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Asian Mega-Deltas



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Research note 1

Farmers' use of, and attitudes towards, Rhizobium and recommended rate of fertilizers in mungbean cultivation in southern Bangladesh



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ABOUT THIS NOTE

Mungbean, the third most important pulse in Bangladesh, is widely grown in Patuakhali, which ranks third nationally in cultivation area (5,089 ha). However, yields are low due to environmental challenges like cyclones, salinity, and water scarcity, as well as limited adoption of effective agronomic practices. Techniques such as line-sowing, timely weed control, proper fertilizer use, and biofertilizers like *Rhizobium* can boost productivity, but adoption remains limited. Farmers' decisions are influenced by risk perceptions, resource constraints, and opportunity costs. A 2021 survey in Patuakhali explored these barriers to inform strategies for sustainable mungbean farming.

BACKGROUND

Mungbean ranks third among all pulses in both demand and production in Bangladesh (BBS, 2022). Notably, the Patuakhali district in Barishal, southwest Bangladesh (Figure 1) is an area of significant mungbean production, being the district with the third highest area coverage (5,089 ha) for this crop nationally (BBS, 2022). Despite its considerable yield potential, actual mungbean yields achieved in Patuakhali are low, exacerbated by environmental challenges including cyclones, soil salinity, poor soil fertility, dry-season water scarcity, and poor awareness by farmers of optimal agronomic management practices.

Effective agronomic practices can significantly enhance mungbean production in Patuakhali. Key practices include using line-sowing machines for precise crop establishment, which replaces the traditional broadcasting method, and implementing good agricultural practices such as timely weed management, appropriate fertilizer application, efficient irrigation, and proper harvesting techniques. Despite these recommendations, the adoption of such practices remains low during the dry season. Farmers frequently apply fertilizers at lower-than-recommended doses, even though this approach is both efficient and cost-effective for improving yields. Similarly, the use of biofertilizers like *Rhizobium* inoculum—recognized for its ability to sustainably enrich soil fertility—has not been widely adopted (Mahmud et al., 2021). Notably, *Rhizobium* biofertilizers may offer greater effectiveness than synthetic nitrogen fertilizers like urea in boosting crop productivity.

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resources to mungbean production rather than other income-generating activities. These perceptions often differ from the recommendations of researchers, government officials, and extension agents, as farmers are attuned to real-time trade-offs and opportunity costs specific to their individual circumstances.

To gain deeper insights into the underutilization of fertilizers in dry-season(Rabi) mungbean cultivation and to identify the challenges influencing farmers' decision-making processes, a comprehensive telephone survey was conducted in 2023 across key mungbean-growing areas of the Patuakhali region. The survey aimed to provide a clearer understanding of the barriers to adopting recommended practices and inform strategies to support farmers in making more informed and sustainable agronomic choices.

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OBJECTIVES OF THE SURVEY

- i) Gain insights into farmer perspectives, challenges, and decision-making processes to use biofertilizers (rhizobium) for mungbean productivity.
- ii) Assess the potential of biofertilizers, particularly rhizobium inoculum, in enhancing mungbean productivity.

Here we summarize the results of this survey and identify potential future research to improve the mungbean productivity and profitability of smallholder mungbean farmers in southern Bangladesh.

METHODOLOGY

A telephone survey was conducted in the major mungbean-growing areas of Patuakhali district, involving interviews with 150 farmers during the Kharif-1 (pre-monsoon) season. Farmers and locations were randomly selected with assistance from the Sub-Assistant Agricultural Officers (SAAOs) of the Department of Agricultural Extension (DAE). Most of the participating farmers had previously been involved in initiatives such as the Water Management Group (WMG), Integrated Pest Management Group (IPM), or the Blue Gold Project. The target group primarily consisted of mungbean farmers practicing rice-mungbean cropping systems.

To conduct the survey, four staff members from CIMMYT's partner organization, Grameen Jano Unnayan Sangstha (GJUS), were trained in telephone survey methods. Data collected during the survey were recorded and analyzed using Excel. Descriptive statistics, including sums, averages, percentages, and Likert scale analysis, were used to describe the extent of mungbean production in the research area.

Additionally, a separate paper-based survey was conducted with 70 SAAOs from the same region to gather their perceptions of rhizobium inoculant usage.

RESULTS AND DISCUSSION

During the dry (rabi) season, mungbean has emerged as a favored crop among farmers, primarily due to its profitability and low input requirements including low investment and less labor requirement (Figure 1). This preference aligns with findings from a study by Uddin et al. (2021), which emphasized the crop's suitability as a short-duration option offering better yields compared to other similar crops. Moreover, its strong market demand, minimal investment, and low labor requirements make it an even more attractive option for farmers.

A majority of farmers—around 74%—reported satisfaction with their crop yields (Table 1). Of these, 44% attributed their positive outcomes to the use of fertilizers. However, the types of fertilizers used varied significantly. Only 16% of farmers relied on basic fertilizers such as urea, TSP, and MoP, while a mere 3% adopted balanced fertilizers, indicating limited uptake of comprehensive nutrient solutions. On the other hand, 26% of farmers expressed dissatisfaction with their yields. Notably, 17% of these dissatisfied farmers had applied fertilizers, suggesting a gap between fertilizer usage and the expected improvements in productivity.

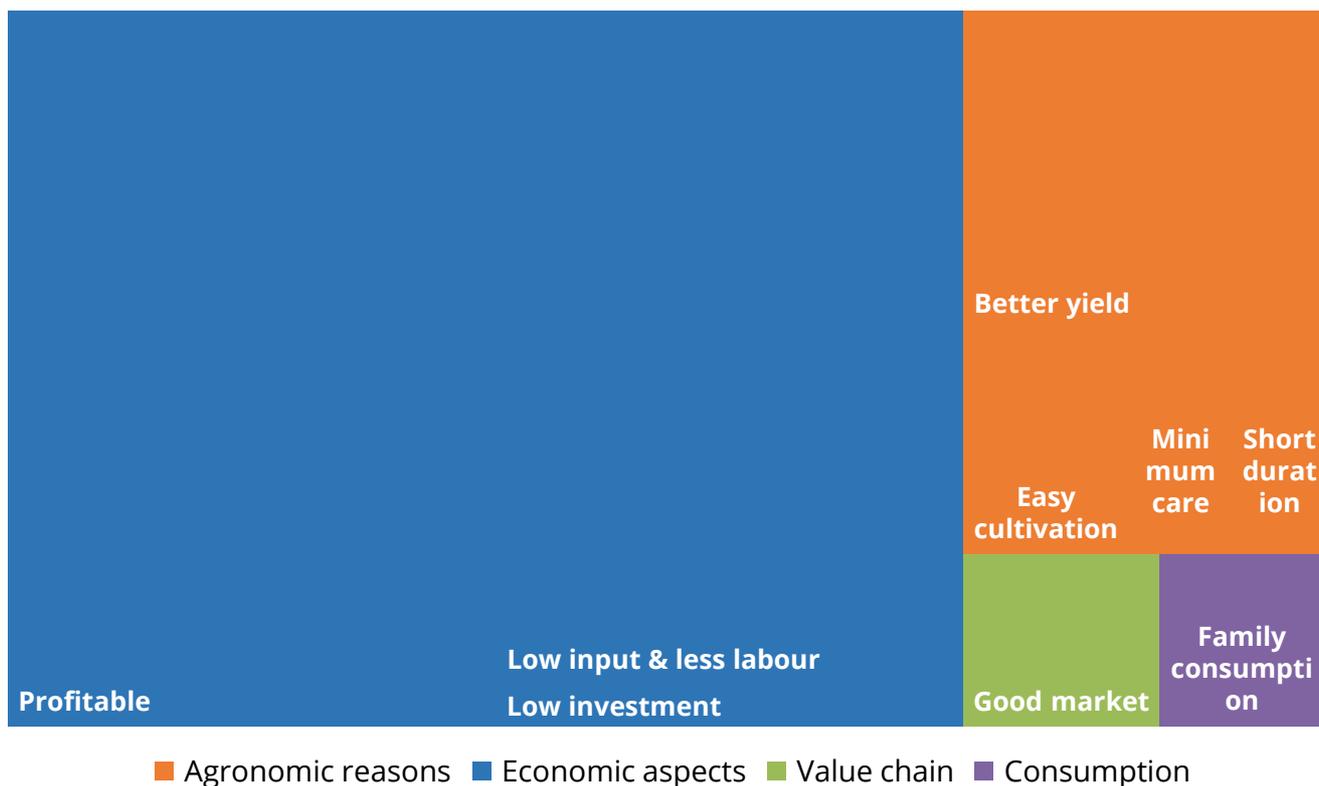


Figure 1: Farmers' preferences for cultivating mungbean during the rabi season over other crops

Table 1: Farmers' responses regarding their satisfaction with crop yields and the use of fertilizers in their Fields

Respondents (n=150)	Farmers satisfied with yields (%)	Farmers who applied fertilizers (%)	Farmers who applied at least 3 fertilizers (%)	Range of farmers' self-reported yields (t ha ⁻¹)
Yes	74	44	16	1.48-0.55
No	26	17	3	0.98-0.53

When it came to selecting fertilizer options for mungbean cultivation, about 52% of the farmers were content with their previous choices (Figure 2). Peer recommendations played a significant role, with 25% of farmers citing advice from neighboring farmers as a key influence. This reliance on traditional knowledge and social networks far outweighed the impact of promotion agents, who ranked third in influence, or agricultural extension agents, who influenced only 10% of respondents. These findings underscore the importance of peer-to-peer interactions in shaping agricultural decisions while highlighting the relatively smaller role of extension services.



Figure 2: Farmers' reason to use fertilizer options

The adoption of Rhizobium technology presents a mixed scenario. Farmers' responses to Rhizobium are influenced by various critical factors. Many of the surveyed farmers believe that current agricultural technologies are insufficient to meet their productivity needs (Figure 3). However, a significant number of farmers recognize that soil fertility can be improved by applying Rhizobium in combination with other fertilizers during sowing to enhance crop yields. Despite this, most farmers are unaware of how to properly use Rhizobium, how to apply it, or what benefits it can offer in the long term, which makes them hesitant to adopt this technology in their farming practices. A lack of awareness and

insufficient knowledge remain significant barriers to progress. This situation highlights the need for more effective integrated agricultural technologies, and farmers require evidence to make the technology sustainable. In the farmers' view, the effectiveness of Rhizobium needs to be demonstrated through more field trials or peer-reviewed scientific research to help build trust in the technology. Affordability is another factor: some farmers view it positively, while others see it negatively. However, most remain neutral, as it is not widely available in the market.

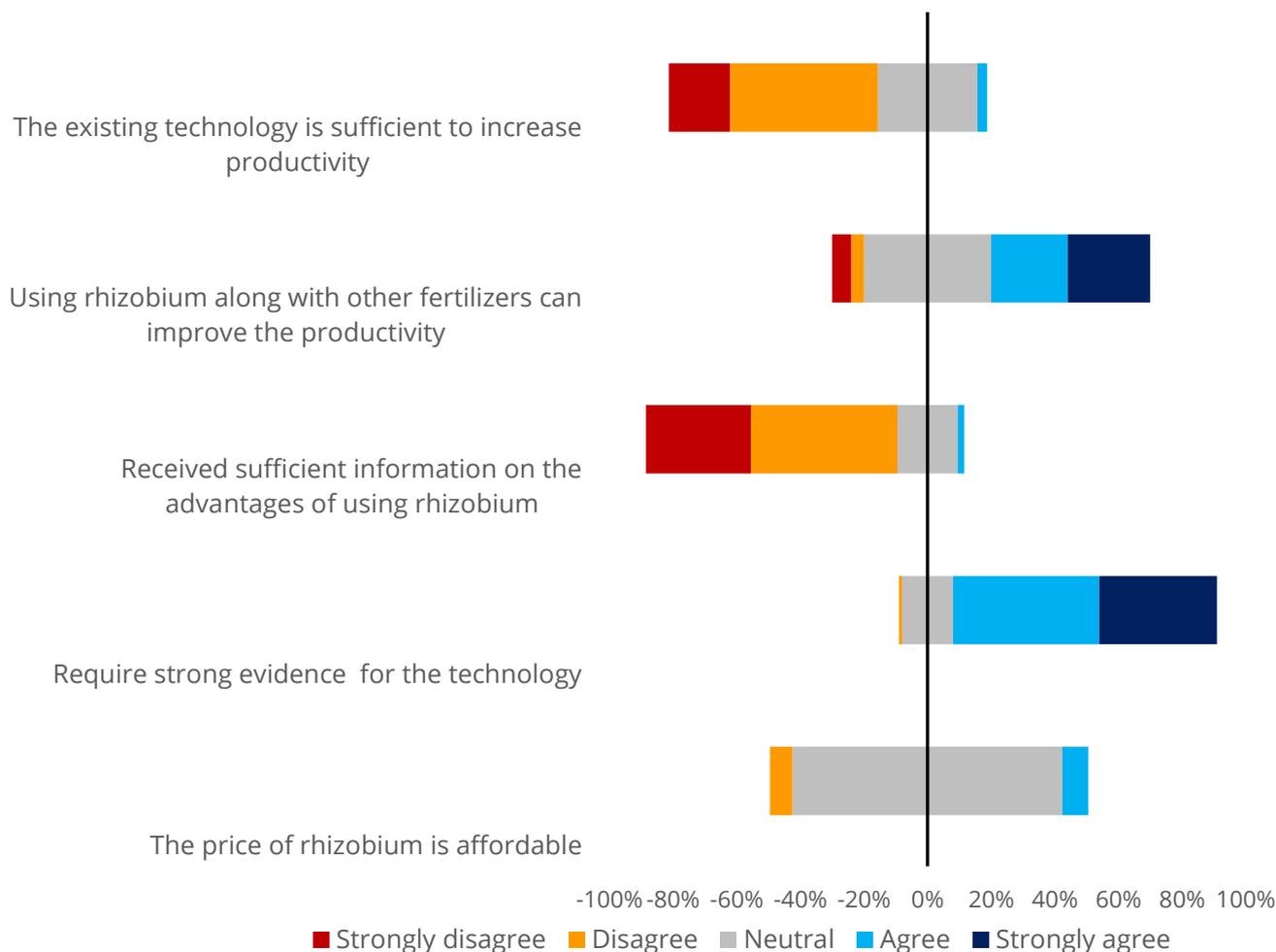


Figure 3: The mixed scenarios for adopting rhizobium inoculum for mungbean production:

Agricultural stakeholders, especially SAAOs, have doubts about whether the available technology is sufficient to improve mungbean productivity. A substantial number of respondents disagree or strongly disagree that current technologies are effective solutions (Figure 4). The respondents also appear to lack confidence in the available solutions, although their interest is fragmented. However, there is no doubt about the effectiveness of rhizobium technology when used in combination with other

fertilizers. The majority of respondents were clear in stating that such an integration would improve yields, as they believe rhizobium can play a key role in addressing productivity issues. The effectiveness of rhizobium needs to be demonstrated through more field trials or peer-reviewed scientific research to help build trust in the technology.

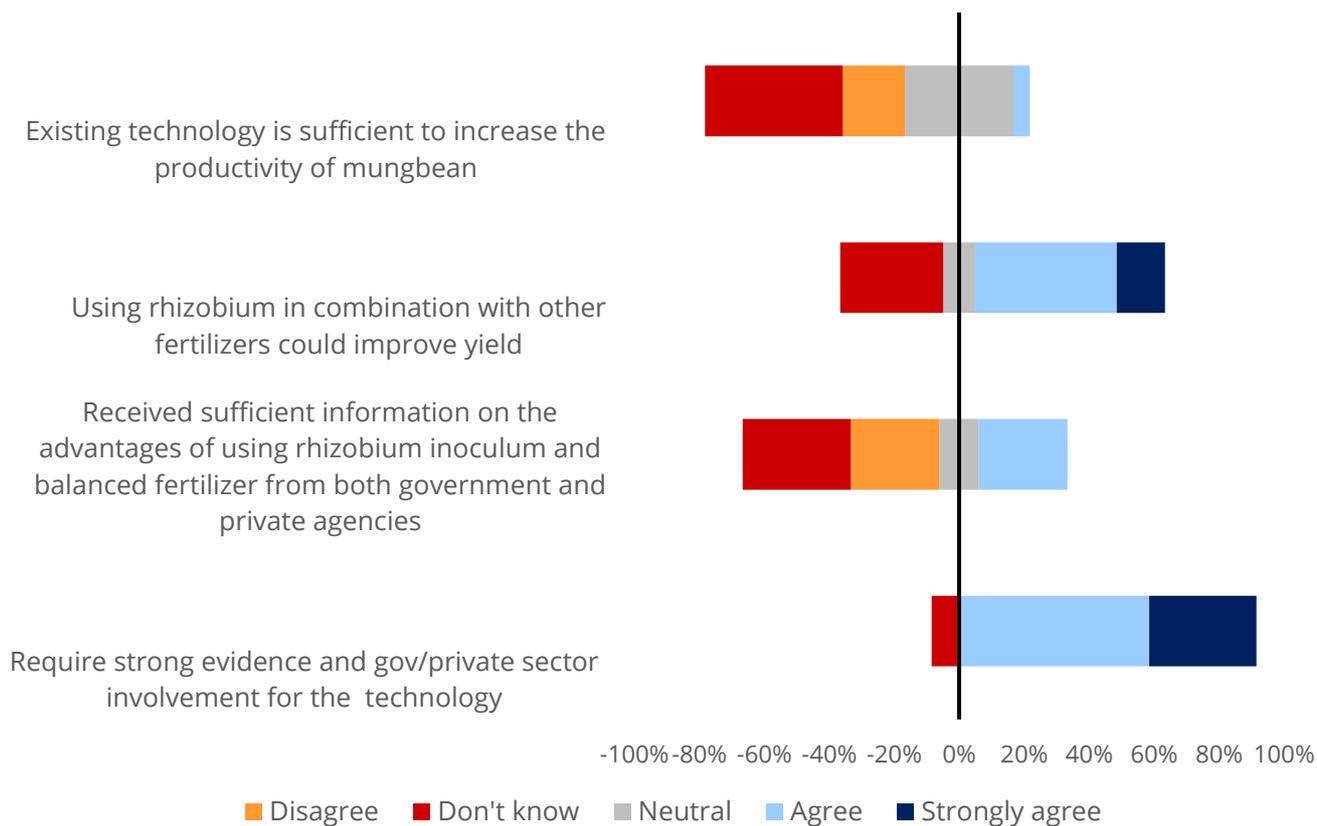


Figure 4: Sub Assistant Agricultural Officers' perception of using rhizobium inoculum

One of the major challenges in scaling up Rhizobium technology is the lack of sufficient information, with many respondents feeling inadequately served by both government and private institutions in educating them about the importance of Rhizobium inoculum, highlighting the need for improved messaging and education campaigns (Figure 5). There is also a significant trust gap, as many people remain skeptical about the claimed benefits, necessitating greater engagement from both government and non-government organizations. To build confidence and knowledge in the technology, it is crucial to provide scientific evidence. Achieving the full potential of Rhizobium technology

requires coordinated efforts, including information sharing, stakeholder engagement, and field evidence to prepare society for adoption and improved agricultural outcomes. Factors contributing to farmers' hesitance to use Rhizobium include limited access to information, lack of availability in local markets, absence of promotional campaigns, and trust issues regarding its effectiveness. Credible agricultural investments are needed to ensure market availability, build trust through demonstrations and success stories, and promote collaboration among agricultural extension service providers, companies, and farmers.

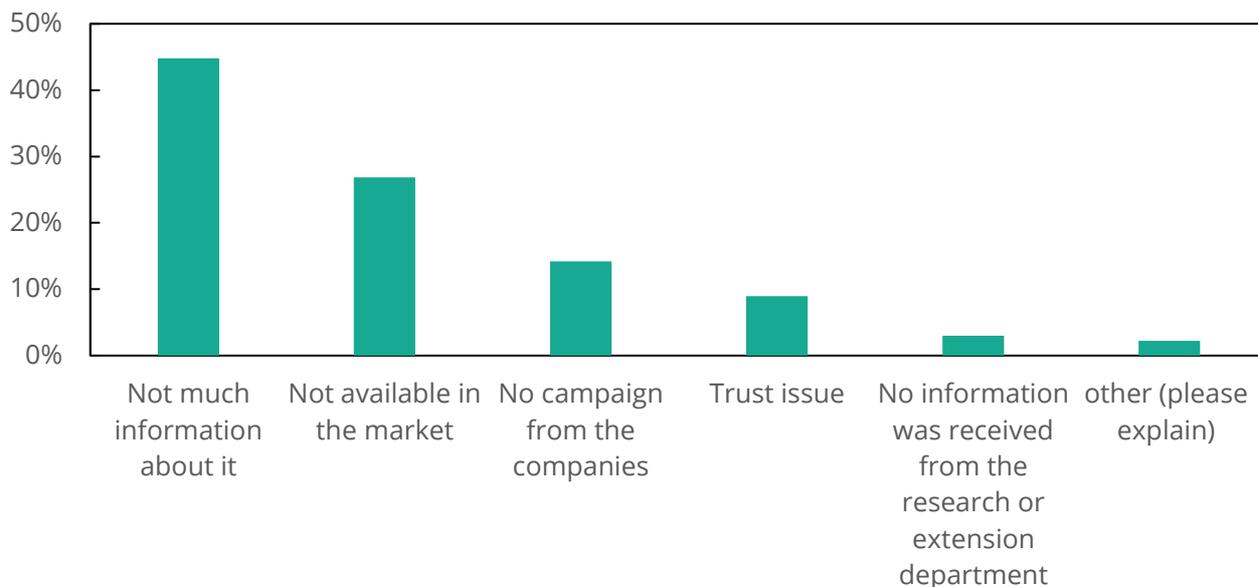


Figure 5: Farmers' reasons not to use rhizobium inoculum in the mungbean field.

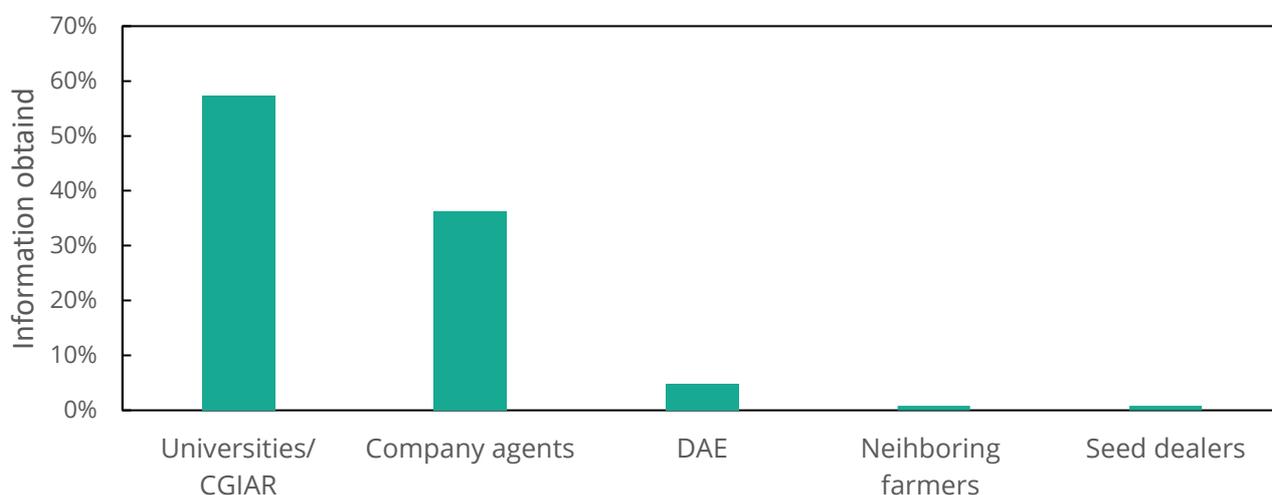


Figure 6: Information flow about Rhizobium to farmers for mungbean cultivation

Most farmers received information about rhizobium primarily from CGIAR initiatives, as they, company representatives, the Department of Agricultural Extension (DAE), and neighboring farmers use the technology to monitor its effectiveness (Figure 6). But the expansion channels are not working effectively. This gap highlights the need for more robust and accessible systems for disseminating knowledge. To ensure that farmers receive timely and accurate

information about agricultural innovations such as Rhizobium, strengthening cooperation between research institutes. Extension services, private companies and local farming communities will play a key role in bridging this gap. and increasing the adoption of profitable agricultural practices.

RECOMMENDATIONS AND CONCLUSION

This study highlights the significant untapped potential for increasing mungbean production in Patuakhali, Bangladesh. This is through improved agricultural practices, integrating Rhizobium inoculation with optimal fertilizer use. Although these technologies have shown their benefits in increasing crop yields and soil fertility, acceptance is limited due to important limitations such as lack of awareness. Inadequate market readiness and skepticism among farmers. A diverse approach is needed to address these challenges.

First, targeted education campaigns are essential to closing information gaps to build farmers' confidence in the benefits of using biofertilizers such as Rhizobium, agricultural extension services, research institutes, and community organizations should work together to convey a clear message. There is empirical evidence. and provide practical training. Second, field trials and study peer-reviewed that demonstrate the effectiveness of Rhizobium technology help build credibility and trust between farmers and Stakeholders. Third, affordability concerns can be alleviated through subsidies. Joint product or financial incentives that make investments such as biofertilizers more accessible to smallholder farmers.

In the end, achieving sustainable mung bean production and improving farmers' resilience to environmental challenges. These strategies must be integrated into broader efforts to strengthen extension services. Facilitate stakeholder participation and improve the market system Further research should focus on improving these interventions to reflect the local socio-economic and climatic context of southern Bangladesh. By addressing identified barriers and promoting the widespread adoption of sustainable agriculture practices.

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