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Purchasing Behaviour and Problems Faced by Farmers in the Adoption of Biostimulants in Selected Talukas of Kutch District, Gujarat, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study explores the purchasing behaviour and challenges faced by farmers in the adoption of biostimulants in four talukas of Kutch district, Gujarat, Nakhatrana, Bhuj, Bhachau, and Mandvi. Primary data were collected from 200 purposively selected farmers through structured interviews conducted over a 60-day period. Results showed that 48 percent of farmers were between 36 and 50 years of age, and 36 percent had only primary-level education. Most respondents (60%) practiced farming as their primary occupation, and 48 percent had annual incomes between ₹1-5 lakh. The analysis using Weighted Average Mean revealed that price (WAM: 4.715) and past

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experience (WAM: 4.366) were the most significant factors influencing purchasing decisions, followed by product quality (WAM: 3.980). Availability (WAM: 2.066) and peer suggestions (WAM: 2.385) had the least influence. Garrett Ranking analysis highlighted major constraints in adoption, with high price (WAM: 2.655), delayed effect (WAM: 2.535), and uncertainty (WAM: 2.160) being top barriers. The study concludes that although biostimulants hold great potential for promoting sustainable agriculture, their adoption remains constrained by affordability, knowledge gaps, and market availability. Strengthening farmer education, providing price support, and ensuring timely access through improved supply chains are essential to enhance adoption levels across the region.

Keywords: Biostimulants; purchasing behaviour; adoption constraints; sustainable farming.

1. INTRODUCTION

Agriculture is a critical pillar of the Indian economy, accounting for nearly 18 percent of the national Gross Domestic Product (GDP) and providing livelihoods to approximately 60 percent of the country's population. Historically, the focus of agricultural policy has been to achieve self-sufficiency in food production, a goal that was largely realized during the Green Revolution of the 1960s and 70s. Food grain production in India surged from 52 million tons in 1951-52 to about 230 million tons by 2007-08, transforming India from a food-deficient to a food-secure nation (Faridi et al*.* 2021).

However, modern agricultural practices, characterized by the indiscriminate use of chemical fertilizers and pesticides, have brought about serious environmental challenges. Soil fertility has diminished, groundwater levels have dropped, and ecosystems have been disrupted. Additionally, the biological and chemical balance of the soil has been adversely affected, leading to concerns over long-term food and nutritional security. Rising global populations and shifting climate conditions further compound these challenges, increasing the cost and complexity of food production (Aryal et al. 2021).

To mitigate these concerns and transition towards sustainable agriculture, biostimulants have emerged as a promising solution. These are substances or microorganisms that, when applied to plants or soil, enhance natural processes to improve nutrient uptake, stress tolerance, and overall plant growth and productivity (Diptesh and Chauhan, 2016). Unlike traditional fertilizers, their effects cannot be solely attributed to the supply of nutrients. Instead, biostimulants work by stimulating physiological functions that help plants grow better, especially under stress conditions (Khan et al. 2009).

Examples of widely used biostimulants include microbial inoculants, fulvic acid, humic acid, seaweed extracts, protein hydrolysates, amino acids, and trace minerals. Their use is gaining momentum globally; for instance, over six million hectares across Europe were treated with biostimulants as early as 2012 (Pathak and Christopher, 2019). New and advanced formulations continue to be developed and introduced into the market, driving demand and farmer interest (Canellas et al. 2025), (Kauffman et al. 2007).

The global biostimulants market is projected to grow at a compound annual growth rate (CAGR) of 8-12 percent between 2024 and 2029, reaching USD 2.34 billion by 2029, up from USD 1.59 billion in 2024 (Canellas et al*.,* 2025). In India, the market is also growing rapidly at a CAGR of 10.27 percent, from USD 210.4 million in 2025 to an expected USD 343 million by 2030. Seaweed extract-based products dominate the Indian segment, comprising 37.4 percent of the market share, valued at USD 57.3 million in 2022 (Mordor intelligence). The Indian market is fragmented, with key players like Bierstadt India Ltd., Coromandel International Ltd., Southern Petrochemical Industries Corporation, T. Stanes and Company Ltd., and Valagro Ltd. collectively holding just over 10 percent of market share (Dwivedi et al. 2021), (Srilatha and Srilatha, 2020).

Indian farmers are increasingly exploring a diverse range of biostimulant products, including those derived from plants, animals, and microorganisms. However, despite their benefits, the widespread adoption of biostimulants remains constrained due to lack of awareness, high product costs, limited product availability, and doubts about effectiveness (Neethi and Sailaja, 2014). Thus, understanding farmers' perceptions, their buying behaviour, and the challenges they face is crucial for shaping future strategies to promote the sustainable use of

biostimulants (Rose et al. 2014), (Katole et al. 2017).

1.1 Objectives

1. To study the socio-economic profile of farmers
2. To study factors affecting farmers purchasing behaviour towards biostimulants
3. To study the problems faced by farmers in the adoption of biostimulants

2. MATERIALS AND METHODS

The study was conducted in four selected talukas of Kutch district, Nakhatrana, Bhuj, Bhachau, and Mandvi using a descriptive research design tailored to meet the study objectives. A total of 200 farmers were selected through non-probability purposive sampling, and the data were collected over a span of 60 days using a pre-tested, structured interview schedule. Primary data were obtained directly from farmers, while secondary data were sourced from published literature, government reports, and credible websites. This dual-source approach ensured both contextual depth and empirical accuracy.

The collected responses were organized into tabular format and analyzed using two major statistical tools: Weighted Average Mean (WAM) and the Garrett Ranking Technique.

Weighted average mean (X) = $(F_1X_1 + F_2X_2 + F_3X_3 + F_4X_4 + F_5X_5) / X_t$

Where,
F = Weight given to each response
X = Number of responses
X_t = Total number of responses

Each response was multiplied by its respective weight, the products summed, and then divided by the total weight to derive the WAM (Cotes, 1722).

Garrett's ranking was used to study rank problems faced by farmers in adopting biostimulants. Respondents were asked to rank all relevant issues based on severity. These ranks were converted into percent position using the formula:

Percentage position = 100 $(R_{ij}$ - 0.5) / N_j

Where,
R_{ij} = Rank given for the ith variable by j^{th} respondent

N_j = Number of variables ranked by j^{th} respondent

(Garrett and Wood worth, 1969).

3. RESULTS AND DISCUSSION

3.1 To Study the Socio-Economic Profile of Farmers

The socio-economic data revealed that 48 percent of the farmers were aged between 36 and 50 years, followed by 30 percent in the 51-65 age group. Young farmers aged 21-35 comprised 12 percent, and only 10 percent were over 65. In terms of education, 36 percent had completed primary school, 24 percent had SSC-level education, 14 percent had HSC, 8 percent were graduates, and 18 percent were illiterate. This indicates a modest but diverse educational background among the respondents.

Marital status data showed that 93 percent of the farmers were married. Regarding landholding, 36 percent owned less than 5 acres, 32 percent held 5-10 acres, 18 percent had 10-20 acres, and 14 percent had more than 20 acres. Farming was the sole occupation for 60 percent of respondents, while 24 percent were engaged in agriculture and animal husbandry, and 16 percent combined agriculture with business.

Income levels varied, with 48 percent earning between ₹1-5 lakhs annually, followed by 23 percent in the ₹5-10 lakh range, 15 percent above ₹10 lakhs, and 14 percent below ₹1 lakh. Most families had 3-5 members (53%), while 36 percent had more than 5 members, and 11 percent had just two. Farming experience also varied: 51 percent had over 15 years of experience, 26 percent between 10-15 years, 13 percent between 5-10 years, and 10 percent had less than 5 years.

In terms of cropping patterns, pomegranate emerged as the dominant crop (34%), followed by cotton (17%), castor (12%), wheat (9%), vegetables (8%), mango (7%), mustard (6%), and date palm (2%). This reflects the diversified nature of farming in the study region.

3.2 To study Factors Affecting Farmers' Purchasing Behaviour towards Biostimulants

Analysis of purchasing behaviour towards biostimulants showed that price (WAM: 4.715)

was the most influential factor, followed by past experience (4.366), quality (3.980), and effectiveness/performance (3.605). Factors like brand (3.245), suggestions from other farmers (2.385), and availability (2.066) had lower influence.

This indicates that farmers' decisions are primarily based on cost and first-hand experience rather than peer influence or brand recognition. Despite increasing awareness, availability and peer recommendations still have limited sway in shaping purchasing preferences.

Table 1. Socio-economic profile of farmers

Sr. No.	Particulars	Respondents	Percentage
1	Age		
	21-35	24	12
	36-50	97	48
	51-65	59	30
	Above 65	20	10
	Total	200	100
2	Education		
	Illiterate	36	18
	Up to primary	72	36
	SSC	48	24
	HSC	29	14
	Graduate	15	8
	Total	200	100
3	Marital status		
	Married	186	93
	Unmarried	14	7
	Total	200	100
4	Landholding (acre)		
	Below 5	72	36
	5-10	64	32
	10-20	36	18
	Above 20	28	14
	Total	200	100
5	Occupation		
	Agriculture	121	60
	Agriculture + Animal husbandary	48	24
	Agriculture + Business	31	16
	Total	200	100
6	Annual income (lakh)		
	<1	28	14
	1-5	96	48
	5-10	46	23
	>10	30	15
	Total	200	100
7	Family size		
	2	22	11
	3-5	107	53
	Above 5	71	36
	Total	200	100
8	Experience of farming		
	Up to 5 years	21	10
	5 to 10 years	26	13
	10 to 15 years	52	26
	More than 15 years	101	51
	Total	200	100

Sr. No.	Particulars	Respondents	Percentage
9	Major growing crop		
	Pomegranate	68	34
	Castor	24	12
	Cotton	33	17
	Vegetable crop	16	8
	Wheat	18	9
	Mango	15	7
	Mustard	12	6
	Date palm	5	2
	Other	9	5
	Total	200	100

Table 2. Factors affecting farmers' purchasing behaviour towards biostimulants

Factor	SD (1)	D (2)	N (3)	A (4)	SA (5)	WAM Score	Rank
Price	0	0	0	57	143	4.715	1
Past experience	0	0	40	48	112	4.366	2
Quality	0	18	45	60	77	3.980	3
Effectiveness/Performance	0	34	55	67	44	3.605	4
Brand	16	30	87	23	44	3.245	5
Other farmers suggestion	43	56	87	9	5	2.385	6
Availability	55	78	67	0	0	2.066	7

(1- Strongly disagree, 2 - Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Table 3. Problems faced by farmers in the adoption of biostimulants

Problems	Not at all (1)	Moderately (2)	Extremely (3)	WAM Score	Rank
High price	15	39	146	2.655	1
Delayed effect	16	61	123	2.535	2
Uncertainty	55	58	87	2.160	3
Availability	54	95	51	1.985	4
Adverse effect	132	54	14	1.410	5
Lack of knowledge	154	41	5	1.255	6
Less products range	165	35	0	1.175	7

(Garrett and Wood worth, 1969)

3.3 To Study the Problems Faced by Farmers in the Adoption of Biostimulants

The key barriers identified through the Garrett Ranking Technique included high price (WAM: 2.655) as the foremost challenge, followed by delayed effects (2.535) and uncertainty about outcomes (2.160). Other significant constraints were poor availability (1.985), fear of adverse effects (1.410), lack of knowledge (1.255), and limited product range (1.175).

These findings emphasize that while biostimulants have potential, adoption is restricted by a combination of economic, informational, and logistical constraints. Farmers remain cautious due to delayed returns, doubts about product efficacy, and limited market accessibility.

4. CONCLUSION

The study highlights the complex dynamics of biostimulant adoption in Kutch's agricultural landscape. Farmers vary widely in age, education, income, and cropping choices, which influence their openness to new technologies. Price and past experience are decisive factors in product adoption, while brand loyalty and availability are less impactful. Adoption of biostimulants is still hindered by high costs, limited awareness, and market uncertainties. To promote broader use, interventions such as subsidized pricing, product demonstrations, educational campaigns, and improved supply

chain logistics are essential. Government support and public-private partnerships can further enhance trust and accelerate the transition to sustainable farming practices. A strategic, multi-pronged approach is vital for integrating biostimulants into mainstream agriculture and empowering farmers to embrace eco-friendly, productivity-enhancing technologies.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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