UNDERSTANDING FARMERS' PERCEPTIONS AND CONSTRAINTS IN BIOGAS SLURRY USE IN ANAND DISTRICT OF GUJARAT

ABSTRACT

Biogas slurry (BGS), a byproduct of anaerobic fermentation of bio-materials, is an eco-friendly and efficient organic fertilizer. While chemical fertilizers enhance crop yields, their excessive use causes soil compaction, reduced fertility, pollution, and greenhouse gas emissions. BGS, rich in essential nutrients, offers a sustainable alternative, but its bulky nature, high water content, and management challenges hinder widespread adoption. This study, "Understanding Farmers' Perceptions and Constraints in Biogas Slurry Use in Anand District of Gujarat," investigated awareness, perception, and constraints faced by farmers. Using purposive sampling, primary data were collected from 120 farmers in Anand district. Analytical methods included Frequencies, Percentages, Tabular analysis, Weighted Average Mean, and Henry Garrett ranking used. Findings showed that 68% of farmers were middle-aged, 72% belonged to nuclear families, 37% had primary education, 69% earned 5-10 lakhs annually, and 37% owned 1-2 hectares of land. Bananas were the primary crop for 72% of farmers, with 63% relying solely on agriculture. A significant gender disparity was noted, with 99% male farmers. All respondents were aware of BGS, primarily due to initiatives like the Deenbandhu scheme and the National Dairy Development Board's Mrida company. BGS was favored for its nutrient content and lower weed issues compared to farmyard manure. However, challenges included transportation, storage, availability, labour, and application difficulties. Recommendations include improving transportation and storage infrastructure, adopting innovative technologies, implementing quality control, and conducting awareness campaigns for wider adaptation

Keywords:*Biogas Slurry (BGS), Sustainable Agriculture, Economic Status, Perceptions, Awareness, Soil Enhancement, Constraints*

1. INTRODUCTION

Biogas slurry (BGS) is an environmentally-friendly byproduct of anaerobic fermentation, used as an organic fertilizer in agriculture. Overuse of chemical fertilizers has led to soil degradation, pollution, and health risks, highlighting the need for sustainable alternatives like BGS (Pindi & Satyanarayana, 2012). Global organic farming is growing, with 186 countries involved and India leading in organic producers as of 2018. Despite benefits, challenges like lower productivity and higher costs hinder widespread adoption [5].

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Benefits of Biogas Slurry

BGS is rich in essential nutrients and beneficial microbes, making it an effective soil conditioner and bio-pesticide. However, its ~~high water~~high-water content and nitrogen loss through ammonia volatilization reduce efficiency. An 800 m³ biogas plant can produce around 15 tons of BGS daily, with 93% water content, posing transportation and application challenges [11,12].

Limitations and Challenges

High nitrogen loss through ammonia volatilization and elevated pH levels in BGS pose challenges during its handling and application. Proper management and technological interventions are needed to optimize its benefits. For instance, nitrogen loss can reach over 50% during agricultural processes, contributing to economic loss [1,6].

Biogas Production and Utilization

India produces approximately 730 million tons of animal dung annually, primarily from bovines, with a potential to generate around 76.8 million tons of BGS. This highlights BGS's vast potential for sustainable agricultural practices [7,9].

Nutrient Profile and Agricultural Applications

BGS contains vital nutrients such as nitrogen (0.95-1.16%), phosphorus (0.54-0.92%), and potassium (1.20-1.26%), making it a valuable fertilizer. Research indicates that BGS application improves crop growth and soil health, reducing the need for synthetic fertilizers and irrigation [4,8].

Biopesticidal Activities

BGS also exhibits biopesticidal properties, effectively controlling nematodes, fungi, termites, and weeds. This makes it an effective alternative to chemical pesticides, contributing to safer agricultural practices [3].

Economic Viability

Economically, BGS holds significant potential. The Indian biogas industry estimates annual revenue of approximately USD 1.5 billion from BGS, highlighting its commercial viability. Using BGS instead of synthetic fertilizers can reduce production costs by up to 30%, making it an economically attractive option for farmers [5].

Objectives

1. To study the awareness among the farmers about Biogas slurry and slurry based products
2. To study the Farmers perception regarding Biogas slurry and slurry based products
3. To identify constraints faced by farmers for utilization of Biogas slurry and slurry based products

2. RESEARCH METHODOLOGY

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This study examined farmers' awareness, perception, and challenges in using biogas slurryand slurry based products in the Anand District of Gujarat. Data were gathered through structured interviews and various secondary sources.

Sampling Method

Purposive sampling method was used to select 120 farmers from Anand, Borsad, Umreth, and Petlad talukas of Anand District.

Research Design and Analysis

A descriptive research design was employed, using frequencies, tabular analysis, percentages, graphical presentation, Garrett ranking, and Weighted Average Mean for data analysis.Weighted Average Mean was used to analyze perceptions of farmers and Garrett Ranking Technique was used to Identified and ranked constraints faced by farmers.

- Weighted Average Mean: [10]

Weighted Arithmetic Mean (X)= $\frac{(FIX1+F2X2+F3X3+F4X4+F5X5)}{Xt}$

Where, F = Weight given to each response

X = Number of responses

Xt =Total number of responses

- Garrett's ranking technique:[2]

Percentage position = $\frac{100\,(Rij-0.5)}{Nj}$

Where Rij = Rank given for the i^{th} variable by j^{th} respondents

Nj = Number of variables ranked by j^{th} respondents

3. RESULTS AND DISCUSSION

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3.1 Socio economic profile of farmers

The survey provides comprehensive data on various aspects of the farming population. The majority of farmers (68%) are aged 36-50, with middle-aged individuals being predominantly involved in farming.

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Most families (72%) have 3-5 members, indicating a nuclear family structure. The educational distribution shows that 37% of farmers have completed primary education, aiding their understanding of modern farming practices. Income levels reveal that 69% of respondents earn 5-10 lakhs annually, primarily due to fruit and vegetable cultivation and livestock farming. Regarding land ownership, 37% of farmers hold 1-2 hectares, classifying them as small farmers. In terms of crops, 72% of farmers primarily grow bananas, which is the major crop in Anand district, aligning with the region's climate and agricultural focus. Additionally, 63% of farmers depend solely on agriculture, while 24% combine agriculture with livestock, and 13% are involved in agriculture and other activities. The survey also highlights a significant gender disparity, with 99% of farmers being male.

Table 1. Socio-economic profile of farmers

Sr.No.	Parameter	Percentage (%)
1	**Age**	
	21-35	7
	36-50	68
	51-65	23
	More than 65	2
2	**Education**	
	Illiterate	3
	Up to Primary	37
	≤ SSC	14
	≤ HSC	11
	Graduate & Above	3
3	**Annual Income (₹)**	
	1 - 5 Lakhs	19
	5 - 10 Lakhs	69
	> 10 Lakhs	12
4	**Source of Income**	
	Agriculture	63
	Agriculture + Livestock	24
	Agriculture + Other	13
5	**Landholding**	
	Less than 1ha	13
	1ha to 2ha	37
	2ha to 4ha	30
	4ha to 10ha	19
	> 10ha	2
6	**Cultivating crop**	
	Banana	72
	Tobacco	13
	Vegetable	10
	Other	5
7	**Gender**	
	Male	99
	Female	1
8	**Farmers awareness regarding Bio- gas slurry/ slurry-based products**	
	Yes	100
	No	0
9	**Farmers usage of bio gas slurry / slurry-based products**	
	Yes	100
	No	0

3.2 To study the awareness among Biogas slurry and slurry based products

The survey reveals that all 120 farmers are aware of biogas slurry and slurry-based products, thanks to initiatives like the Deenbandhu scheme and the National Dairy Development Board's Mrida company. Farmers regularly use biogas slurry due to its higher nutrient content and fewer weed problems compared to farmyard manure (FYM). Among slurry-based products,"Prom fertilizer" is the most recognized, with 102 farmers aware of it, followed by "MRL" (97) and "Root Guard" (96)."Gold fertilizer" and "Liquid fertilizer RICH plus" are known to 88 and 83 farmers, respectively. "Sundar liquid" is known to 66 farmers, while "Garden mix" is known to 25."Glow Liqvitonic" and "Micro Liquid Organic" have lower awareness, known to 6 and 4 farmers, respectively. This indicates strong overall awareness and use of slurry-based products among farmers, with varying levels of recognition for specific brands.

Table 2. Awareness among the farmers about Biogas slurry and slurry based products

Awareness regarding Bio- gas slurry/ slurry-based products	Frequency	Percentage
Yes	120	100
No	0	0
Total	**120**	**100**

Table 3. Usage of bio gas slurry / slurry-based products

Usage of bio gas slurry / slurry-based products	Frequency	Percentage
Yes	120	100
No	0	0
Total	**120**	**100**

Table 4. Awareness regarding different slurry based products among the farmers

Product Name	Frequency
Prom fertilizer	102
MRL	97
Root Guard	96
Garden Nutrikit	65
GroMax	59
Amul Gold fertilizer	88
Liquide fertilizer RICH plus	83
Sundar organics	66
Garden mix	25
Glow liqvitonic	6
Micro liquid organic	4

3.3 To study the Farmers perception regarding Biogas slurry and slurry based products

Farmers perception of biogas slurry is highest rating for its ability to improve soil water retention. They also believe it enhances soil fertility and boosts crop yields. The perceived benefit for crop quality. However, concerns exist about slurry perishability and odor. The lowest rating reflects skepticism about slurry fully replacing chemical fertilizers. Overall, farmers recognize several benefits of biogas slurry but have reservations about its limitations and complete efficacy as a fertilizer substitute.

Table 5. Farmers perception regarding Biogas slurry and slurry based products

Particulars	WAM score	Rank
Improve soil water retention capacity	4.87	1
Improve soil fertility	4.78	2
Slurry has positive impact on yield	4.01	3
Slurry has positive impact on quality	3.99	4
Slurry is perishable	3.50	5
Slurry has a distinct odour	2.92	6
Fully replace chemical fertilizer	1.88	7

3.4 To identify constraints faced by farmers for utilization of Biogas slurry and slurry based products

Farmers face several constraints regarding biogas slurry and slurry-based products. The primary challenge is transportation, followed closely by storage issues and availability at specific times, Labour unavailability and concerns about slurry prices also pose significant hurdles. Additionally, farmers encounter difficulties in the application of slurry, indicating uncertainties about its proper usage in agricultural practices. Overall, logistical, storage, and availability challenges are the most pressing constraints faced by farmers regarding biogas slurry and its derivatives.

Table 6. Constraints faced by farmers for utilization of Biogas slurry and slurry based products

Particulars	Mean score	Rank
Transportation	70.34	1
Storage	62.53	2
Availability	55.17	3
Labour	43.28	4
Price of slurry	43.25	5
Application of slurry	29.31	6

4. CONCLUSIONS

The survey shows that farmers in Anand district are mostly middle-aged men living in small families with 3-5 members. They have a Basic education. The results indicate that the majority of farmers are small and medium-scale, growing Bananas, which suit the region's climate and soil. They earn an income between 5-10 lakh from farming.All farmers are aware about biogas slurry and its products, largely due to initiatives like the Deenbandhu scheme and the National Dairy Development Board's efforts. Biogas slurry is preferred over farmyard manure for its higher nutrient content and fewer weed issues. Among slurry-based products, SuDhan's "Prom fertilizer" is the most recognized, followed by "MRL" and "Root Guard."Farmers has positive perception towards Biogas slurry is better for improving soil water retention capacity, soil fertility, and crop yields. However, they worry about slurry application and doubt it can't fully replace chemical fertilizers. Farmers face significant constraints with biogas slurry and slurry-based products, primarily related to transportation, storage, and availability at specific times. Labour unavailability and slurry prices also present notable challenges. Additionally, there are difficulties in application of slurry, indicating uncertainties in proper usage. Overall, Transportation, storage, and availability issues are the most pressing concerns for farmers regarding biogas slurry and its derivatives.

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