesh. South Zone states are Karnataka, Lakshadweep, Kerala, Tamil Nadu and Andhra Pradesh. The North East zone includes Sikkim, Tripura, Assam, Mizoram, Meghalaya, Nagaland and Arunachal Pradesh.

State-wise production/consumption of Organic Fertilizers in India

State wise Consumption of Organic Fertilizers		
Year 2022-23 (in MT)		
South Zone		
1	Pondicherry	2,470.00
2	Karnataka	22,78,241
3	Andhra Pradesh	2,72,572.13
4	Tamil Nadu	2,31,522.00

5	Telangana	28,788.03
6	Kerala	13,560.189
Sub-Total (South Zone)		44,818.219
West Zone		
7	Chhattisgarh	0
8	Goa	11,221.37
9	Maharashtra	2,37,843.28
10	Madhya Pradesh	84,598.05
11	Gujarat	2,78,036.86
12	Rajasthan	50,477.00
Sub-Total (West Zone)		146296.42
North Zone		
13	Uttarakhand	7,440.451
14	Punjab	7,407.06
15	Jammu & Kashmir	3,250.48
16	Chandigarh	0
17	Himachal Pradesh	32.7965
18	Haryana	71,179.412
19	Delhi	0
20	Uttar Pradesh	74,799.23
Sub-Total (North Zone)		164109.4295
East Zone		
21	West Bengal	6,704.806
22	Jharkhand	0
23	Bihar	53,256.38
24	Orissa	14,763.90
Sub-Total (East Zone)		74725.086
North East Zone		
25	Sikkim	0
26	Tripura	946.81
27	Arunachal Pradesh	0
28	Meghalaya	0
29	Nagaland	0
30	Assam	43,773.20
31	Mizoram	0
32	Manipur	0
Sub-Total(North East Zone)		44720.01
All India		**474669.8845**

The Four most organic fertilizer consumption states for the period from financial year 2022-23 were Gujrat, Andhra-Pradesh and Maharashtra and Tamilnandu. No organic fertilizer is used by saven Indian States and Union Territories namely Arunachal pradesh, nagalend, maniur, mizoram, Meghalaya, jharkhand, Chatteesgarh, Delhi, Chandigarh, Lakshadweep and Sikkim. Because it does not have any agriculture related practices and its farming methods are completely based on inorganic agriculture.

Very less amount of organic fertilizers is used by Tripura, Punjab, Uttarakhand, Jammu & Kashmir, pondicherry and West bangal. The share of overall fertilizer use by region is shown. East, North East and South regions of India are using less fertilizer while the northern and western areas of India tend to use more. The share of Western India was the highest, followed by south and northeaast.

Research Methodology

This paper is based on secondary data. Different information is obtained from a number of government websites which are available for the public in order to meet these objectives. Information about organic fertilizer production and consumption is available on the www.sansad.in (GOVT. Website), which were analyzed in MS Excel. Various reports made public by the Indian Government's Department of Agricultural Cooperation & Farmers Welfare collect data on food grains. Tables are drawn to illustrate these data.

Pestle Analysis

Political Factors (P) - Political and governmental influences are major drivers in this sector:

- **Government Promotion of Sustainable & Organic Farming**
  - Policies such as Paramparagat Krishi Vikas Yojana (PKVY), MOVCDNER, and National Project on Organic Farming (NPOF) support organic inputs adoption.
- **Subsidy Realignment**
  - Heavy subsidies still favor chemical fertilizers (Urea, DAP, NPK), making organic fertilizers comparatively costlier.
  - Some states offer targeted subsidies on organic inputs (e.g., compost, biofertilizers).
- **Certification & Standardization**
  - NPOP and FCO standards regulate quality and certification of biofertilizers and compost, influencing production cost and compliance.
- **State-Level Agricultural Missions**
  - States like Sikkim, Uttarakhand, Andhra Pradesh (Natural Farming) encourage organic-based systems, boosting consumption regionally.

Impact: Political environment is generally supportive, but subsidy imbalance distorts farmer adoption economics.

Economic Factors (E) - Economic variables affect both demand (consumption) and supply (production):

Demand-Side

- **Cost Sensitivity of Farmers**
  - Organic fertilizers are often higher priced than subsidized chemical fertilizers.
  - Farmers evaluate yield returns vs. cost, influencing adoption.
- **Premium Market for Organic Produce**
  - Higher prices for organic produce (domestic + export) increase demand for organic inputs.
  - Horticulture & export crops (spices, fruits, tea, medicinal plants) drive consumption.

Supply-Side

- **Production Costs**
  - Raw material availability (biomass, manure) is plentiful but collection, processing & transport add costs.
- **Growing Waste Management Market**
  - Urban composting & municipal waste treatment create new supply streams for compost-based fertilizers.
- **Market Size Growth**
  - Indian organic fertilizers market is growing due to sustainability push, but remains smaller than chemical fertilizer sector.

Impact: Economic viability for producers is improving, but price parity vs. chemicals remains a barrier for mass adoption.

Social Factors (S) - Social perceptions and behavior strongly influence consumption:

- **Increasing Awareness of Soil Health**
  - Degradation from chemical fertilizers drives interest in organic inputs among informed farmers.
- **Consumer Health Preferences**
  - Urban consumers increasingly demanding residue-free & organic foods → back-propagates input demand.

- **Farmer Risk Aversion**
  - Many farmers adopt integrated practices (INM) instead of fully switching to organic—impacting volumes.
- **Training & Knowledge Gap**
  - Effective application of biofertilizers requires extension services; lack of knowledge limits adoption.
- **Regional Variations**
  - Higher adoption in NE states, hilly states, and states with large horticulture sectors.

Impact: Social trends are positive for growth, but education gaps slow consumption expansion.

Technological Factors (T) - Technology affects both production efficiency and product performance:

- **Advances in Biofertilizers & Microbial Consortia**
  - Improved strains of Rhizobium, Azotobacter, PSB, etc. increase nutrient fixation efficiency.
- **Fermentation & Composting Technology**
  - Better composting, vermiculture, and fermentation processes enhance quality and reduce processing time.
- **Application Technology**
  - Drip fertigation & liquid biofertilizer formulations improve nutrient uptake.
- **Quality Control & Certification**
  - Technology supports standardization, microbial count testing, and shelf-life improvements.
- **Digital Marketplaces**
  - Agri-tech platforms enable direct-to-farm sales and farmer education.

Impact: Technology is enhancing product reliability, improving farmer trust, and supporting future scalability.

Legal Factors (L) - Regulatory frameworks define production and marketing conditions:

- **Fertilizer Control Order (FCO) Regulations**
  - Sets norms for organic fertilizers, biofertilizers, and compost quality and labeling.
- **Certification Requirements**
  - NPOP, NOP, and APEDA frameworks regulate organic agriculture inputs for export markets.
- **Waste Management Rules**
  - Swachh Bharat and municipal waste composting rules influence compost supply chain.
- **Intellectual Property and Strain Licensing**
  - Microbial strains for biofertilizer production may require licensing and regulatory approval.
- **Environmental Compliance**
  - Producers handling waste biomass must follow environmental clearances, especially for city composting.

Impact: Regulatory environment is structured but complex, adding compliance costs for producers.

Environmental Factors (E) - Environmental considerations are both drivers and beneficiaries of organic fertilizer use:

- **Soil Degradation & Nutrient Imbalance**
  - Long-term chemical fertilizer use caused declining soil health → boosting organic adoption.
- **Climate Change & Carbon Farming**
  - Organic fertilizer supports carbon sequestration and low-carbon agriculture, aligning with global ESG priorities.

- **Waste-to-Resource Transition**
  - Organic fertilizer converts agricultural & municipal waste into usable nutrients → circular economy benefits.
- **Reduced Pollution**
  - Lower runoff pollution compared to chemical fertilizers benefits water bodies & ecosystems.
- **Biodiversity & Soil Microbiome**
  - Encourages microbial diversity critical for sustainable agriculture.

Impact: Strong environmental drivers make organic fertilizer a strategic necessity for sustainable farming in India.

Summary of PESTLE Implications

Dimension	Overall Influence
Political	Positive (drivers)
Economic	Mixed (price barriers)
Social	Positive but slow adoption
Technological	Strong positive for scalability
Legal	Supportive but compliance-heavy
Environmental	Strong positive & long-term

Result and Discussion

The PESTEL analysis reveals that the organic fertilizer sector in India is shaped by a complex interaction of **policy incentives, economic constraints, social awareness, technological advancements, legal frameworks, and environmental necessities**. The results indicate that while the industry is supported by strong political and environmental drivers, **economic and behavioral factors continue to act as significant limiting variables in its widespread adoption**.

- **Political Policy Findings:** The analysis shows that **political and policy support acts as a major enabling factor**. Current government initiatives such as PKVY, MOVCDNER, and state organic missions have increased the visibility and legitimacy of organic inputs. However, the coexistence of **heavy subsidies on synthetic fertilizers** introduces an asymmetric market condition. This price distortion reduces the economic attractiveness of organic fertilizers for conventional farmers, thereby slowing consumption growth.
  - **Discussion:** This suggests that while policy direction favors sustainability, the subsidy system still structurally supports chemical-intensive agriculture. A policy realignment toward either **input-neutral subsidies** or **outcome-based soil health incentives** could accelerate adoption.
- **Economic Results:** Economically, the sector displays both **growth potential and cost-related barriers**. Producers benefit from increasing demand in urban organic food markets and export-oriented value chains (spices, tea, fruits). However, on the consumption side, farmers show **high price sensitivity** and often compare organic fertilizers directly with subsidized urea, where organic products appear costlier per nutrient unit.
  - **Discussion:** The economic viability improves significantly in regions where:
    - farmers target premium markets,
    - certification systems exist,
    - soil degradation is severe, or
    - horticulture dominates over field crops.

Therefore, the economic drivers are **crop-specific, region-specific, and market-linked**, rather than uniform across India.

- **Social Results -** Social factors reveal a **positive shift in awareness but slow behavioral adoption**. Farmers acknowledge long-term soil health benefits; however, short-term risk perceptions and lack of technical knowledge restrict adoption. Integration-based practices (e.g., INM) are preferred over complete substitution of chemical fertilizers.

- **Discussion:** This reflects a **transitional stage** of the market. Consumption growth is not merely a matter of product availability but involves:
  - extension services
  - demonstration effects
  - trust in microbial efficacy
  - Training and knowledge dissemination will determine how fast consumption scales.

- **Technological Results -** Technological advancements are improving **production efficiency and product performance**. Innovations in microbial strains, liquid formulations, composting methods, and application technologies have increased reliability and reduced application uncertainty. Digital platforms are expanding direct-to-farm access and reducing distribution friction.
  - **Discussion:** Technology plays a critical bridging role between the perceived risk of organic fertilizer use and actual performance outcomes. As shelf-life, microbial counts, and nutrient-release characteristics improve, farmer confidence is likely to strengthen, accelerating adoption rates.

- **Legal–Regulatory Results -** The legal framework under FCO and NPOP provides **standardization and quality assurance**, which is essential for a biologically sensitive product category. However, compliance introduces **additional certification and licensing costs** for producers, particularly MSMEs. Waste management laws also influence the supply chain by linking municipal composting to fertilizer production.
  - **Discussion:** Legal frameworks are generally supportive but could be streamlined to reduce regulatory duplication between food export certifications and fertilizer input regulatory systems.

- **Environmental Results -** Environmental factors present the **strongest long-term justification** for growth in both production and consumption. Soil nutrient imbalance, pollution from chemical runoffs, loss of microbial biodiversity, and climate pressures all position organic fertilizers as a sustainable corrective input. Waste-to-resource value chains further align production with circular economy objectives.
  - **Discussion:** Unlike chemical fertilizers which mainly address immediate yield needs, organic fertilizers address **system-level agricultural sustainability**. This makes environmental drivers irreversible and increasingly influential over time, regardless of short-term economic constraints.

Overall Interpretation - The combined results show:

- **Strong Long-Term Drivers:** Political, environmental, and technological factors make organic fertilizers a **strategic necessity** for India's agricultural sustainability.
- **Short- to Medium-Term Barriers:** Economic and social constraints—especially price parity, perceived yield risk, and knowledge gaps—limit immediate widespread adoption.
- **Market Transition Phase:** India is in a shift from **chemical-intensive farming** toward **integrated and residue-free models**, rather than a full organic conversion.

Conclusion

Organic fertilizer consumption and production in India are on **an upward trajectory** shaped by agronomic necessity, environmental concern, and market demand. While still small compared to conventional fertilizer systems, the sector's **growth prospects are significant** under supportive policy conditions and broader adoption of organic farming. Addressing structural constraints and scaling production will be essential to deepen the role of organic fertilizers in India's sustainability agenda.

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