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Promoting Bio Fertilizers in Indian Agriculture

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ABSTRACT: ***The green revolution resulted in significant increases in food production, but with little regard for long-term sustainability. Only imports and subsidies have guaranteed the availability and affordability of fossil fuel-based chemical fertilizers at the farm level in India. Chemical fertilizer reliance for future agricultural expansion would result in increased soil degradation, the risk of water pollution, and an unsustainable economic load. The Indian government has been attempting to encourage a better practice that includes the use of bio-fertilizers in addition to fertilizers. These inputs have a variety of positive effects on the soil and may be quite inexpensive and easy to utilize. In line with current expectations, the government wants to promote not just their usage in agriculture, but also private initiative and economic viability. This study examines existing industry statistics and concludes that there has been only a limited amount of success to far. There has been no rapid rise in distribution over time, insufficient geographical dispersion, and no obvious evidence of privatization success despite the entrance of tiny private units into the sector. However, the study contends that, given the promised social advantages, the government has sufficient reason to interfere in order to create a viable market for the new product while promoting private participants. However, the policy and intervention tools must be carefully crafted.***

KEYWORDS: ***Agriculture, Biofertilizers, Government, Market, Nitrogen-Fixing.***

1. INTRODUCTION

When the anticipated societal benefits from a relatively new product exceed the costs but the private benefits do not, a market failure necessitates government action. Uncertainty regarding the product's effectiveness, along with the time it takes to understand it, may contribute to low demand from farmers as end users. So long as market knowledge is incomplete, the government has a role to play in inducing a socially optimum investment level and setting up an effective market, even in the context of market liberalization. However, the precise nature of the function and the policy tools to be used must be determined with a thorough knowledge of the agents' strengths and weaknesses. Plants may use nutrients that are naturally plentiful in soil or the environment thanks to biofertilizers. Field tests have shown that they are effective and inexpensive inputs that are devoid of the harmful effects that chemicals have on the ecosystem. Biofertilizers are a novel technique for Indian agriculture that has the potential to overcome many of the drawbacks of traditional chemical-based technologies. It is a product that, in the long term, is likely to be economically viable if sufficient knowledge is made accessible to producers and farmers via experience and communication [1], [2].

There is a current effort in India to promote biofertilizers via government involvement, and in line with the spirit of the times, the policy encourages the private sector and profit incentive to drive the new technology forward. The issue addressed in this article is whether the intervention policy in Indian agriculture has been effective. The Indian government and several state governments

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have been supporting the fledgling biofertilizer industry at the user-farmer and producer-investor levels via the following measures:

1. Extension and promotion programs at the agricultural level,
2. Financial support to investors for the establishment of units,
3. Sales subsidies and
4. Direct production in the public sector, cooperatives, universities, and research institutes.

As the sector matures and gains public direction, the following insights are likely to emerge:

(a) expanding sales volumes and distribution throughout the nation
(b) More prominent role for profit-driven private business.

Because data on farm-level biofertilizer use or unit profitability has yet to be provided, one method to get around is to use the secondary indicators included in (a) and (b).

2. BIOFERTILIZERS

Biofertilizers, also known as microbial inoculants, are cultures of specific soil organisms that have been intentionally reproduced in order to enhance soil fertility and crop production. Although legumes' positive benefits on soil fertility have been known since antiquity, and their involvement in biological nitrogen fixation was identified more than a century ago, commercial exploitation of such biological processes is a relatively new phenomenon.

The commercial history of biofertilizers started in 1895 with the introduction of 'Nitragin,' a laboratory culture of Rhizobia by Nobbe and Hiltner, followed by the discovery of Azotobacter, blue green algae, and a slew of other microorganisms. The organisms Azospirillum and Vesicular Arbuscular Micorrhizae (VAM) are relatively new to science. N.V.Joshi performed the first research on legume Rhizobium symbiosis in India, and the first commercial production began in 1956. However, during the Ninth Plan, the Ministry of Agriculture began a serious attempt to publicize and promote the input by establishing the National Project on Biofertilizer Development and Use (NPDB). The most often studied biofertilizers in India are listed below, along with some key characteristics [3]–[5].

2.1. Rhyzobium (RHZ):

These inoculants are renowned for their capacity to fix nitrogen from the atmosphere in a symbiotic relationship with plants by producing nodules in the roots (stem nodules in sesabaniamrostrata). RHZ, on the other hand, are restricted by their specificity, and only a few legumes benefit from this symbiosis [6].

2.1. Azotobacter (AZT):

A broad range of crops, including grains, millets, vegetables, cotton, and sugarcane, have benefited from this. It is a non-symbiotic, free-living nitrogen-fixing bacterium that also generates chemicals beneficial to plant development as well as antibodies that inhibit numerous root diseases.

2.3. Azospirillum sp. (AZS):

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This is a nitrogen-fixing microbe that benefits non-leguminous plants as well. The advantages, like those of AZT, go beyond nitrogen enrichment via the synthesis of growth-promoting chemicals.

2.4. Azolla with Blue Green Algae (BGA):

BGA are free-living photosynthetic nitrogen fixers. In India, they may be found in large quantities. They, too, provide growth-promoting chemicals like vitamin B12, enhance aeration and water holding capacity in the soil, and contribute to bio mass when destroyed at the end of their life cycle. Azolla is an aquatic fern that may be found in rice fields and tiny, shallow water bodies. It has a symbiotic relationship with BGA and may aid rice or other crops by dual cropping or soil green manuring [7].

2.5. Phosphate solubilizing (PSB)/Mobilizing biofertilizer:

Because of its poor mobility and solubility, as well as its propensity to stay fixed in soil, phosphorus, both native in soil and added in inorganic fertilizers, becomes largely inaccessible to crops. PSBs are living organisms that may aid in plant phosphate absorption in a variety of ways. The PSB also has the potential to make use of India's vast rock phosphate resources, most of which are not enriched.

2.6. Limitations and Reactions

On the basis of reported nitrogen equivalence, crude calculations of bulk and cost in terms of N presented in Table 1 indicate that biofertilizers are cheap and convenient compared to chemical and farm organic fertilizers (FYM), and thus have considerable promise for crops such as cereals, oilseeds, vegetables, and cotton. However, it is prudent to note that the nitrogen equivalences reported for biofertilizers are only indirectly approximated through controlled experiments because, unlike nutrient-containing chemical fertilizers and manures, the method of accessing nutrients is indirect, and the bulk and cost comparisons may not be realistic. Nonetheless, a rough estimate is made in order to get a sense of the possibilities without assigning any importance to the magnitudes.

Biofertilizers offer a number of advantages. Different biofertilizers offer growth-promoting elements to plants in addition to providing nutrients for current and residual consumption, and some have proven successful in aiding composting and efficient recycling of solid wastes. These organisms assist not only in conserving, but also in efficiently using chemical fertilizers by reducing soil borne illnesses and increasing soil health and soil characteristics, resulting in better yield rates.

3. Government Intervention in Biofertilizer Market

During the Ninth Plan, the Government of India launched a central sector scheme named National Project on Development and Use of Biofertilizers (NPDB) for the manufacture, distribution, and promotion of biofertilizers in order to meet production goals. As a subordinate agency of the Department of Agriculture and Cooperation, the National Biofertilizer Development Centre was created in Ghaziabad, with six regional centers. The scheme's goals included organizing training courses for extension workers and field demonstrations, as well as offering quality assurance services. Different biofertilizers were also produced and distributed, but these operations were

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eventually phased out as the institutes shifted their focus to R&D and HRD. However, capacity development and production were aided by a one-time subsidy for new units [8], [9].

The financial support, first provided as a grant-in-aid of Rs 13 lakh per unit and now raised to Rs 20 lakh per unit and made available to everyone, was routed via state governments, but due to delays in grant distribution, the onus has been shifted to NABARD/NCDC. The public sector accounts for the majority of the industry's units, although comparable private-sector units are increasingly emerging. Different state governments also offer subsidies, which may amount to up to 50% of the sales revenue, although the method of subsidization is somewhat ad hoc. Discrimination and manipulation in subsidies have resulted in a lot of intra-industry pricing variance in several instances [10]. The government is also heavily involved in the marketing of biofertilizers via three different channels:

1. State government to farmers via District level officers and Village level employees
2. Farmers and ranchers are served by the State Marketing Federation through cooperative entities.
3. Farmers are served by State Agro-Industries Corporations via Agro Service Centers.

Producers, on the other hand, have the option of selling via their own sales network or through the market (i.e., wholesalers and private dealers).

3.1. Information:

The Fertilizer Association of India (FAI) publishes data on capacity and distribution of biofertilizers by different units on a regular basis. In the lack of published data on input usage at the farm level, this may aid in assessing the technology's development and acceptance in India. The data spans the years 1992-1993 through 1998-1999. The FAI report shows the distributions of various strains by state in recent years, which may be used as a proxy for farmer use. Firm-level data on capacity, distribution, and pricing would be more helpful for a better understanding of demand for usage. However, owing to non-response, the FAI was unable to report for all existing generating units, and this irregularity affects distribution and pricing more than anything else. As a result, the conclusions made in this research are based only on the samples that provide the necessary data. The FAI reports (1996, 1998, 2001) provide data on yearly distribution levels of different inoculants and their selling prices by companies for successive years. Additionally, the yearly capacity as of March for the three years 1995, 1997, and 1999 is given.

3.2. Biofertilizer Technology's Success

With varied degrees of focus, the Government of India and several state governments have been encouraging the use of biofertilizers via grants, extension, and sales subsidies. Farmers, too, learn about technology through time, developing their perceptions based on agronomic realities in their areas, knowledge acquired from the experiences of other farmers, including themselves, and information given by various disseminating agents, and making their own adoption choices. Above all, the foresight of businesses working via their marketing, research, and development activities would lead to broad adoption of the inputs once the possibility of profit was recognized. With the passage of time and government backing, it has gained commercial appeal.

4. DISCUSSION

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The industry seems to have had a continuous rise in the number of units generating the input based on data from 1995, 1997, and 1999. The number of units increased by 53 percent during four years, from 62 to 95, and then to 122 in 2002. (Ministry of Agriculture, GOI). According to data from units reporting their capabilities, overall capacity increased by 102 percent. New private companies entered the market, increasing their numerical share, whereas the public sector stagnated following the first boom. A closer examination, on the other hand, might be more instructive. The overall distribution, as reported by the units on a yearly basis, has risen at a remarkable pace of more than 50% over time. However, it is apparent that the majority of the increase occurred between 1992 and 1995, and then plateaued. There are also variations in share percentages by kind, with AZT having modest success and PSB having by far the greatest result. The drop in RHZ suggests that groundnut and pulse success was less than expected. By comparing actual distribution (rather than production) to capacity, a measure of capacity utilization is produced. The industry has been shrinking as the average capacity of a unit has decreased from 261.8 to 205.6 tones. Due to the entrance of smaller new units, the capacity increase in the industry was less than the addition of new units. The average distribution fell in the first two years, perhaps indicating the need for a downsize, before rebounding. Although average capacity utilization has been low, downsizing seems to have halted the downward trend.

Because biofertilizers are perishable and sensitive to handling quality, plant dispersion would follow regional distribution patterns to some degree. However, units with extensive distribution networks do disperse across greater regions, thus this is only partly true. IFFCO's MLN Farmers' Training Institute in Phulpur, Uttar Pradesh, manufactures all strains of biofertilizers and distributes them in states other than the home state. Eastern states like as Bihar and Orissa are also covered, but their participation has decreased in recent years, particularly in West Bengal, where disbursements were zero in 2000-02.

In the 1990s, India transitioned to a market-oriented system, and the government's intended role shifted to that of a facilitator. In the past, public sector entities, such as state-owned cooperative groups, played a critical role in continuously executing the government's social goals, sometimes at the expense of commercial interests. Failure to achieve commercial viability in a more competitive market does not bode well for the organizations' long-term survival as well as the public budget. In the case of biofertilizers, the public sector's initiative, along with numerous universities and state-funded research units, must eventually lead to commercial success once the technology is transmitted to the field, and this, in turn, is expected to attract private enterprise because the market is open for entry.

Biofertilizer production began in India with substantial government engagement and active participation of the public sector, which is guided by public policy and social goals rather than profit. So long as the market is open to newcomers, the degree of commercial success will be determined by the involvement of private commercial units. Universities, research institutions, cooperatives, agro-marketing, and other public sector groups are among the private businesses that reported. Finally, given the observed concentration trend, the geographical distribution of the businesses is of importance.

5. CONCLUSION

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Critics claim that the Green Revolution just borrowed output from future generations by depleting soils and disrupting natural balances. Environmentalists have also pointed out that the new free trade system would increase the scale of activity, particularly for goods with a comparative advantage, resulting in more environmental harm. While this is an extreme and controversial viewpoint, the need of correcting previous ecological issues to the degree feasible and establishing more sustainable patterns in the future cannot be overstated. The National Biofertilizer Development Board (NPDB) has been encouraging the use of biofertilizers in agriculture, and state governments have aided the process via subsidization and extension. These inputs, which are based on live microorganisms, can make nutrients abundantly available in the environment and soil for plant use while avoiding the negative effects that chemical fertilizers have on soil, water, and air. Through field demonstrations, research, and financial support to investors, the national plan aimed to disseminate the innovative biofertilizer-based technology. Based on data provided by the Fertilizer Association of India, this study finds that, despite efforts, input use as indicated by the distribution has not increased steadily over time, has been far below projected levels, and there has been virtually no diffusion across states, with the western and southern regions accounting for about 90% of use. Although new units have been added and considerable capacity has been added, average capacity has decreased, despite a slight increase in capacity utilization. Despite being open to entrance, private commercial units have not increased their distribution share. According to a regression study, a private unit distributes less than others given the same capacity and other relevant circumstances, casting doubt on the industry's economic performance. The study also shows that there is no inherent advantage that explains the industry's apparent concentration in certain locations. The initiative of state governments may have had a larger influence in directing the spread of technology than the federal government's programs.

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