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Awareness and Adoption of Biostimulants for Sustainable Livelihoods Among Farmers in Rural Areas

*Samiksha Singh Dewangan, Dr. Payal Jaiswal and Dr. Subuhi Nishad
College of Agriculture, IGKV, Raipur (C.G.), India
*Corresponding Author's email: veg.sc.dept.samiksha@gmail.com

Biostimulants are increasingly recognized as important components of sustainable agriculture because they support plant growth, nutrient-use efficiency, stress tolerance and crop quality. However, limited technical knowledge, high cost, poor availability of quality products and inadequate awareness of support schemes restrict their adoption among rural farmers. An awareness programme was conducted in selected villages of Raipur district, Chhattisgarh. Three villages, namely Pirda, Banarsi and Sammanpur, were covered and 60 farmers participated. Personal interviews, pamphlets, posters, question-and-answer sessions, field visits and demonstrations were used. Farmers were introduced to different biostimulants, their application methods and relevant support schemes. Major constraints were high cost, lack of technical knowledge, difficulty in dosage and timing, poor access to quality products and marketing problems. Farmers suggested hands-on training, demonstrations, financial support, certified suppliers, institutional linkages and stronger farmer groups.

Keywords: Biostimulants, Farmer awareness, Sustainable agriculture, Rural development, Extension education

Introduction

Agriculture plays an important role in rural livelihoods and sustainable agricultural development. Rising production costs, changing climatic conditions and the need for quality agricultural produce have increased interest in sustainable inputs. Biostimulants are natural substances or microorganisms that stimulate plant growth by improving nutrient uptake, enhancing tolerance to environmental stresses, and increasing crop quality and yield. According to the Fertilizer Control Order of 1985, biostimulants are used on plants, seeds, or soil (rhizosphere) to support growth and do not include pesticides or plant growth regulators, which are governed by separate laws. India's biostimulant market was valued at USD 355.53 million in 2024 and is expected to grow to USD 1,135.96 million by 2032, with a CAGR of 15.64%.

Types of Biostimulants

There are seven major categories/inputs: humic substances, seaweed extracts, amino acids, protein hydrolysates, microbial inoculants, Jeevamrit and Novel Organic Liquid Nutrient (NOLN).

1) **Seaweed Extract** - Seaweed biostimulants are obtained from marine algae such as *Ascophyllum nodosum* or *Kappaphycus alvarezii*. The preparation process involves harvesting seaweed, washing to remove salts, drying, and then grinding into powder. This powder is subjected to extraction using alkaline or enzymatic methods to release bioactive compounds like cytokinins, auxins, and polysaccharides. The resulting liquid extract is filtered and concentrated into commercial formulations. Seaweed extracts are widely used as foliar sprays or soil amendments, promoting seed germination, root development,

flowering, and stress tolerance. They are particularly effective in vegetable crops like tomato, cucumber, and capsicum.

2) **Humic and Fulvic Acid** - Humic substances are naturally derived from the decomposition of organic matter such as plant residues, compost, and lignite. They are extracted through alkaline solutions, followed by acid precipitation to separate humic acid from fulvic acid. The process involves collecting organic material, composting it under controlled conditions, and then chemically treating it to isolate the active fractions. Humic acid improves soil structure, enhances nutrient uptake, and stimulates root growth. Fulvic acid, being more soluble, penetrates plant tissues easily and acts as a chelating agent for micronutrients. Farmers typically apply these substances as soil drenches or foliar sprays to improve crop vigor and resilience.
3) **Amino Acid Formulations** - Amino acid biostimulants are produced by hydrolyzing proteins from plant sources (soybean, alfalfa). The process involves enzymatic or chemical hydrolysis, where proteins are broken down into free amino acids and peptides. These compounds act as signaling molecules in plants, stimulating chlorophyll synthesis, enzyme activity, and stress tolerance.
4) **Protein Hydrolysates** - Protein hydrolysates are usually formulated as liquid concentrates for foliar application. Farmers use them during critical growth stages or under stress conditions such as drought or salinity, as they help maintain metabolic activity and improve yield quality.
5) **Microbial Inoculants** - Microbial biostimulants consists of beneficial microorganisms such as *Rhizobacteria*, *Azospirillum*, *Trichoderma*, and mycorrhizal fungi. The preparation process involves isolating these microbes from soil or plant roots, culturing them in nutrient media, and then multiplying them in fermenters under sterile conditions. The microbial cultures are mixed with carriers like peat, talc, or lignite powder to stabilize them for field application. Farmers apply microbial inoculants through seed treatment, root dipping, or soil incorporation. These microbes colonize the rhizosphere and protect plants against abiotic stress.
6) **Jeevamrit (Traditional Indian Biostimulant)** - Jeevamrit is a traditional, low cost biostimulant widely used in organic farming. It is prepared by fermenting a mixture of cow dung, cow urine, jaggery, gram flour, and a handful of soil from the root zone of a banyan tree. The ingredients are mixed in water and left to ferment for 5–7 days, during which microbial activity multiplies. The resulting liquid is rich in beneficial microbes, enzymes, and growth promoting substances. Farmers apply Jeevamrit as a soil drench or foliar spray to enhance soil fertility, microbial diversity, and crop productivity. Its preparation is simple, affordable, and suitable for smallholder farmers.
7) **NOVEL Organic Liquid Nutrient (NOLN) –** It is a patented organic liquid nutrient extracted from banana pseudo stems during fiber processing. It acts as an eco-friendly growth booster containing macro-nutrients, micro-nutrients, natural plant hormones and beneficial microbes to enhance crop yields. These formulations are designed to be eco-friendly, safe, and highly effective in improving nutrient uptake and plant vigor. Farmers can apply NOLN through foliar sprays. They are particularly useful in horticultural crops where quality enhancement is critical.

Benefits of Biostimulants

- Improves seed germination and root development.
- Enhances nutrient absorption.
- Increases plant growth and yield.
- Improves quality of vegetables and fruits.
- Enhances resistance to drought, heat, and salinity.
- Improves soil microbial activity.
- Reduces dependence on chemical fertilizers.
- Promotes sustainable and eco-friendly agriculture.

- Increases farmers' income through better productivity.

Key Differences Between Biostimulants and Fertilizers

- **Function**

Fertilizers: Supply essential nutrients (NPK) directly.
Biostimulants: Enhance nutrient uptake and internal plant processes.

- **Plant Health Approach**

Fertilizers: Focus on basic growth through nutrition.
Biostimulants: Improve stress tolerance and overall resilience.

- **Soil Impact**

Fertilizers: May degrade soil and harm microbes with overuse.
Biostimulants: Boost soil microbes and improve long-term fertility.

- **Regulation**

Fertilizers: Tightly regulated based on nutrient content.
Biostimulants: Less regulated; defined by function, not content.

- **Environmental Effect**

Fertilizers: Risk of runoff and pollution.
Biostimulants: Eco-friendly; reduce need for excess fertilizer.

Materials and Methods

Study Area and Sample

The programme was conducted in selected villages of Raipur district, Chhattisgarh. Pirda, Banarsi and Nakti/Sammanpur were covered. A total of 60 farmers participated in the study.

Data Collection and Extension Methods

Data were collected through personal interviews using a structured Hindi interview schedule. Extension approaches included farmer interaction, pamphlet distribution, poster presentation, question-and-answer sessions, field visits, group discussions and practical demonstrations.

Activity	Purpose
Farmer interaction	Information collection and individual awareness
Pamphlet distribution	Technical information dissemination
Poster/Q&A	Visual awareness and doubt clarification
Field visit	Practical exposure
Demonstration	Practical skill development
Group discussion	Problem identification and feedback

Fig.1. Different Biostimulants are demonstrated

Fig.2. Process of Making Natural Jeevamrit

Fig.3. Demonstrating Foliar Spray

Fig.4. Distributing pamphlet and informing farmers about biostimulants

Results and Discussion

The awareness activities were implemented through a sequence of village-level interactions. The programme included individual contact, pamphlet-based awareness, information regarding government subsidy schemes, poster-based awareness, question-and-answer sessions and field demonstrations. The activities generated interest among farmers in learning more about biostimulants, while cost and availability remained major concerns.

S.No.	Activity	Farmers involved
1	Individual contact at Sammanpur	12
2	Awareness through pamphlets at Sammanpur	10
3	Subsidy information and feedback at Banarsi	10
4	Awareness programme with demonstrations at Banarsi	10
5	Poster and Q&A programme at Pirda	12
6	Field visit and biostimulant demonstration at Pirda	6

Constraints in Adoption of Biostimulants

Financial constraints were the most prominent barrier, with 40% reporting high cost of biostimulants. Technological constraints were also important, particularly lack of technical knowledge/training (35%) and difficulty in correct dosage/timing (28%).

S. No.	Problems / Constraints	Frequency	Percentage
Technological Constraints			
1	Lack of technical knowledge/training	21	35%
2	Difficulty in correct dosage/timing	17	28%
3	Limited knowledge of application methods	14	23%
Financial Constraints			
4	High cost of biostimulants	24	40%
5	Lack of subsidy scheme	19	31%
Marketing Constraints			
6	Poor access to local markets	15	25%
7	Low price confidence for produce	14	23%
Awareness-Related Constraints			
8	Limited awareness of subsidy schemes	11	19%
9	Misconceptions (treated as fertilizers)	9	15%

Suggestions Received from Farmers

Problem	Farmers reporting	Suggested solution
Lack of knowledge/training	10	Regular training and field demonstrations
High cost of biostimulants	13	Financial support and subsidy
Poor access to quality products	8	Certified vendor information and improved supply
Low market confidence	7	Market linkage and group marketing through FPOs

Discussion

The programme demonstrated the importance of practical extension approaches in communicating agricultural technologies. Farmers showed interest in biostimulants, but adoption was influenced by financial, technological, marketing and awareness-related constraints. Demonstrations, direct interaction and field visits helped make the information more practical and encouraged community participation.

Conclusion

This awareness programme successfully provided farmers with information regarding biostimulants, their uses and application methods. High cost, lack of technical knowledge, difficulty in dosage and timing, limited access to quality products and marketing concerns were important barriers. Farmers emphasized the need for hands-on training, field demonstrations, subsidies, certified suppliers, institutional linkages and collective marketing.