**AWARENESS AND FARMERS’ PERCEPTION TOWARDS BIOSTIMULANTS IN DEESA TALUKA OF BANASKANTHA, GUJARAT, INDIA**

**ABSTRACT**

Modernizing the agriculture sector is essential to address current challenges and ensure long-term sustainability. Traditional agricultural practices—particularly the excessive use of chemical fertilizers and pesticides—have significantly contributed to environmental degradation, resulting in issues such as soil erosion, water contamination, and a decline in biodiversity. That’s how focus now shifted towards eco-friendly inputs to revitalize production with sustainable future for generations. Biostimulants plays vital role to fulfil the current demand with quality agriculture production and support sustainability too. This study was carried out to find farmers’ awareness and perception towards biostimulants. The 200 respondence were selected using purposive sampling from the study area with the help of semi-structured scheduled. Ten villages were chosen for the research. Twenty farmers from each village were selected through purposive sampling technique. The study found that the majority of farmers are well aware of biostimulants and use them to enhance crop yields. The study suggests that increased use of extension tools can improve the dissemination of information. It also recommends conducting more demonstrations and farmer training programs to enhance outreach and maximize the benefits, supporting sustainable agricultural production.

***Keywords:*** *Chemical fertilizers, environment degradation, soil erosion, water contamination, Eco-friendly inputs, Biostimulants, Sustainable agriculture, Crop production*

**1. INTRODUCTION**

Agriculture plays a major role in global economies, especially in developing countries like India, where it is a main source of livelihood for over half of the population. However, traditional agricultural practices, including the over use of chemical fertilizers and pesticides, have led to severe environmental degradation, including soil erosion, water pollution, and loss of biodiversity. Moreover, the increasing challenges posed by climate change, such as erratic rainfall patterns, droughts, and extreme temperatures, have compounded the vulnerability of agricultural systems worldwide (Yakhin *et al.*, 2017). These challenges have brought a global transition towards sustainable farming practices that minimize environmental impact while maintaining high agricultural productivity. One such practice that has gained momentum is the use of biostimulants—natural or bio-based substances and microorganisms that stimulate plant growth and enhance resilience to abiotic stresses such as drought, salinity, and poor soil conditions (du Jardin, 2015).

Biostimulants differ from traditional fertilizers in a way that they do not provide nutrients directly to plants but instead stimulate plant physiological processes, including nutrient uptake, root development, and stress tolerance (Rouphael & Colla, 2020). Some commonly used biostimulants include seaweed extracts, humic substances, amino acids, and beneficial microbes such as mycorrhizae and plant growth-promoting rhizobacteria (Calvo *et al*., 2014). There is a shift observed in fertilizer usage. Different agencies are laying emphasis on the use of organic fertilizer [10]. The study on farmers’ perception towards organic fertilizers in Kutch district of Gujarat was carried out. All the farmers were aware about organic fertilizer and all were using organic fertilizer in their field. Most of the respondents strongly believed that application of organic fertilizer helps in improvement of microbial activity and water retention capacity of soil (Chauhan *et al.*, 2024). Furthermore, the demographic factor also influences in farmers’ decision-making, such as cost, access to information, and perceived benefits, that plays a vital role in the adoption of biostimulants

As sustainable farming becomes increasingly important, it is essential to assess farmers' awareness, perceptions, and willingness to adopt biostimulants as part of environmentally friendly agricultural practices. Studies on the socio-economic factors influencing the use of biostimulants in different farming communities can provide valuable remarks into the barriers to adoption and how these obstacles can be addressed in future for awareness programs, policy support, and research initiatives (Bhattacharyya & Jha, 2012). The future of biostimulants in promoting sustainable agriculture will rely on farmer education, availability to biostimulants products, and a supportive regulatory environment that ensures product quality and consistency. By bridging the knowledge gap and improving accessibility, biostimulants can play a crucial role in transforming agriculture into sustainable, environmentally friendly, and climate-resilient industry.

This study explored the factors influencing farmers’ adoption of organic farming. Key motivators for adopting organic farming included personal interest, belief in chemical-free cultivation, and government support, while peer influence played a minor role. Organic farmers recognized environmental and economic benefits but cited challenges like pest control, high costs, labor demands, and lower yields (Bodapati & Dudhagara, 2023). A study on Purchasing behaviour and problems faced by farmers and dealers related to insecticide was conducted to understanding the factors influencing farmers' decisions while purchasing insecticides and identifies the problems faced by the farmers. A major part of the respondents were small and marginal farmers. Major issues faced by farmers were high cost of pesticides and the lack of after-sales support. The major issues faced by farmers were the relatively high price and after-sale service (Sahoo & Dudhagara, 2023). The study covers demographics, education, income, landholding, cropping patterns, gender distribution, family types, irrigation sources, seed procurement, awareness of agricultural products, promotional influences, factors affecting seed purchases, satisfaction levels, and challenges in crop establishment. Farmers were facing major problems like higher input costs and prevalence of various disease & pest attack on groundnut crop (Paghdar *et al.,* 2024).

The study was carried out with the broad objectives to find the level of awareness regarding biostimulants and to know the farmers’ perception towards biostimulants.

**2. METHODOLOGY**

**2.1 Method**

The study on awareness and farmers' perception towards biostimulants in Deesa taluka of Banaskantha district of Gujarat, was conducted using a purposive sampling method. Ten villages—Mahadeviya, Bhadath, Jerda, Vadaval, Sandiya, Kumpat, Dama, Lorvada, Davas, and Kansari—were chosen for the research. Twenty farmers from each village were selected through purposive sampling technique. Both primary and secondary data were collected to meet the objectives of the study.

**2.2 Analytical Tools**

Descriptive statistical tools such as frequency analysis, percentage analysis, and graphical representation were employed to address the defined objectives related to the socio-economic profile and awareness of biostimulants. To assess farmers’ perception of biostimulants, the Weighted Average Mean (WAM) method was applied.

**3. RESULTS AND DISCUSSION**

The section is crucial as it presents the key findings of the research in a clear and logical manner. It helps interpret the data and connects it to the research objectives. The research results were presented and explains their findings as per the objectives of the study. It also highlights patterns, relationships, and trends observed during the study.

**3.1 Socio-economic profile of farmers**

The below table 1 shows the socio-economic profile of the farmers.

**Table 1: Socio-economic profile of farmers**

|  |  |  |  |
| --- | --- | --- | --- |
| Sr. No. | Particular | No. of Respondents | Percentage |
| 1 | **Age** | | |
| < 25 | 12 | 6.00 |
| 25-40 | 37 | 18.50 |
| 41-60 | 97 | 48.50 |
| > 60 | 54 | 27.00 |
| **Total** | **200** | **100.00** |
| 2 | **Family Size** | | |
| Up to 2 Members | 0 | 0 |
| 3-5 Members | 83 | 41.50 |
| More than 5 members | 117 | 58.50 |
| **Total** | **200** | **100.00** |
| 3 | **Education Level** | | |
| Illiterate | 25 | 12.50 |
| Up to Primary | 94 | 47.00 |
| Up to SSC | 33 | 16.50 |
| Up to HSC | 27 | 13.50 |
| Graduate & Above | 21 | 10.50 |
| **Total** | **200** | **100.00** |
| 4 | **Annual Income** | | |
| <1 Lakh | 36 | 18.00 |
| 1 - 2.5 Lakhs | 73 | 36.50 |
| 2.5 - 5 Lakhs | 53 | 26.50 |
| > 5 Lakhs | 38 | 19.00 |
| **Total** | **200** | **100.00** |
| 5 | **Source of Income** | | |
| Agriculture | 27 | 13.50 |
| Agriculture + Livestock | 153 | 76.50 |
| Agriculture + Other | 20 | 10.00 |
| **Total** | **200** | **100.00** |
| 6 | **Land Holding Size (ha)** | | |
| Less than 1 | 29 | 14.50 |
| 1 to 2 | 48 | 24.00 |
| 2 to 4 | 79 | 39.50 |
| 4 & above | 44 | 22.00 |
| **Total** | **200** | **100.00** |
| 7 | **Type of Farming** | | |
| Rainfed | 0 | 0 |
| Irrigated | 200 | 100 |
| **Total** | **200** | **100.00** |
| 8 | **Kharif Season Crops** | | |
| Groundnut | 165 | 82.50 |
| Fodder crop | 35 | 17.50 |
| **Total** | **200** | **100.00** |
| 9 | **Rabi Season Crops** | | |
| Potato | 147 | 73.50 |
| Wheat | 27 | 13.50 |
| Mustard | 15 | 7.50 |
| Amaranth | 11 | 6.50 |
| **Total** | **200** | **100.00** |
| 10 | **Summer Season Crops** | | |
| Muskmelon | 65 | 32.50 |
| Pearl millet | 53 | 26.50 |
| Watermelon | 47 | 23.50 |
| Groundnut | 35 | 17.50 |
| **Total** | **200** | **100.00** |

The above table 1 shows the socio-economic profile of 200 farmers from the study area. It indicates that significant portion (48.50%) were aged between 41–60 years. Family sizes were generally large, with 58.50% having above 5 members. In terms of education, 47.00% of the farmers have completed their primary level education, while 12.50% were illiterate and only 10.50% were graduates or above, suggesting limited access to higher education among the farming community.

Income classes shows that 36.50% farmers earn between ₹1–2.5 lakhs annually, reflecting a lower-middle-income group. The primary source of income was agriculture combined with livestock was 76.50%, while only 13.50% rely solely on agriculture. Land holding patterns show that 39.50% of the farmers own 2–4 ha of land, and all farmers practice irrigated farming.

Season wise crop adoption by farmers shows that, groundnut was the most dominant crop, cultivated by 82.50% farmers during the Kharif season. In the Rabi season, potato was the major crop grown by 73.50% of farmers, followed by wheat with 13.50% and mustard with 7.50%. Summer season crops were muskmelon with 32.50% and followed by pearl millet with 26.50% farmers. These findings indicate a high dependency on a few crops, especially groundnut and potato. It points toward a need for crop diversification, improved irrigation efficiency, and better educational outreach to enhance farming sustainability and farmer income.

**3.2 Awareness regarding Biostimulants**

The below table 2 shows the awareness level regarding biostimulants among the farmers.

**Table 2: Awareness regarding biostimulants**

|  |  |  |  |
| --- | --- | --- | --- |
| Sr. No. | Particular | No. of Respondents | Percentage |
| 1 | **Awareness** | | |
| Yes | 172 | 86.00 |
| No | 28 | 14.00 |
| **Total** | **200** | **100.00** |
| 2 | **Source of Awareness** | | |
| Retailer’s suggestion | 73 | 42.44 |
| Poster / Leaflets | 42 | 24.42 |
| Field demonstration | 23 | 13.37 |
| Farmers / friends suggestion | 19 | 11.05 |
| Social media /Advertisement | 15 | 8.72 |
| **Total** | **172** | **100.00** |

The above table 2 show the awareness level and sources of awareness of 200 farmers regarding biostimulants. The data on awareness regarding biostimulants reveals that majority 86.00% of farmers were aware about biostimulants, while only 14.00% farmers has lack of awareness. This indicates a fairly good level of familiarity among farmers with such agricultural inputs, showing a positive trend towards adopting modern farming practices.

Among the 172 farmers who were aware, the main source of information was retailers’ suggestions (42.44%), followed by poster / leaflets (24.42%), and field demonstrations (13.37%). Farmers / friends suggestion (11.05%) and social media / advertisement (8.72%) play a smaller role in spreading awareness, which indicated that more focus is needed to create awareness using social media.

While the overall awareness was encouraging, the main outcomes from commercial sources suggests a need to strengthen formal and reliable awareness mechanisms. Increasing the reach of agricultural extension services, organizing field demonstrations, and promoting scientific guidance which make farmers aware and promotes effective use of biostimulants for better crop productivity and sustainable farming.

**3.3 Farmers’ perception towards Biostimulants**

The below table 3 shows the farmers’ perception towards biostimulants.

**Table 3: Farmers’ perception towards biostimulants**

|  |  |  |  |
| --- | --- | --- | --- |
| Sr. No. | Particular | No. of Respondents | Percentage |
| 1 | **Usage of biostimulants in the farm** | | |
| Yes | 129 | 75.00 |
| No | 43 | 25.00 |
| **Total** | **172** | **100.00** |

Above table 3 indicates the usage of biostimulants by farmers on their fields. A majority 75.00% of farmers reported using biostimulants, indicating that most farmers were adopting this practice. In contrast, 25.00% of farmers do not use biostimulants, pointing to a group of farmers who well awared about but not adopt in their practice. This data highlights the growing interest in biostimulants, but also suggests that there is need for further awareness and adoption.

The below table 4 shows the farmers agreement towards the usage of biostimulants in their farming practices.

**Table 4: Farmers agreement towards the usage of the biostimulants**

|  |  |  |
| --- | --- | --- |
| Statements | WAM Score | Rank |
| Biostimulants like humic acid, fulvic acid sea weed extracts are yearly available in market | 4.85 | 1 |
| Use of biostimulants can increase the crop yield | 4.71 | 2 |
| Farmers have sufficient knowledge regarding the application of biostimulants | 4.33 | 3 |
| Farmers having confidence regarding the result of biostimulants | 4.27 | 4 |
| Application of biostimulants will maintain the fertility of the soil | 4.07 | 5 |
| Application of biostimulants protect crops from abiotic stresses | 3.39 | 6 |

The level of agreement regarding biostimulants was assessed using the Weighted Average Mean (WAM) method. Farmers were asked to respond the different statements using a five-point Likert scale: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. The analysis revealed that the statement "Biostimulants like humic acid, fulvic acid, and seaweed extracts are available year-round in the market" received the highest agreement with 4.85 WAM score securing the first rank. "Use of biostimulants can enhance crop yield" followed with 4.71 WAM score ranking second. The third position was occupied by the statement "Farmers have sufficient knowledge regarding the application of biostimulants" with 4.33 WAM score. Fourth rank was the “Farmers having confidence regarding the results of biostimulant” with 4.27 WAM score. The statement "Application of biostimulants helps maintain soil fertility" ranked fifth with 4.07 WAM score, while “Biostimulants protect crops from abiotic stresses” was ranked sixth with 3.39 WAM score. Overall, the findings indicate that biostimulants were perceived to be readily available throughout the year and were considered effective in enhancing crop yields.

The below table 5 shows the factors affecting towards the usage of biostimulants.

**Table 5: Factors affecting towards the usage of Biostimulants**

|  |  |  |
| --- | --- | --- |
| Rank | Factors | WAM score |
| 1 | Availability | 2.96 |
| 2 | Quality | 2.85 |
| 3 | Brand | 2.66 |
| 4 | Quantity | 2.26 |
| 5 | Price | 2.07 |

Above table 5 highlights the farmers’ agreement towards various attributes related to the usage of biostimulants, evaluated using the Weighted Average Mean (WAM). The attribute availability ranked highest with 2.96 WAM score, suggesting that most farmers find biostimulants easily accessible throughout the year. Quality with 2.85 WAM score and brand with 2.66 WAM score also rated positively, indicating that farmers place importance on product performance and trusted brands. Quantity scored moderately with 2.26 WAM score showing that farmers were somewhat satisfied, there may be concerns regarding the packaging or volume offered. The attribute price received the lowest WAM score of 2.07, reflecting dissatisfaction among farmers with the affordability of biostimulants. Overall, the findings suggest that while farmers appreciate the availability and quality of biostimulants, price remains a major constraint in their wider adoption.

**4. CONCLUSION**

A study conducted in Deesa taluka of Banaskantha district of Gujarat, examined farmers' awareness, perception, and usage of biostimulants. The findings reveal that 86.00% of farmers were aware of biostimulants, most of them gaining knowledge through retailers and advertisements. Among those aware, 75.00% actively use biostimulants, mainly to boost crop yields and improve soil fertility. Although farmers generally perceive biostimulants as beneficial, concerns remain about correct application practices and product affordability. However, the study highlights a significant knowledge gap regarding the effective use and application of these products. While biostimulants have the potential to combat challenges such as soil degradation and crop stress, wider adoption requires enhanced farmer education, affordable pricing, and better access to agricultural extension services. Overall, biostimulants offer promising benefits for sustainable farming, but their full impact will depend on improving awareness, training, and economic accessibility for farmers.

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 the writing or editing of this manuscript.

**5. REFERENCES**

1. Bhattacharyya, P. N., & Jha, D. K. (2012). Plant growth-promoting rhizobacteria: A critical review. *Environmental Sustainability, 5*(1), 7-14. <https://doi.org/10.1007/s42398-019-0017-0>
2. Bodapati, R. K., Dudhagara, C. R. (2023). “Study of Factors Influencing Farmer’s Decision to Adopt Organic Practices”, *The Pharma Innovation Journal*, SP-12(6), 3692-3695.
3. Calvo, P., Nelson, L., & Kloepper, J. W. (2014). Agricultural uses of plant biostimulants. *Plant and Soil, 383*(1-2), 3-41. <https://doi.org/10.1007/s11104-014-2131-8>
4. Chauhan, T. T., Dudhagara, C. R., & Mahera, A. B. (2024). Farmers’ perception towards organic fertilizers in Kutch District of Gujarat, India. *Archives of Current Research International*, 24(5), 739–744. <https://doi.org/10.9734/acri/2024/v24i5748>
5. Du Jardin, P. (2015). Plant biostimulants: Definition, concept, main categories, and regulation. *Scientia Horticulturae, 196*, 3-13. <https://doi.org/10.1016/j.scienta.2015.09.021>
6. Paghdar, S. J., Dudhagara, C. R. & Mahera, A. B. (2024). “Purchasing Behaviour and Satisfaction Level of Farmers Regarding Groundnut Seeds”, *Journal of Scientific Research and Reports,*30 (7), 487-95. <https://doi.org/10.9734/jsrr/2024/v30i72164>
7. Rouphael, Y., & Colla, G. (2020). Biostimulants in agriculture. *Frontiers in Plant Science, 11*, 580-595. <https://doi.org/10.3389/fpls.2020.00022>
8. Sahoo, A., Dudhagara, C. R. (2023). “Purchasing Behaviour and Problems Faced by Farmers and Dealers Related to Insecticide”, *Journal of Experimental Agriculture International*, 45 (8), 118-25. <https://doi.org/10.9734/jeai/2023/v45i82164>
9. Yakhin, O. I., Yakhin, I. A., & De-Souza, F. A. (2017). Biostimulants in plant production: A review. *Environmental and Experimental Botany, 137*, 1-14. <https://doi.org/10.1016/j.envexpbot.2017.01.003>
10. Ruiz-Nieto, Á., Gómez-Serrano, C., Acién, G., & Castro, A. J. (2022). Farmers’ Knowledge and Acceptance of Microalgae in Almería Greenhouse Horticulture. Agronomy, 12(11), 2778.