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BETTING ON BIOSTIMULANTS FOR ENHANCED YIELDS

"Maharashtra fisheries have a wide scope for regional economic development that underlines the need for the Aqua Chamber of Commerce"
- Sudhir Mungantiwar, Minister, Department of Forests, Cultural Affairs, Fisheries, Government of Maharashtra - *15*

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Betting on Biostimulants for Enhanced Yields

Factors such as the growing popularity of organic farming, surging demand for environmentally friendly agricultural inputs, and official encouragement of the practice, are driving the expansion of the biostimulant market in India, though inadequate production infrastructure may present challenges in distributing products on time and in sufficient numbers. The lack of education, awareness and encouragement of biostimulant use in India's agricultural sector further exacerbates this problem.

Despite being in the early stages of development, the biostimulant market in India has substantial potential for expansion as demand for sustainable farming methods and reduced use of chemical fertilisers grows. Multinational corporations currently dominate the market but rely on local distributors for product sales.

Biostimulants, such as biopolymers, non-living products produced from microbes, formulations based on biomolecules, and botanical extracts, are designed to be used in harsh environments and require targeted marketing to reach their full potential.

According to **Dr Venkatesh Devanur, CEO, MD Agri Life,** "the biostimulant industry is growing well in most crop segments across India. Abiotic pressures on crops and their adverse impacts are felt by farmers."

Biostimulants have the potential to enhance crop yields, improve soil health, and increase farmer income sustainably, making them an attractive option for the Indian agricultural sector. Despite facing challenges such as erratic weather patterns, soil salinity, and declining soil health due to the climate crisis, India's agricultural sector has made remarkable strides in becoming a leading food provider worldwide.

As the world's population continues to grow, sustainable agricultural practices, such as the use of seaweed biostimulants will become increasingly important in maintaining soil health and meeting food demand.

Commenting on the subject, **Prashant Kharwadkar, Regional Business Director, Acadian Plant Health,** said, "increasing awareness among farmers on the importance of good quality biostimulants against the adverse

impact of crop chemicals/residues, pest–disease resurgence, increasing cost of production, climate changes (abiotic stresses), and deteriorating soil health will continue to drive the demand for good quality biostimulants and sustainable technologies in agriculture for increasing crop yield and produce quality. India is an emerging market for biostimulants and provides a unique opportunity for continued growth on a sustainable basis."

Why biostimulants are popular

When it comes to increasing crop yields in an environmentally friendly and sustainable way, an increasing number of Indian farmers are turning to biostimulants.

Biostimulants are compounds and microorganisms that promote plant growth and health by boosting the soil's beneficial microbe population, increasing the plant's resistance to stress, and facilitating better nutrient uptake.

Both organic and conventional farming in India are adopting biostimulants, which have been integrated into the National Programme for Organic Farming by the Indian government.

In India, biostimulants such as seaweed extracts, humic and fulvic acids, amino acids, and beneficial microorganisms like mycorrhizal fungus and rhizobacteria are frequently used.

Biostimulants have been found to increase crop yields, particularly under adverse conditions such as drought or high temperatures, and can also reduce the use of toxic and expensive synthetic fertilisers and pesticides.

Despite the fact that the use of biostimulants is still relatively novel in India, its usage in agriculture is on the rise. As new studies are published, the broad application of biostimulants is expected to increase further.

Transforming agri-eco system

Most Indian farmers own less than 2 hectares of land, and rely heavily on their harvests for subsistence. Biostimulants allow farmers to increase output per acre of land used. Research and evidence from farmer's fields show that biostimulants boost crop output and improve produce quality.

The overuse of chemical inputs and fertilisers has led to severe soil degradation across India. Using biostimulants, one can improve crop yields by rehabilitating the soil, as reported by farmers

over the past 15 years, observed **Pradeep Jaipuria, Managing Director, PJ Margo.** It can also help combat the effects of climate change on crop output, which may be greater than that of biotic stressors like disease and insects, Jaipuria added.

Dr Devanur stated that biostimulants are becoming necessary to use, as farmers tend to overuse urea because it is cheap, which weakens the soil. P and K fertilisers (containing phosphorus and potassium, respectively) on the other hand, are expensive and, as a result, farmers use less of those, leading to imbalanced nutrition that increases abiotic pressure.

Manohar Shete, Executive Director, M&M Industries, a Nasik-based manufacturer and exporter of organic inputs, notes that most biostimulants use raw materials from organic sources and do not damage crops, whereas conventional chemical fertilisers and growth regulators can damage crops if not used in recommended dosages, which happens often.

Inclusion in organic farming

Biostimulants are an integral part of organic farming methods in India due to the rising awareness of the negative effects of conventional farming on the environment. Organic farming aims to achieve soil health, pest control, and increased crop yields using only natural inputs and methods. Biostimulants, which do not rely on harmful synthetic fertilisers and pesticides, can effectively boost soil health and plant development.

Moreover the government's goal of encouraging sustainable agriculture practices in India is consistent with the use of biostimulants. Biostimulants can reduce agriculture's negative impact on the environment by promoting natural methods and decreasing reliance on synthetic inputs.

The government has acknowledged the potential economic benefits of biostimulants for farmers. By increasing crop yields and decreasing the need for expensive synthetic inputs, biostimulants can enhance farmers' incomes and reduce their reliance on such inputs.

By including biostimulants in the National Programme on Organic Agriculture, the

The Biostimulant Advantage: Opportunities for Indian Agriculture

MAHESH GIRDHAR,
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Under the climate change scenario, achieving sustainable and doubled yields of high-quality agricultural crops poses a significant challenge. Improper and imbalanced use of inorganic fertilisers in many parts of the world is a major factor contributing to the declining trend in productivity. The situation may worsen with the growing challenges of increasing population and demand for food to feed a projected 9 billion people by 2050, limited cultivable land due to urbanisation and an increasing frequency of abiotic stress incidents such as droughts, high temperatures, and floods.

These factors could cause food crises in the near future. Therefore, biostimulants are one of the most effective and proven solutions to address productivity and quality issues. Biostimulants can increase the efficiency of inorganic fertilisers while reducing dependence on them. This makes biostimulants a suitable replacement and a valuable tool in promoting sustainable and efficient agriculture.

Opportunity & Size

Biostimulants by definition are substances mainly derived from humic & fulvic acids, seaweed extracts, protein hydrolysates, amino acids, vitamins, botanical extracts, cell-free microbial products, and antioxidants. They can be applied in the form of liquid, dry granules, or powder to plants, seeds or the rhizosphere. Biostimulants stimulate physiological processes in plants, leading to better root and shoot growth, increased nutrient use efficiency, yield, crop quality, and stress tolerance, regardless of their nutrient content. Additionally, biostimulants act as soil improvers.

Given the multi-advantageous nature of biostimulants in terms of plant and soil benefits, government has demonstrated its commitment to promoting ecologically responsible agricultural methods in India while simultaneously improving farmers' livelihoods.

Unlocking profits and growth

According to a report from Research and Markets, the Indian biostimulant industry is expected to grow at a compound annual growth rate (CAGR) of 14.06 per cent. It is projected to reach $145.947 million by 2027, up from $58.112 million in 2020.

Dr SK Malhotra, Project Director at the Indian Council of Agricultural Research (ICAR) Directorate of Knowledge Management and Former Agricultural Commissioner, Government of India says, “India could become a major source of biostimulants, because people everywhere value food safety, discussions of biostimulants as agri-inputs have gained traction. The European market is huge. The incorporation of microorganisms into the biostimulants field is sought after.” This means regulations need to be reviewed on a frequent basis to accommodate these changes. He suggests that more substantial policy guidelines be drawn up, with the assistance of the Bioagri Input Producers Association (BIPA).

Dr Malhotra points out that India is being looked at as a source for biostimulants, a nascent industry that needs to establish a strong reputation.

Sudha Reddy, Managing Director of KN Bio Sciences Pvt Ltd predicts that biostimulants will one day rival the popularity of conventional growth promoters. This prediction stands a good chance of coming true, thanks to the Indian government's

eco-friendliness, and their applicability as stress-mitigators in agriculture, they have yielded promisingly successful responses in open field and protective environment crops, dramatically increasing the scope of the agricultural-biostimulant industry.

The global biostimulant market in terms of revenue was estimated to be worth $3.5 billion in 2022, and it is poised to reach $6.2 billion by 2027, growing at a rate of 11.8 per cent (Market & Market Research, 2022). The Indian market in this segment has dramatically crossed the mark of $315 million since 2015. Amongst different types, the liquid segment is projected to dominate the biostimulant market due to its ease of application, ability to cover larger areas in a shorter period and wider compatibility with other fertilisers and pesticides.

With the increasing demand for sustainable alternatives and organic foods, the Indian biostimulant market is projected to grow by 16.49 per cent indicating significant potential in this industry (KK Meena & Pradeep Kumar, 2020). Looking at the surge in this market segment, to maintain quality and pesticide-free products, the Government of India has clearly defined regulations for the registration of biostimulants under Schedule VI of the "Fertilizer Control Order (FCO)" and amended the Fertilisers (Inorganic, Organic or Mixed) (Control) Order 2021, dated February 23, 2021.

Challenges and the Way Forward

In India, apart from the limitations in production technologies, dissemination and awareness initiatives on biostimulants remain major concerns. Presently approximately 138 million Indian farmers own an average land size of 1.15 hectare, and the existing extension mechanisms are under pressure due to the availability of only one extension personnel for every 800-1000 farmers (KK Meena & Pradeep Kumar, 2020).

Next generation biostimulants, such as biopolymers, microbe-based non-living products, biomolecules-based formulations, and target products, are known for their ease of application, storability, stability, and potent action under relatively harsh environments. They can address the specific challenges of abiotic stresses and are known for their ability to enhance the soil carbon pool, which is the need of the hour to build better soil carbon and soil health in the long term. Promoting the use of biostimulants will positively impact the environment and health of existing agricultural systems, and secure stability and sustainable production for future generations.

recent decision to regulate biostimulants under the Fertiliser Control Order (FCO), which is expected to stimulate the market.

Echoing similar sentiments on the government's move, Acadian Plant Health's Prashant Kharwadkar said, "India's biostimulant regulation may lead to consolidation in the biostimulant industry segment, and this move by the government is trying to ensure that only good quality products are available and reach the farmers. These new developments augur well for the farmers and Indian agriculture as a whole for its sustainable development."

N P Singh, President of Biostadt Philippines & Business Head of InGene Organics Pvt Ltd concurred. Lauding the government's action on biostimulants he said, "The agricultural sector in India is undergoing a sea change, and it's one for the better. This will provide the guidelines and standards necessary for farmers to produce high-quality goods. "

However, Dr Devanur believes the government has not been pragmatic in drawing up guidelines without consulting the industry and stakeholders. He lamented that microbial products in particular have been left out of the new regulations.

Authorities in many states historically discouraged citizens from using biostimulants. They were trying to prevent fly-by-night vendors from peddling potentially dangerous goods, by not allowing the sale of biostimulants. However, once the products are registered under the new FCO rule, the situation is expected to change.

The growth of biostimulants in India has been so encouraging that large chemical fertiliser businesses and global corporations have quickly added biostimulants and other bio inputs to their product lines.

Increasing numbers of farmers are showing interest in biostimulants as they become more aware of the negative impacts of traditional agricultural inputs. "Even conventional agri-inputs suppliers have taken note of this trend and begun producing these inputs," said Sudha Reddy. Investors believe that the market will expand overseas as well. Chandrakant Seth, R&D Director at Cippy Bio International in Ahmedabad, sees potential in the Asia-Pacific region.

Addressing the key obstacles to growth

One problem is that many people still know very little about biostimulants and the benefits they can provide. However, improved implementation of rules and laws is crucial for substantial firms that produce organic products. It's also important to remember that biostimulants need time to work before they can have a beneficial effect on the soil. Soil loses some of its nutrient value with each use, but the application of biostimulants has gradually improved soil lacking in nutrients. The improved crop output and increased productivity from the altered soil greatly benefit the farmer.

Moreover, when future demand is expected to rise, inadequate production infrastructure may make it challenging to distribute the products on time in sufficient numbers. A large number of Indian farmers own an average of 1.15 hectare of land, putting pressure on the existing extension mechanisms, with only one extension staff member available for every 800-1000 farmers. This raises the question of how to best disseminate and raise awareness about biostimulants in India. Despite launching a range of government schemes, India's agricultural sector is hampered by the failure to raise public awareness through effective publicity and promoting the use of biostimulants to achieve long-term sustainability.

Major biostimulant players in India

● AgriLife ● Tradecorp APAC Pty. Ltd.
● Acadian Seaplants Ltd. ● Isagro ● Valagro
● Bayer AG ● Koppert B.V.
● Eastman Chemical Company
● Biostadt India Ltd ● BASF

Types of biostimulants used in India

- Seaweed Extracts – loaded in Bentonite Clay Granules – used in South and North India for rice and wheat crops
- Humic Acid – (Humic and Fulvic Substances) for foliar spray and through drip irrigation – in South and West India
- Amino Acid – (Protein Hydrolysates) for foliar spray – Across all over India
- Plant Growth Promoting Rhizobacteria – Microbes, used across India

Biostimulants, such as biopolymers, are known to increase soil carbon pools, which is urgently needed for two reasons: controlling rising atmospheric CO_2 levels by sequestering atmospheric CO_2 as soil organic carbon and improving soil health in the long run by encouraging a buildup of soil carbon. Hence, the application of biostimulants in conjunction with other sustainable agronomic approaches, such as the use of resistant cultivars, resistant rootstock-based grafted seedlings, a protective environment, water-conservative irrigation practices, and suitably recycled farm-waste-derived amendments, will not only ensure relatively sustainable yields in highly stress-prone areas (such as arid and semi-arid regions) but may also improve the ecosystem services of the existing agriculture.

Commenting on the issue, Kharwadkar said, “Bridging the last mile gaps i.e., reaching out and connecting with the farmers spread across more than 600,000 villages and making them understand the importance of quality biostimulants, are the biggest challenges. Farmer’s perception of all biostimulants inputs is similar. Therefore, dissemination of knowledge and differentiation are key to the speedy growth of the market with farmer’s ROI.”

However, Dr Devanur has highlighted four specific challenges in this sector: confused regulations, too many unorganised players, no standardisation, and dealer apathy.

What industry expects

The Agro Inputs Manufacturers Association of India (AIM) welcomes the inclusion of

biostimulants included in the Fertiliser Control Order, but has requested that the government allow MSMEs to use the pool data collected by the AIM during the registration process to continue their operations. The association represents the biostimulant sector in Pune and has been around since 2010. It has records for eight of the most important biostimulants, and its members can be found all over India.

AIM argues that it is not feasible for small manufacturers to collect this data on their own, and hence, it is seeking permission for its pooled data to be used by small manufacturers during the registration process.

AIM believes that label claim-based products can increase farmers' incomes by as much as two fold, and the guidelines should support this.

Enumerating the benefits and drawbacks of government policy, Kharwadkar said, “the Indian government has already placed a strong emphasis on and encouraged sustainable agriculture practices such as organic farming and the use of biostimulants. The growth of India's biostimulant industry has received a boost because of the government's efforts in this area. Previously largely disorganised and dominated by small, local firms, the industry may be streamlined as a result of the new fertiliser rules on biostimulants.”

However, the government should make available an electronic system for acquiring licences and selling permission from the relevant state governments. It is time-consuming and difficult to get selling permission for biostimulants from each individual state. “One Country, One Licence, please,” urged Kharwadkar.

Moreover, AIM has argued that the current Minimum Residue Limit (MRL) of 0.01 ppm should be raised to a minimum of 5-10 ppm to prevent lacing and adulteration in biostimulants. It is important to note that instrument contamination and water contamination used in product formulation allow for detection down to the 0.01 ppm limit.

Even if a pesticide is tainted with 1-5 ppm, according to the group, it will have no effect on insects. Therefore, it serves no purpose beyond potential Insecticide Act litigation.

They are calling for an urgent policy clarification regarding the import of biostimulants as raw materials, saying biostimulant registration requirements should not apply to importers.

However Singh said “We have reason to believe that the government's efforts to regulate biostimulant goods are proceeding along the correct lines. For businesses with a focus on that market, this is a huge boon.”

Global trends

- Development of new active ingredients
- Improved formulations
- Microbial biostimulants
- Biostimulant testing protocols
- Combination products
- Application technology

Road map

The biostimulant industry in India has great potential for growth, but it faces several obstacles that need to be overcome. A lack of knowledge and understanding among farmers, a disorganised industry, and a clumsy distribution system are just a few of the challenges. Despite the government's strong backing, there are still certain stakeholders' issues that need to be resolved soon.

To achieve the goal of promoting biostimulant use, various stakeholders need to be consulted by policy makers as new policies and regulations are developed. Farmers need to be trained and educated on the benefits of using biostimulants, which can be achieved through campaigns and seminars.

The quality of produce is directly related to the state of the soil, which is deteriorating with time. Farmers are increasingly favouring products that promote root formation and stimulate microbial activity in the rhizosphere to increase nutrient uptake and usage efficiency. However, there are still significant gaps in the diffusion of knowledge that can be narrowed with the aid of digital technology and IT.

Overall, to leverage the full potential of the biostimulant industry in India, a collaborative effort between stakeholders, including the government, farmers, and industry players, is required to overcome existing obstacles and achieve sustainable growth.

Nitin Konde