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Factors influencing usage of biofertilizers in paddy cultivation and the constraints faced by farmers in the usage of biofertilizers in Konaseema district of Andhra Pradesh

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Abstract

This study examines the socio-economic profile, awareness, usage patterns, and key factors influencing the adoption of biofertilizers among paddy farmers in Konaseema district. A survey was conducted with 64 farmers, collecting data on landholding size, education, income levels, biofertilizer awareness, application practices, and satisfaction levels. The findings reveal that 75% of the respondents were aware of biofertilizers, with accessibility being high in local markets. However, cost and promotional activities significantly influenced adoption rates. Among the various biofertilizers used, Vesicular Arbuscular Mycorrhiza (VAM) was the most preferred, followed by Azospirillum and Rhizobium. Satisfaction levels indicated that 43% of farmers were highly satisfied with biofertilizer performance. Promotional strategies such as farmers' meetings and posters were the most effective in encouraging adoption. The study highlights the need for targeted awareness programs and improved accessibility to enhance biofertilizer adoption, thereby promoting sustainable agricultural practices in the region. However, constraints such as limited technical knowledge, inadequate training, and financial barriers still hinder widespread adoption, requiring focused interventions for effective utilization.

Keywords: Socio-economic Profil, biofertilizers, paddy farmers, Konaseema district, adoption of biofertilizers

Introduction

Fertilizers are essential for enhancing agricultural productivity by supplying vital nutrients necessary for plant growth. These nutrients help maintain soil fertility, ensuring high crop yields. Chemical fertilizers, which consist of inorganic compounds synthesized through chemical reactions, play a significant role in modern agriculture. They are categorized into simple- substance and compound fertilizers, providing essential elements such as nitrogen, phosphorus, potassium, calcium, sulfur, and micronutrients like zinc, boron, and iron (J. L. Havlin, 2013) ^[1]. Common examples include potassium chloride, potassium sulfate, ammonium sulfate, and urea. The Indian fertilizer industry is projected to experience significant growth, reaching a market size of Rs 1.38 lakh crore by 2032, with a CAGR of 4.2% from 2024 to 2032 (The Economic Times, 2024) ^[2]. However, while chemical fertilizers improve plant productivity, excessive use can have adverse environmental effects, prompting a shift toward sustainable alternatives like biofertilizers.

Biofertilizers consist of beneficial microorganisms such as bacteria, fungi and algae that enhance soil health and

promote plant growth without harming the environment (E. Malusa, 2014) ^[3]. Soil microorganisms, including bacteria, actinomycetes, fungi, algae and protozoa, play distinct roles in maintaining soil fertility (Mendes *et al.*, 2013) ^[4]. The application of biofertilizers can be carried out using various methods, including seed treatment, where biofertilizers are mixed with water and adhesives like gum acacia or jaggery solution before coating seeds (Subba Rao, 1993) ^[5]. Another method is the seedling root dip, where paddy seedling roots are immersed in a biofertilizer solution for 8–10 hours before transplantation (Kannaiyan, 2002) ^[5]. Soil treatment involves mixing biofertilizers with compost and allowing it to rest overnight before incorporating it into the soil during planting or sowing. With increasing consumer awareness regarding food safety and sustainability, countries like the USA, Germany, Switzerland, Denmark, India and China have expanded their organic farming practices, boosting the demand for biofertilizers. In India, major biofertilizer manufacturers include International Panaacea Limited, Kan Biosys, Rashtriya Chemicals & Fertilizers Limited (RCFL), Indian Farmers Fertilizer Cooperative Limited (IFFCO) and others, highlighting the growing market potential for

sustainable agricultural solutions. However, the adoption of biofertilizers is influenced by multiple factors such as cost, accessibility, awareness and promotional efforts. Understanding these factors is essential for formulating strategies that encourage farmers to integrate biofertilizers into their agricultural practices, ensuring long-term sustainability and productivity.

Materials and Methods

The study utilized a survey approach, gathering data from 64 paddy farmers in Konaseema district. The data collection focused on farmers' socio-economic characteristics, awareness, usage patterns, satisfaction levels, and the key factors influencing their adoption of biofertilizers. The survey covered aspects such as landholding size, educational background, income levels, awareness of biofertilizers, sources of information, application practices, and satisfaction with the outcomes of biofertilizer use. To analyze the collected data, methods such as rating scales, tabular analysis and percentage analysis were employed.

Results and Discussion

Socio Economic Profile of Sample Farmers.

The respondents' socio-economic characteristics, including gender, age group, educational background and landholding size are analysed to gain a comprehensive understanding of their socio-economic status.

Gender of the Respondents

Gender effects farming through the division of labor, with women typically handling labor-intensive jobs and males focusing on decision-making and higher-value activities.

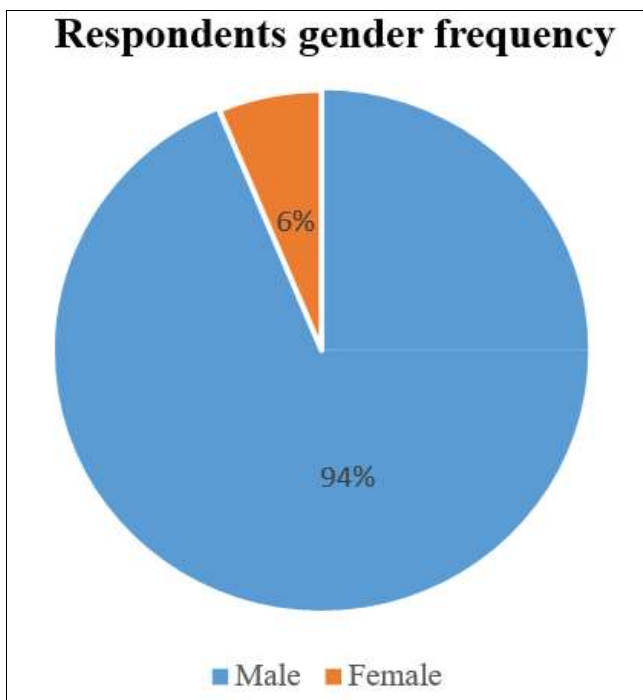


Fig 1: Illustrate the gender distribution of the respondents

Age of the Respondents

Age plays a significant role in shaping individual decision-

making particularly in terms of farmers' risk tolerance and openness to adopting new technologies. The age distribution of the sample respondents was presented in the Table 3.1.

Table 3.1: Age of the Sample Respondents

S. No.	Age Group (Years)	No. of Sample Farmers	Percentage (%)
1	20-30	10	15.63
2	30-40	24	37.50
3	40-50	18	28.12
4	50 and above	12	18.75
	Total	n = 64	100

Educational Qualifications of Respondents

Education helps in adopting new technologies at a faster pace. Table 3.2 present the educational qualifications of the respondents.

Table 3.2: Educational Qualifications of Sample Respondents

Education	Number	Percentage (%)
Primary School	24	37.50
High School	32	50.00
Graduation	08	12.50
Total	64	100.00

Landholdings of Respondents

Landholding size is a crucial socio-economic factor that influences respondents' farming practices and decision-making. Table 3.3 presents the distribution of 64 farmers based on their landholding size and average area cultivated by them.

Table 3.3: Landholdings of Sample Farmers

S. No	Category	Sample	Average holding size (ha)
1	Marginal (<1 ha)	13	0.92
2	Small (1-2 ha)	25	1.84
3	Medium (2-4 ha)	17	3.45
4	Large (>4 ha)	09	14.77
	Total	64	26

Monthly Income of Respondents

The income distribution data of 64 farmer's highlights a significant diversity in their monthly earnings are presented in Table 3.4

Table 3.4: Monthly Income of Respondents

S. No	Income Range (in Rupees)	Number	Percentage (%)
1.	Below 10000	13	20.31
2.	10000-20000	21	32.81
3.	20000-30000	13	20.31
4.	30000-40000	09	14.06
5.	40000 & Above	08	12.5
	Total	64	100.00

Analysis of Bio fertilizers Usage in Paddy Cultivation

Biofertilizers such as VAM, Azospirillum and Rhizobium play a vital role in paddy cultivation. The usage patterns of these nutrients are presented below.

Table 3.5: Usage pattern of Bio fertilizers by sample farmers

S. No	Bio Fertilizers			
	Category	VAM	Azospirillum	Rhizobium
1	Marginal	7	1	1
2	Small	15	4	2
3	Medium	8	3	1
4	Large	5	1	0
Total biofertilizer used by sample respondents		35	9	4
Percentage use of Bio- Fertilizers		72.91	18.75	8.34

Factors Influencing the Usage of Biofertilizers in Paddy Crop

The adoption of biofertilizers in paddy cultivation is influenced by several key factors, including cost-effectiveness, awareness, accessibility, experience and promotional activities. A survey was conducted to analyze these aspects, ranking them based on their impact on farmers' decision- making.

Cost-Effectiveness

Cost plays a vital role in determining farmers' preference for biofertilizers and comparison of prices of leading bio fertilizer companies is presented in Table 3.8. across its product range.

Table 3.6: Comparison of Biofertilizer Prices across leading Companies

S. No	Category	No. of farmers	Percentage (%)
1	Aware	48	75
2	Unaware	16	25
Total		64	100

Awareness and Knowledge

Table 3.7: Farmers Awareness on Biofertilizers

Products	C SPI	L NF	T-Stanes	F RC	KRIBHCO
VAM	477	550	425	518	482
Rhizobium	455	572	470	535	471
Azospirillum	409	493	422	498	423
PHOS	445	472	452	505	476
Pseudomonas	352	395	406	425	398
Trichoderma	465	592	483	472	491

Among the 64 farmers surveyed, 75% were aware of biofertilizers, while 25% lacked awareness. This highlights the need for targeted awareness programs to enhance knowledge and confidence among farmers, promoting sustainable agricultural practices.

Accessibility of Biofertilizers

Table 3.8: Accessibility of biofertilizers to Sample Respondents

S. No	Category	Frequency	Percentage (%)
1	Local market	48	100
	Total	48	100

All 48 farmers who were aware of biofertilizers confirmed their easy availability in local markets. However, for the 25% of farmers who are unaware, increasing both awareness and accessibility can boost adoption rates.

Overall Experience of Using Biofertilizers

Table 3.9: Farmers experience on performance of Bio fertilizers

S. No	Category	Frequency	Percentage (%)
1.	Highly Dissatisfied	3	7
2.	Dissatisfied	5	11
3.	Neutral	8	16
4.	Satisfied	11	23
5.	Highly Satisfied	21	43
Total		48	100

From Table 3.9,

By assuming up the total contributions

$$\sum Wi. Xi = (3*1) + (5*2) + (8*3) + (11*4) + (21*5)$$

$$= 3 + 10 + 24 + 44 + 105$$

$$= 186$$

$$\sum Wi. Xi = 186$$

$$\sum Wi = 48$$

$$\text{Mean score} = 3.875$$

Table 3.9 indicates that the majority of farmers (43%) are highly satisfied with the performance of biofertilizers

Impact of Promotional Activities

Table 3.10: Impact of promotional activities on farmer's biofertilizer usage behavior

S. No	Category	Frequency	Percentage (%)
1.	By Campaigning	8	17
2.	By Sales Person	9	18
3.	By Posters	12	25
4.	By Banners	3	6
5.	By Literature	2	4
6.	By Farmers Meeting	13	30
Total		48	100

Promotional activities significantly influenced biofertilizer adoption, with farmers' meetings being the most effective (30%), followed by posters (25%) and sales interactions (18%). Campaigns (17%), banners (6%) and literature (4%) had a lesser impact, emphasizing the importance of direct engagement strategies.

The Constraints faced by Farmers in the Usage of Biofertilizers

The adoption of biofertilizers faces challenges like

awareness, accessibility, financial constraints, and technical knowledge. Without proper guidance, farmers struggle to integrate them effectively into their practices. Overcoming

these barriers requires efforts to enhance knowledge, availability, and confidence. Targeted interventions can ensure better adoption and utilization of biofertilizers.

Table 3.11: Constraints faced by farmers in the usage of biofertilizers

S. No	Constraints	Garrett Mean Score	Rank
1.	Limited farmer awareness about bio-fertilizer knowledge	52.375	1
2.	Inaccessibility of bio-fertilizers.	49.296	7
3.	Unavailability of bio-fertilizers tailored to specific crop recommendations.	50.593	4
4.	Lack of technical expertise in the proper use of bio-fertilizers.	50.765	3
5.	. Delays in processing and inadequate credit facilities.	50.359	5
6.	Limited expertise in utilizing various bio-fertilizers.	50.84	2
7.	Insufficient training on the application of bio-fertilizers	50.046	6
8.	Low confidence in applying bio-fertilizers	47.07	8

According to the Garrett ranking, the biggest barrier to biofertilizer adoption is farmers' lack of knowledge regarding biofertilizers (Rank 1), highlighting the need for awareness programs on their benefits and usage. Limited knowledge of different biofertilizers (Rank 2) further restricts adoption, necessitating targeted training and information sharing. The lack of technical knowledge (Rank 3) prevents efficient usage, emphasizing the importance of providing technical guidance and instructional materials. The absence of crop-specific biofertilizers (Rank 4) makes selection difficult, requiring customized recommendations from producers and distributors. Processing delays and limited credit facilities (Rank 5) create administrative and financial barriers, calling for improved funding options and streamlined processes. Inadequate training (Rank 6) further hampers effective usage, underlining the necessity of educational initiatives to enhance farmers' technical skills. Inaccessibility of biofertilizers (Rank 7) due to distribution and supply chain issues also restricts adoption, making it crucial to improve local availability and logistics. Lastly, low confidence in using biofertilizers (Rank 8) discourages farmers from trying new methods, which can be addressed through demonstration projects, peer endorsements, and confidence-building measures.

Conclusion

The analysis of the socio-economic profile and biofertilizer usage among paddy farmers reveals several important insights. The majority of respondents are male, predominantly aged between 30 and 40 years, with a considerable proportion having completed high school education. Most farmers have small to medium landholdings, and their monthly incomes vary, reflecting economic diversity. Regarding biofertilizer adoption, VAM is the most commonly used, followed by Azospirillum and Rhizobium. Key factors influencing adoption include cost, awareness, accessibility, and promotional efforts. Among biofertilizer brands, SPIC was found to be the most cost-effective. While 75% of farmers are aware of biofertilizers, targeted awareness programs are needed for the remaining 25%. Accessibility is not a major concern, as biofertilizers are widely available in local markets. Farmers' overall experience with biofertilizers is positive, with 43% expressing high satisfaction, resulting in a mean satisfaction score of 3.875. Promotional activities play a significant role, with farmers' meetings (30%) and posters (25%) being the most influential. These findings highlight the need for

increased awareness initiatives, enhanced direct engagement strategies and cost-effective pricing to further promote biofertilizer adoption and support sustainable paddy cultivation. However, despite these positive trends, challenges such as limited technical knowledge, inadequate training, and financial constraints continue to hinder the widespread adoption of biofertilizers, necessitating targeted interventions for improved usage.

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