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Assessing the Trends and Adoption Patterns of Biofertilizer Use Among Farmers in Chandrapur District, Maharashtra

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Abstract: The present study investigates the patterns and determinants of biofertilizer adoption among farmers in Chandrapur district, Maharashtra. A total of **200 farmers** across **five tehsils**—Chandrapur, Warora,Chimur, Mul, and Bhadravati were surveyed through structured interviews. Data were analyzed using descriptive statistics, Chi-square tests, and binary logistic regression to determine the influence of socio-economic variables on adoption. Findings revealed that **62% of respondents** had used biofertilizers in the past three years, with education level, access to extension services, and farm size being significant determinants. While 78% of users recognized improved soil fertility, only 41% used biofertilizers consistently due to availability and awareness constraints. The study concludes with policy recommendations for scaling sustainable agricultural practices in Vidarbha.

Keywords: Biofertilizer adoption, Chandrapur, Sustainable agriculture, Farmer awareness, Logistic regression, Soil fertility

1. INTRODUCTION

Excessive reliance on chemical fertilizers has led to nutrient imbalance and declining soil productivity in many parts of India. In contrast, **biofertilizers**—microbial formulations that enhance nutrient uptake—offer an eco-friendly alternative that restores soil health and reduces input costs (Sharma & Kumar, 2020).

In **Chandrapur district** of Maharashtra, agriculture forms the economic backbone, dominated by crops like **cotton, soybean, paddy, Arhar and chickpea**. Despite the Government of India and state government initiatives through krishivigyan Kendra, National Project on Organic Farming (NPOF) and various agriculture scheme adoption rates of biofertilizers remain inconsistent.

This study aims to evaluate **the trends, determinants, and constraints** of biofertilizer use among Chandrapur farmers to support regional sustainability policies.

2. OBJECTIVES

1. To assess the level of awareness and adoption of biofertilizers among farmers in Chandrapur district.
2. To analyze socio-economic and institutional factors influencing adoption.
3. To examine the trend of biofertilizer use over the past five years.
4. To recommend strategies for improved dissemination and adoption.

3. METHODOLOGY

3.1 Study Area and Sampling

The study covered **five tehsils** of Chandrapur district. A **multi-stage random sampling**

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method was adopted to select **200 respondents** from 20 villages (40 respondents per tehsil).

3.2. Data Collection

Primary data were collected via structured questionnaires covering:

- Demographics (age, education, landholding, income)
- Awareness and perception of biofertilizers
- Sources of information and institutional support
- Extent and frequency of biofertilizer use

Secondary data were gathered from **District Agriculture Office**, Agriculture College and **KVK in Chandrapurdistrict** , and **Maharashtra State Agriculture Portal**.

3.3. Analytical Techniques

- **Descriptive statistics** for awareness and usage levels
- **Chi-square test** for association between socio-economic factors and adoption
- **Binary logistic regression** for identifying determinants of adoption

4. RESULTS AND DISCUSSION

4.1. Socio-Economic Profile of Respondents

Variable	*Category*	*Frequency*	*Percentage (%)*
Age (Years)	Below 30	32	16.0
	30–50	112	56.0
	Above 50	56	28.0
Education	Illiterate	18	9.0
	Primary	64	32.0
	Secondary	82	41.0
	College and Above	36	18.0
Farm Size	Marginal (<1 ha)	52	26.0
	Small (1–2 ha)	78	39.0
	Medium (2–4 ha)	48	24.0
	Large (>4 ha)	22	11.0

Majority of farmers (56%) were aged 30–50 years, representing the economically active group. About 41% had secondary education, suggesting moderate literacy. The majority (65%) had small or marginal holdings, typical of Vidarbha agriculture

4.2. Awareness and Use of Biofertilizers

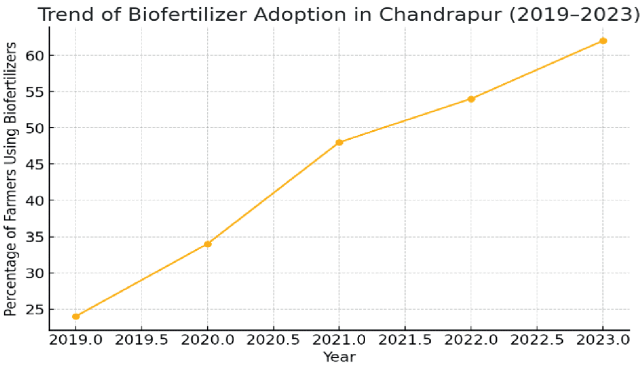
Awareness Level	*Frequency*	*Percentage (%)*		
Aware and Using	124	62.0		
Aware but Not Using	36	18.0		
Unaware	40	20.0		
Frequency of Use	Once per Year	Twice per Year	Occasio-nally	Never
% of Farmers	32%	21%	9%	38%

Nearly two-thirds of farmers were aware of biofertilizers, yet only half were consistent users. Awareness was positively correlated with education and participation in farmers **training and awareness programs**.

4.3. Trend of Biofertilizer Use (2019–2023)

Year	*No. of Users*	*% Adoption*	*Major Crops Using Biofertilizers*
2019	48	24%	Cotton, Soybean
2020	68	34%	Cotton, Soybean Chickpea
2021	96	48%	Cotton, Paddy,
2022	108	54%	Cotton, Paddy, Tur,Chickpea
2023	124	62%	Cotton, Soybean, Wheat,

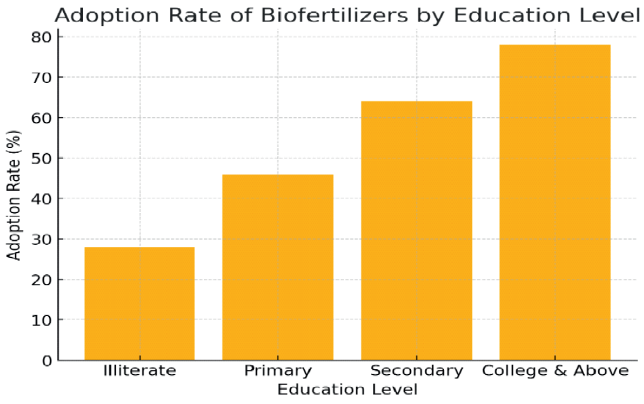
A consistent upward trend is observed in adoption from 24% to 62% over five years. Field interviews suggest this growth is driven by **extension training, demonstration plots**, and **price incentives**.



4.4. Determinants of Adoption: Chi-Square Test

Variable	*χ^2 Value*	*df*	*Significance ($p < 0.05$)*	*Association*
Education	19.56	3	0.001	Significant
Farm Size	11.32	3	0.012	Significant
Access to Extension	27.41	2	0.000	Significant
Annual Income	6.22	2	0.045	Significant
Age	2.11	2	0.34	Not significant

Education, farm size, extension access, and income were statistically significant determinants of adoption. Younger age groups showed more openness to innovation, though the relationship was not significant.



4.5. Logistic Regression: Determinants of Adoption

Independent Variable	*Coefficient (β)*	*Exp(β) (Odds Ratio)*	*Significance (p-value)*
Education Level	0.743	2.10	0.004
Farm Size	0.653	1.92	0.011
Access to Extension	1.203	3.33	0.001
Perception of Cost	-0.564	0.57	0.045
Age	-0.132	0.88	0.28
Constant	-2.450	—	0.002

- Farmers with **extension access** were 3.3 times more likely to adopt biofertilizers.
- **Education and farm size** positively influenced adoption, while **high perceived cost** discouraged it.

The regression model had a **Nagelkerke $R^2 = 0.47$**, indicating good explanatory power.

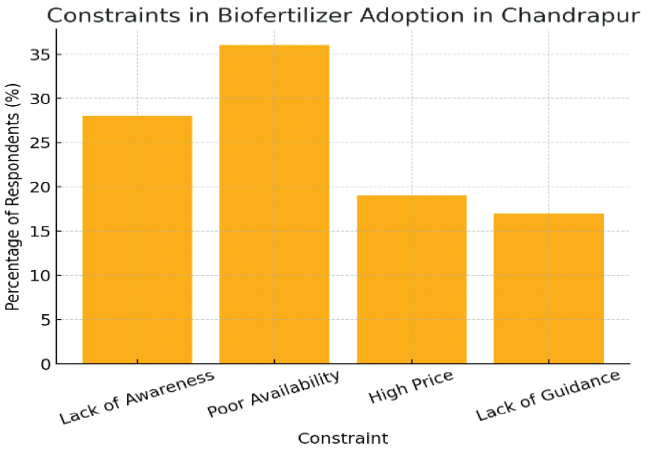
4.6. Perceived Benefits of Biofertilizer Use

Perceived Benefit	Percentage of Respondents (%)
Improved Soil Fertility	78
Higher Crop Yield	65
Reduced Fertilizer Cost	54
Environmental Benefits	49
Long-Term Soil Health	72

Farmers predominantly recognized soil fertility and long-term health as major benefits. However, many expected immediate yield increases, reflecting a **need for awareness of long-term effects**.

4.7. Constraints in Biofertilizer Adoption

Constraint	*Frequency*	*Percentage (%)*
Lack of Awareness	56	28.0
Poor Availability in Market	72	36.0
High Price	38	19.0
Lack of Technical Guidance	34	17.0



The most common constraints were poor market availability and low awareness. Supply chain strengthening and dealer training are therefore critical.

5. DISCUSSION

The findings support the hypothesis that **education, institutional access, and resource base** play a pivotal role in biofertilizer adoption. The **trend analysis** indicates a gradual shift toward sustainable practices, driven by exposure to **KrishiVigyan Kendra programs** and local NGO interventions.

These results align with earlier studies (Patel & Singh, 2022; Karthikeyan et al., 2021), which reported education and farm size as major adoption determinants in Maharashtra and Tamil Nadu.

However, low usage consistency suggests a gap between **awareness and habitual adoption**. Strengthening farmer networks and promoting **demonstration plots** can enhance behavioral continuity.

6. STRATEGIC POLICY DIRECTIONS FOR ENHANCING BIOFERTILIZER ADOPTION IN CHANDRAPUR DISTRICT

1. **Extension and Training:** Increase KVK-led demonstration projects at the village level focusing on composting and biofertilizer use.
2. **Market Linkages:** Establish local **biofertilizer production units** under Farmer Producer Organizations (FPOs).
3. **Subsidy Support:** Offer 20–30% subsidies on certified biofertilizer products to improve accessibility.
4. **Awareness Programs:** Launch district-level awareness campaigns via mobile-based applications and Agri Helpline Centers.
5. **Integration in Soil Health Cards:** Include recommendations for biofertilizer types suitable for each soil profile in **Soil Health Card reports**.

7. CONCLUSION

The study reveals an encouraging but incomplete transition toward biofertilizer use in Chandrapur. Education, farm size, and extension access emerge as significant determinants. Enhancing institutional support, improving availability, and promoting farmer-led demonstrations will strengthen the sustainability of agriculture in the region.

Future research should focus on **economic cost–benefit analyses** and **soil microbiological assessments** to quantify long-term benefits.

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