I3-4-BIOFERTILIZERS

SOWING INNOVATION
HARVESTING SUSTAINABLE YIELD

Interregional innovation investments for biofertilizers and circular bioeconomy solutions for a sustainable agriculture

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1. Summary

This deliverable examines the current landscape of the biofertilizer market by analyzing survey responses from fertilizer producers, sellers, and farmers. The findings provide insights into production trends, commercialization challenges, and adoption barriers, offering a comprehensive view of the sector's potential within the framework of sustainable agriculture and the circular bioeconomy.

Among fertilizer producers, 72% are familiar with biofertilizers, though large-scale production remains limited. Key challenges include high costs (32%), logistical constraints (28%), and inconsistent feedstock quality (60%). Standardizing raw material sources and implementing certification schemes could enhance market stability. Despite moderate demand, 60% of producers anticipate significant market growth driven by sustainability trends and organic farming practices.

Fertilizer sellers report that biofertilizers account for less than 20% of overall sales, with customers primarily choosing them for soil health benefits (50%) and environmental concerns (21%). However, price volatility and limited awareness hinder broader adoption. Nitrogen-fixing biofertilizers are the most sold, with seasonal demand peaks in spring and autumn. While sellers expect moderate growth, policy incentives and increased awareness are essential for expansion.

Farmers exhibit a growing interest in biofertilizers, though only 57% are familiar with them, and none describe themselves as "extremely familiar." While conventional fertilizers continue to dominate, 52% of farmers report using biofertilizers, indicating that adoption is slowly increasing but remains a minority practice due to challenges such as high costs and inconsistent performance. Furthermore, only 28.6% of farmers produce organic fertilizers on-farm, underscoring the need for better integration of livestock waste into fertilization practices. A significant barrier to the adoption of biofertilizers is insufficient EU support, with 73.7% of farmers citing it as a major obstacle. On the fertilizer production side, a significant barrier is the lack of a network or database on agricultural and agro-processing sector residues, byproducts, co-products, and waste that could be used in fertilizer formulations. Establishing such a resource would enhance circularity and sustainability in agriculture. To foster the widespread use of biofertilizers, targeted policy support is essential, including proposed subsidy models to reduce costs, case studies of successful government programs that have encouraged adoption, and suggestions for improving EU funding mechanisms to better support research and development in this area.

Overall, while biofertilizers hold considerable promise for enhancing soil health and sustainability, their market growth is hindered by economic and technical challenges. Addressing these through research, strategic policy support, and strengthened stakeholder collaboration will be key to overcoming these barriers and encouraging broader adoption.

2. Introduction

The agricultural sector faces increasing pressure to adopt sustainable practices while addressing the challenges posed by market dynamics, environmental concerns, and evolving consumer demands. In this context, fertilizers, biofertilizers, and biostimulants play a pivotal role in shaping the future of agricultural ecosystems and their economic potential. This deliverable, provides an in-depth exploration of market trends in the biofertilizer sector,

drawing on the results from targeted questionnaires distributed to fertilizer producers, sellers, and farmers. It further maps interregional ecosystems, identifies barriers and opportunities within the sector, and offers recommendations to foster innovation and growth in sustainable agricultural practices [1].

The analysis conducted integrates the results of three surveys targeting farmers, fertilizer producers, and fertilizer sellers, providing critical insights into the dynamics of production, commercialization, and application of fertilizers. These survey findings are contextualized within broader market trends and policy frameworks outlined in official European Union documents, including the Fertilizer Market Observatories and relevant market analyses[2].

This deliverable aligns with the objectives of the Fertilizer Market Observatory, which monitors key market developments, including production costs, market prices, and trade flows, as outlined in the most recent analysis and stakeholder discussion[3]. By connecting survey results with these broader trends, the report provides a comprehensive understanding of interregional ecosystems and their potential for fostering innovation in sustainable fertilizer practices.

3. Methodology

The methodology for analyzing market trends and mapping the ecosystem related to organic fertilizers begins with an analysis of the key stakeholders (see mapping process example in Annex 6.1). This mapping allowed the identification of key players and based on evaluations of their interest and influence in the organic fertilizer sector. For the purposes of the document, the main stakeholders have been identified as farmers, fertilizer producers, and fertilizer sellers.

The survey design process involved three distinct questionnaires tailored for farmers, fertilizer producers, and fertilizer sellers. The questions were collaboratively developed by the consortium, drawing on expertise and referencing key European official documents and reports focused on fertilizers, biofertilizers, biostimulants, their production, commercialization, and applications. Examples of these documents include the European Commission's Fertilizing Products Regulation (Regulation (EU) 2019/1009)[4], the EU Circular Economy Action Plan[5], and technical guidelines on sustainable agriculture and soil health provided by the European Food Safety Authority (EFSA)[6] and the Joint Research Centre (JRC)[7]. By aligning with these authoritative sources, the surveys were designed to address relevant regulatory, market, and practical considerations in the field. Once finalized, the surveys were produced using Google Forms:

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1 https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/fertilisers_en; https://agriculture.ec.europa.eu/document/download/a32c1658-4c08-41c5-aea8-9a051951a209_en?filename=fertilisers-mo-2024-09-04-market-analysis_en.pdf; https://agriculture.ec.europa.eu/document/download/7f36a740-18e7-40d1-b247-950d458f90bb_en?filename=fertilisers-mo-2024-09-04-minutes_en.pdf

2 https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/fertilisers_en

3 https://agriculture.ec.europa.eu/document/download/a32c1658-4c08-41c5-aea8-9a051951a209_en?filename=fertilisers-mo-2024-09-04-market-analysis_en.pdf

4 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1009

5 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

6 https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2017.4982

7 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0416&qid=1706624227744

- Farmers survey: https://docs.google.com/forms/d/e/1FAIpQLSdyYDJf2rb_FDXcgvLGGJ2O-7n_Dk54yoH14bkzegMRBLSH1Q/viewform?usp=sf_link
- Producers survey: https://docs.google.com/forms/d/e/1FAIpQLSdlPJov2lstq8M6E7MaVV4BB2zP1h2q333v639mKsc8QJ5WYQ/viewform?usp=sf_link
- Sellers survey: https://docs.google.com/forms/d/e/1FAIpQLSd-ZHXGTOeN9TdJkiSZZxuvuZuhPg5LpD-Y6gyRYWIv1uVlNw/viewform?usp=sf_link

Excerpts from the surveys can be found in the Annexes 6.2, 6.3. and 6.4. Consortium members distributed the surveys through their professional networks, targeting stakeholders from the three groups to ensure diverse and representative participation. The responses were collected and analyzed to capture perspectives on biofertilizer adoption, production, and challenges. To comply with the General Data Protection Regulation (GDPR) and ensure the protection of privacy, the analysis was conducted from a European perspective without referencing personal data, company names, countries, or any other identifiers that could compromise the anonymity of respondents. This approach ensured full adherence to privacy standards while maintaining the integrity of the survey results.

4. Market trends in the biofertilizer sector: results from the surveys

This section presents three case studies that provide detailed insights into the perspectives of farmers, fertilizer producers, and fertilizer sellers regarding the adoption and commercialization of biofertilizers. Each case study is based on the responses gathered from the respective surveys, highlighting the unique challenges, opportunities, and trends within these stakeholder groups. The case studies offer a closer look at regional variations, production practices, and market dynamics, thereby enriching the understanding of how these actors engage with biofertilizers and their role in shaping sustainable agricultural practices. These case studies will help inform the development of recommendations aimed at fostering innovation and addressing the barriers identified across the sector.

4.1. Case 1 – Fertilizer producers

The survey results offered a comprehensive snapshot of the biofertilizer market as perceived by fertilizer producers. These findings (Table 1) provide critical insights into production trends, technological challenges, market drivers, and barriers to growth in the industry. The results also highlight areas for research focus, policy interventions, and collaboration opportunities to support the sustainable expansion of the biofertilizer sector.

Table 1. Results from the survey conducted for the specific target group "fertilizer producers" (25 participants).

How familiar are you with biofertilizers?	
Very familiar	40.00%
Moderately familiar	32.00%
Slightly familiar	20.00%
Not familiar	8.00%
How much fertilizer and biofertilizer do you produce annually?	
Less than 100 tons	20.00%
100 - 1000 tons	48.00%

1000 - 10,000 tons	24.00%
More than 10,000 tons	8.00%
How many types of biofertilizers do you manufacture?	
1 - 2	32.00%
3 - 5	56.00%
More than 10	12.00%
What is the average price per ton of biofertilizer produced?	
Less than 500 €	24.00%
500 - 1000€	48.00%
More than 1000 €	28.00%
How much of your biofertilizer production is exported?	
None	20.00%
Less than 10%	40.00%
10% - 30%	28.00%
More than 50%	12.00%
What is the expected growth in biofertilizer production in the next 5 years?	
Grow significantly	60.00%
Grow moderately	32.00%
No growth	8.00%
What is the biggest barrier to scaling up biofertilizer production?	
Higher production costs	32.00%
Logistical challenges	28.00%
Regulatory hurdles	24.00%
Limited market demand	12.00%
Inconsistent raw material	4.00%
Which area of biofertilizer research should receive more focus?	
Formulation and delivery systems	40.00%
Nutrient solubilization and fixation mechanisms	32.00%
Developing better formulations	20.00%
Plant-microbe interactions	8.00%
Which type of waste/by-products are used in your biofertilizer production annually?	
Compost	24.00%
Manure	20.00%
By-product from animal processing	28.00%
Green waste from gardening	4.00%
Sewage sludge	4.00%
Organic fraction of municipal solid waste	4.00%
Microorganisms	12.00%
Vegetal extracts	4.00%
By-product from sugar industry	4.00%
Natural sediments	4.00%
Fermentation products	8.00%
How would you rate the current demand for biofertilizers in the EU?	
Very Low	12%
Low	8%
Moderate	52%
High	20%
Very High	8%
Which of the following do you consider the main drivers for biofertilizer adoption in the market?	
Environmental concerns	88.00%
Soil health improvement	88.00%
Regulatory pressures	76.00%
Cost effectiveness	56.00%
Consumer demand for organic products	48.00%

Adaptation to climate change	4.00%
Support for farmers (formation, technical advice)	4.00%
Fluctuating price of conventional fertilizers	4.00%
To do more with less	4.00%
In your opinion, which crop sector shows the highest potential for biofertilizer use?	
Cereals	44.00%
Fruits and vegetables	76.00%
Oilseed crops	20.00%
Legumes	44.00%
Vine	36.00%
I don't know	4.00%
Every sector	4.00%
How do you expect the biofertilizer market to evolve in the next 5 years?	
Remain the same	4.00%
Grow moderately	52.00%
Grow significantly	44.00%
In your opinion, which is the most important technological challenge in biofertilizer production?	
Developing better formulations	32.00%
Quality control and consistency	28.00%
Improving product stability	20.00%
Scaling up production	16.00%
Enhancing nutrient release	4.00%
How familiar are you with circular bioeconomy principles in fertilizer production?	
Extremely familiar	32%
Very familiar	24%
Moderately familiar	20%
Slightly familiar	16%
Not at all familiar	8%
In your opinion, which waste streams or by-products show the most promise for biofertilizer production?	
Animal by-products	16.00%
Industrial by-products	8.00%
Meat	4.00%
Agro-industry by-products	4.00%
Beetroot by-product	4.00%
Green gardening waste	4.00%
Insect frass	4.00%
Municipal organic waste	4.00%
Food industry waste	4.00%
Bio-waste, compost, compost tea, digestate	4.00%
Waste from vegetable origin	4.00%
Is it challenging to source consistent, high-quality feedstocks for biofertilizer production?	
Yes	60.00%
No	40.00%
If "Yes," why is it challenging to source feedstocks for biofertilizer production?	
Variability in raw materials	28.00%
Costs and logistics	16.00%
Lack of adequate infrastructure	8.00%
Regulatory standards	8.00%
Competition with other uses	4.00%
Others (general feedback)	20.00%
Which policy measure would most effectively support the growth of the biofertilizer industry?	
Streamlined regulatory processes	48.00%
Increase research funding	16.00%

Tax incentives	16.00%
Facilitate end-of-waste status	4.00%
Industry-sponsored positions	4.00%
Other	12.00%
How can EU funding mechanisms better support innovation in biofertilizers?	
Allocate more resources for R&D	24.00%
Support collaborative projects	20.00%
Prioritize environmental sustainability	16.00%
Simplify funds access and reduce delays	12.00%
Provide training programs for stakeholders	8.00%
Other	20.00%
Which methods are better to improve collaboration between academia, industry, and government?	
Joint research programs	40.00%
Cross-sector working groups	28.00%
Government-facilitated networking	12.00%
Other	20.00%
Do you source any animal manure for biofertilizer production?	
Yes	48.00%
No	52.00%
If "Yes," what types of livestock manure are used in the biofertilizers you sell? (Select all that apply)	
Cattle	24.00%
Poultry	20.00%
Pigs	16.00%
Sheep	12.00%
Horses	12.00%
Goats	8.00%
How much livestock manure do you use annually for biofertilizer production?	
Less than 10 tons	16.00%
10-50 tons	8.00%
50-100 tons	4.00%
More than 100 tons	20.00%
Not applicable	52.00%
What percentage of your total biofertilizer production is based on livestock manure?	
Less than 10%	16.00%
10-30%	20.00%
30-50%	16.00%
More than 50%	12.00%
Not applicable	36.00%

Note: The total percentage values in some questions may not amount to 100% due to respondents selecting multiple options, choosing not to answer certain questions, or providing responses that do not fall into predefined categories.

This survey reveals a growing awareness of biofertilizers among fertilizer producers, with 72% familiar with these products. This reflects the broader trend toward sustainable agriculture and the circular bioeconomy. Most producers (48%) operate on a medium scale, producing between 100–1000 tons annually, while large-scale production remains rare, suggesting potential for growth in this area.

Producers typically offer 3–5 types of biofertilizers, with prices averaging between €500 and €1000 per ton. However, export levels are low, with 40% of producers exporting less than 10% of their output, indicating untapped global market potential. Barriers to scaling production include high costs (32%), logistical challenges (28%), and inconsistent feedstock quality (60%).

Regarding inconsistent feedstock quality, variability in raw materials, particularly those derived from animal by-products and fermentation processes, can impact product efficacy, nutrient composition, and regulatory compliance. This inconsistency poses technical and economic challenges, requiring additional processing, quality control, and formulation adjustments to maintain product reliability. Addressing this issue is crucial for establishing robust and sustainable value chains in the biofertilizer sector. Standardizing feedstock sources, improving preprocessing techniques, and fostering strategic collaborations between waste generators, biofertilizer producers, and policymakers could enhance supply chain stability. Additionally, implementing certification schemes and harmonized regulations across the EU would help ensure a consistent supply of high-quality raw materials, supporting the growth of a competitive and resilient biofertilizer market.

Looking forward, 60% of producers anticipate significant market growth driven by sustainability, organic farming practices, and soil health improvement. However, current demand within the EU remains moderate, suggesting the need for strategies to boost adoption. Technological challenges, particularly in formulation and quality control, are also noted, with research priorities focused on improving product performance.

Raw material use primarily involves animal by-products and fermentation products. Awareness of circular bioeconomy principles is moderate, with 56% of producers familiar with them. Collaboration between academia, industry, and government is seen as key to fostering innovation, with streamlined regulations and tax incentives identified as supportive policy measures.

4.2. Case 2 – Fertilizer sellers

Table 2 shows the results from the surveys conducted on fertilizer sellers.

Table 2. Results from the survey conducted for the specific target group "fertilizer sellers" (14 participants).

How familiar are you with biofertilizers?	
Very familiar	42.86%
Moderately familiar	28.57%
Extremely familiar	21.43%
Slightly familiar	7.14%
How much biofertilizer do you sell annually (in tons)?	
0 - 1	14.29%
1 - 10	14.29%
10 - 100	21.43%
100 - 1000	21.43%
1000 - 10000	28.57%
Not concerned (technical advisor)	7.14%
What percentage of your overall fertilizer sales is biofertilizer?	
Less than 10%	42.86%
10 - 20%	42.86%
20 - 50%	14.29%
More than 50%	7.14%
How many tones of fertilizer you sell in total (conventional and biofertilizers)?	
Less than 500	21.43%
500 - 1000	21.43%
1000 - 5000	21.43%
5000 - 10000	21.43%
More than 10000	14.29%
What type of conventional fertilizer are you using and which quantities per ha?	

N-P-K (e.g., 15-15-15, 6-10-20, 25kg P/ha, etc.)	57.14%
Organic or Organo-mineral fertilizers	14.29%
Water-soluble, foliar, or other specialized types	14.29%
Liquid Fertilizers	14.29%
How have fertilizer prices fluctuated in recent years?	
More than 10%	85.71%
5 - 10%	14.29%
In your opinion, what factors influence the price fluctuation?	
Energy-Related Factors	35.71%
Raw Materials & Supply	28.57%
Geopolitical & Market Factors	21.43%
Market Dynamics (Speculation, Demand)	14.29%
What is the average price per ton of biofertilizer sold in your shop?	
Less than 500€	50.00%
500 - 1000€	50.00%
Which types of biofertilizers do you stock (select all that apply)?	
Nitrogen-fixing biofertilizers	92.86%
Phosphorus-solubilizing biofertilizers	71.43%
Potassium-mobilizing biofertilizers	64.29%
Mycorrhizal fungi biofertilizers	35.71%
Improvement of soil quality (aeration, organic matter content, CEC)	35.71%
Do you use any biostimulants? If so, what type (s)?	
Aminoacids	14.29%
Granulated (base fertilization) & Liquid (foliar application)	14.29%
Algae-based products (e.g., Spirulina)	7.14%
Stress-related biostimulants (e.g., anti-abiotic-stress, anti-hydric/water-stress, improved vigor, insect tolerance)	35.71%
No use or no significant amounts	42.86%
On which seasons do farmers buy biofertilizers?	
Autumn	21.43%
Spring	42.86%
Summer	14.29%
Winter	21.43%
What are the most common questions or concerns customers have when purchasing biofertilizers??	
Effectiveness	57.14%
Price	35.71%
Environmental Impact	7.14%
Which of the following do your customers cite as the main reasons for choosing biofertilizers?	
Environmental concerns	21.43%
Soil health improvement	50.00%
Cost-effectiveness	14.29%
Consumer demand	7.14%
Regulatory pressures	7.14%
Which types of crops do your customers primarily use biofertilizers for?	
Fruits and vegetables	50.00%
Cereals	21.43%
Oilseed crops	14.29%
Vine cultivation	7.14%
Legumes	7.14%
How do you expect the demand for biofertilizers to change over the next 5 years?	
Increase moderately	50.00%

Increase significantly	21.43%
Stay the same	28.57%
Which product attributes are most important to your customers when choosing biofertilizers?	
Nutrient Release Efficiency	50.00%
Product Stability	21.43%
Scaling Up Production	21.43%
Quality Consistency	7.14%
What do you consider the biggest challenges to selling biofertilizers?	
Higher Costs	35.71%
Limited Product Availability	28.57%
Lack of Awareness	21.43%
Regulatory Hurdles	7.14%
Inconsistent Product	7.14%
Which policy changes would most benefit biofertilizer sales in your shop?	
Tax Incentives	78.57%
Streamlined Regulations	7.14%
Increased Research	7.14%
Mandatory Targets	7.14%
Do most customers buy fertilizers based on brand loyalty, price, or recommendations?	
Recommendations	50.00%
Price	35.71%
Loyalty	14.29%
Do you sell biofertilizers that include livestock manure in their formulation?	
Yes	85.71%
No	14.29%
If you answered 'Yes' in the previous question, what types of livestock manure are used in the biofertilizers you sell?	
Cattle	28.57%
Poultry	28.57%
Pigs	28.57%
Sheep	14.29%
Goats	14.29%
Horses	14.29%
How would you rate the current demand for biofertilizers in the EU?	
Moderate	53.85%
Low	23.08%
Very low	15.38%
High	7.69%
How do you expect the biofertilizer market to evolve in the next 5 years?	
Grow moderately	78.57%
Grow significantly	21.43%
Are there any supply chain issues or delays affecting the availability of fertilizers?	
Shipping delays	46.15%
Availability issues (Import restriction, Lack of availability)	30.77%
Material issues (Smell and instability of the material)	23.08%
What strategies are you using to attract and retain customers in a competitive market?	
Customer service, Field tests and events	46.15%
Field tests and events	30.77%
Product variety	15.38%
Marketing techniques, Product variety	7.69%
What new products or innovations in the fertilizer industry are you excited about?	

Technological Innovations: Nanoparticles, Microencapsulation of microorganisms, Precision fertilizer application technologies	30.00%
Sustainable Fertilizer Production: Local waste turned into fertilizers from agricultural products, Gradual release to improve Nitrogen Use Efficiency (NUE), Carbon impact	40.00%
Product Development: Moreira formulas, Combination of biobased products and bacteria or fungi	30.00%
What do you think the future holds for the fertilizer market in your area?	
Stable Market: Stable, Unstable, Slowly changes	40.00%
Sustainable Practices & Local Waste: Local waste turned into fertilizers from agricultural products or byproducts	20.00%
Demand Trends: Decrease in demand, low incomes, extreme weather impacts on production	20.00%
Growth: Very good, increasingly significant, evolving market	20.00%

Note: The total percentage values in some questions may not amount to 100% due to respondents selecting multiple options, choosing not to answer certain questions, or providing responses that do not fall into predefined categories.

The survey results offer valuable insights into the fertilizer and biofertilizer market. A significant majority of sellers (85.71%) reported fertilizer price fluctuations exceeding 10% in recent years, with energy-related factors being the primary concern. This highlights the vulnerability of the fertilizer market to external factors.

While most fertilizer sellers are familiar with biofertilizers, their sales volumes remain modest, with biofertilizers accounting for less than 20% of overall sales for many. Despite this, customers primarily choose biofertilizers for soil health improvement (50.00%), followed by environmental concerns (21.43%). This indicates a growing interest in these products, particularly due to their environmental benefits and ability to improve soil health. However, the higher cost of biofertilizers and concerns about their effectiveness continue to limit widespread adoption.

Nitrogen-fixing biofertilizers are the most sold, followed by phosphorus-solubilizing and potassium-mobilizing types. Seasonal demand peaks in spring and autumn, aligning with planting cycles. A significant portion of respondents cited price, product availability, and lack of awareness as key barriers to greater sales.

Looking ahead, sellers expect moderate growth in demand for biofertilizers, though challenges like high costs and limited product availability remain. However, growing interest in sustainable practices and potential policy support, such as tax incentives, could drive further market expansion. Ultimately, while biofertilizers are still a smaller segment in the fertilizer market, they show promise for future growth, provided these challenges are addressed.

A key takeaway from this survey is that while there is growing interest in biofertilizers, concerns about effectiveness and high costs remain major barriers to widespread adoption. Farmers are generally open to innovative solutions, but they need tangible proof of efficacy under real-world conditions before committing to these products. Providing on-farm field trials and personalized customer support services could significantly enhance confidence in

biofertilizers. By allowing farmers to test these products on their own land, under their specific soil and climatic conditions, producers can demonstrate measurable benefits, such as improved soil health and crop performance. Additionally, offering technical guidance, tailored recommendations, and post-purchase support would strengthen customer trust and long-term engagement. Establishing partnerships with agronomists, extension services, and cooperatives could further facilitate knowledge transfer and best practices for biofertilizer application. These customer-oriented strategies would not only help attract new users but also ensure their continued adoption, ultimately driving market growth and reinforcing biofertilizers as a viable alternative to conventional fertilizers.

4.3. Case 3 – Farmers

Table *3* shows the results from the surveys conducted on farmers.

Table 3. Results from the survey conducted for the specific target group "farmers" (21 participants).

How familiar are you with biofertilizers?	
Very familiar	57.14%
Moderately familiar	28.57%
Slightly familiar	14.29%
Extremely familiar	0.00%
What is the total area of your farmland (in ha)?	
0 – 10 ha	28.57%
11 – 50 ha	9.52%
51 – 100 ha	9.52%
101 – 500 ha	33.33%
501 – 1000 ha	14.29%
1001 – 1500 ha	4.76%
Which type of crops do you grow?	
Fruits	23.81%
Cereals	28.57%
Vegetables	14.29%
Olive	4.76%
Grape	9.52%
Cotton	4.76%
Pulses	9.52%
Horticulture	9.52%
Oilseeds	4.76%
Seed Production	4.76%
Ornamental / Above Ground Production	4.76%
Please detail the size of the cultivation (in ha).	
0.2 ha	9.52%
2–3 ha	14.29%
6 ha	9.52%
15–30 ha	19.05%
40–80 ha	28.57%
100–300 ha	19.05%
600–1000 ha	9.52%
What type of conventional fertilizer are you using?	
NPK Fertilizers	52.38%
Special and Patent Fertilizers	28.57%
Organic Fertilizers	9.52%
Nitrogen Fixing Biofertilizers	4.76%
Other Fertilizers (unspecified)	4.76%

How much biofertilizer (including soil conditioners) do you use per year on your farm (in kg/ha)?	
0 kg/ha	28.57%
10 - 50 kg/ha	52.38%
51 - 100 kg/ha	4.76%
101 - 200 kg/ha	9.52%
201 - 500 kg/ha	4.76%
501 - 1000 kg/ha	4.76%
What is your main source of conventional fertilizers ?	
Local supplier	95.24%
Produced on farm	4.76%
On average, how much does conventional fertilizer cost you annually per ha?	
Less than 50€	28.57%
50 - 80€	38.10%
80 - 120€	14.29%
More than 120€	19.05%
What is your main source of biofertilizers?	
Local supplier	81.00%
Produced on farm	14.30%
Imported	4.80%
Do you use any biostimulants?	
No	57.10%
Not yet, but searching	4.80%
Yes, ROOTS Biostimulant	4.80%
Humic and soil acids, amino acids, seaweed extracts	9.50%
Rarely (vegetable cultures)	9.50%
Kelp and other (liquids)	4.80%
Yes, Basfolaire kelp	4.80%
Humic acids (5L/ha)	4.80%
On average, how much do biostimulants cost you annually per ha?	
Less than 20€	42.90%
20 - 50€	28.60%
50 - 80€	14.30%
More than 80€	14.30%
On average, how much do biofertilizers cost you annually per ha?	
Less than 50€	42.90%
50 - 80€	42.90%
More than 120€	14.30%
Do you produce any of the organic fertilizers (like compost) on your farm?	
Yes	28.60%
No	71.40%
If you answered "Yes" to the previous questions, please indicate the type of organic fertilizer.	
Manure	50.00%
Compost	25.00%
Manure and compost	25.00%
What is the expected increase in yield (in percentage) when using biofertilizers?	
No increase	25.00%
1 - 10% increase	68.75%
10 - 20% increase	18.75%
Which of the following do you consider the main drivers for biofertilizer adoption in European agriculture?	
Environmental concerns	28.57%
Consumer demand for organic products	21.43%
Regulatory pressures	14.29%
Soil health improvement	28.57%

Cost-effectiveness	7.14%
Which crop sector shows the highest potential for biofertilizer use on your farm?	
Fruits and vegetables	57.14%
Cereals	14.29%
Horticulture	14.29%
Oilseed crops	7.14%
Pistachio	7.14%
Why did you choose to use biofertilizer?	
To improve soil health, microbial activity, and nutrient availability	42.86%
To restore soil condition	14.29%
Better root development	14.29%
Economic reasons	7.14%
To improve microbiota	7.14%
Environmental reasons	7.14%
Better food quality	7.14%
To increase microorganisms, plant-available nutrients, and organic matter	7.14%
For organic production (AB)	7.14%
Which area of biofertilizer research and development would most benefit your farm?	
Nutrient solubilization and fixation mechanisms	28.57%
Formulation and delivery systems	42.86%
Microbial strains selection and improvement	14.29%
Plant-microbe interactions	14.29%
Which are, in your opinion, the obstacles to wider biofertilizer adoption in EU agriculture?	
Lack of farmer awareness and education	41.38%
Higher costs compared to conventional fertilizers	34.48%
Inconsistent product performance	10.34%
Regulatory hurdles	6.90%
Limited product availability	6.90%
How familiar are you with circular bioeconomy principles in fertilizer production?	
Very familiar	39.13%
Moderately familiar	26.09%
Extremely familiar	21.74%
Slightly familiar	8.70%
Not at all familiar	4.35%
How do you stay updated on the latest innovations in organic farming and fertilizers?	
Agronomist, Research	43.48%
Retail shop, Institutional channels	30.43%
Farmer's association, Other farmers	21.74%
Technician of the collective compost plant	4.35%
How do you rate the support from EU to fertilizer products?	
Little support	73.68%
Sufficient	21.05%
No support	5.26%
Where do you go if you have any problem about plant nutrient deficiencies?	
Agronomists/Experts	51.85%
Cooperative/Associations	22.22%
Suppliers and Retail	22.22%
Other	3.70%
Do you have livestock?	
Yes	26.32%
No	73.68%
How much manure do you produce from your livestock annually?	

10 - 50 tons	60.00%
Less than 10 tons	20.00%
More than 100 tons	20.00%
Do you currently use livestock manure as a biofertilizer or as part of your organic fertilization process?	
Yes	60.00%
No	40.00%
If you answered "Yes" to the previous question, what percentage of your fertilization comes from livestock manure?	
More than 50%	60.00%
Less than 10%	40.00%

Note: The total percentage values in some questions may not amount to 100% due to respondents selecting multiple options, choosing not to answer certain questions, or providing responses that do not fall into predefined categories.

While 57.14% of farmers are familiar with biofertilizers, none describe themselves as "extremely familiar," highlighting a general awareness but also a knowledge gap that may limit adoption.

Farm size distribution shows a mix of smallholders and larger agribusinesses, with a wide variety of crops represented. Conventional fertilizers dominate (52.38% using NPK), while biofertilizers are used by 52.38% of respondents, often at rates of 10–50 kg/ha annually. However, 28.57% reported no use of biofertilizers, pointing to barriers like access, awareness, or confidence. Cost is a key factor, with most farmers spending under €80/ha annually on fertilizers, though reliance on external suppliers for biofertilizers (81.0%) reflects limited on-farm production.

Biostimulants remain underutilized, with 57.1% of farmers not using them. Those who do favor products like humic acids and seaweed extracts, but spending remains low, typically under €50/ha annually. Expectations for biofertilizers vary; while many anticipate modest yield increases (1–10%), 25% report no improvement, likely reflecting mixed results or product mismatches. Farmers value biofertilizers for soil health and environmental benefits but cite high costs and inconsistent performance as major barriers.

Circular bioeconomy awareness is moderate, but 73.68% of farmers feel EU support for fertilizers is insufficient, highlighting the need for stronger policies. Agronomists and experts are key advisors, showing the importance of technical support in nutrient management.

Manure and compost use remain limited, with only 28.6% of farmers producing organic fertilizers on-farm. For those who do, manure often constitutes over 50% of fertilization inputs, signaling potential for expanding livestock waste integration.

Overall, while interest in biofertilizers is growing, challenges like costs, awareness, and product performance hinder broader adoption. Targeted interventions in education, policy support, and product development are essential to realize their potential in sustainable agriculture.

5. Conclusions

A comparative analysis of the responses gathered from fertilizer producers, sellers, and farmers reveals distinct perspectives, challenges, and opportunities, providing valuable insights into the factors influencing biofertilizer adoption and use in agriculture. Table 4 summarizes the key findings and highlights the interplay between stakeholders, emphasizing the need for alignment to accelerate biofertilizer adoption.

Table 4. Comparison of key insights from fertilizer producers, sellers, and farmers.

Aspect	Fertilizer Producers	Fertilizer Sellers	Farmers
Focus Areas	Innovation in microbial strains, formulation, and delivery systems	High-value crops (fruits, vegetables), meeting market demand	Cost, yield reliability, ease of use
Main Challenges	Complex regulations, high R&D costs, farmer education gaps	Inconsistent supply chains, fluctuating demand, farmer skepticism	High costs of biofertilizers, lack of awareness, concerns over yield performance
Opportunities	Growing consumer demand for sustainable farming products	Increasing interest in biofertilizers, especially for organic farming	Soil health improvement, potential for organic certification, environmental benefits
Barriers to Adoption	Price sensitivity, regulatory complexity	Limited availability, logistical issues, lack of farmer trust	Affordability, insufficient knowledge, preference for conventional fertilizers
Priorities for Growth	Addressing regulatory barriers, demonstrating effectiveness, scaling production	Building trust through education, ensuring consistent supply and quality	On-farm trials, subsidies, clear benefits in yield and soil health
Role of Policymakers	Simplify regulations, fund innovation, incentivize sustainable practices	Support supply chain development, regulate product quality	Provide subsidies, create awareness campaigns, facilitate access to biofertilizers
Residues and waste availability	Lack of mapping and information about potential residues to be used for bio-fertilizer inputs	-	Lack of framework to incentivize residues management

Comparing the three surveys, a disconnect emerges between the producers' focus on innovation, the sellers' emphasis on market logistics, and the farmers' practical concerns. Producers and sellers are optimistic about the potential of biofertilizers, but farmers prioritize immediate economic viability and reliable performance. Additionally, while producers and sellers emphasize environmental and regulatory drivers, farmers often view biofertilizers through a lens of risk versus reward, favoring familiar practices unless strong incentives or evidence of benefits are presented. To bridge these gaps, collaboration among stakeholders is essential (Figure 1).

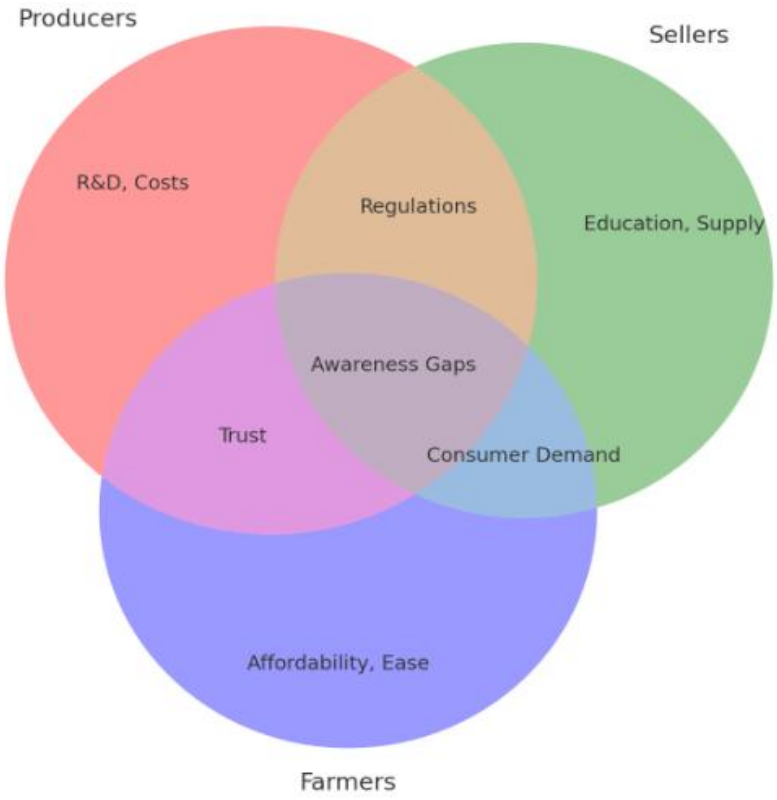
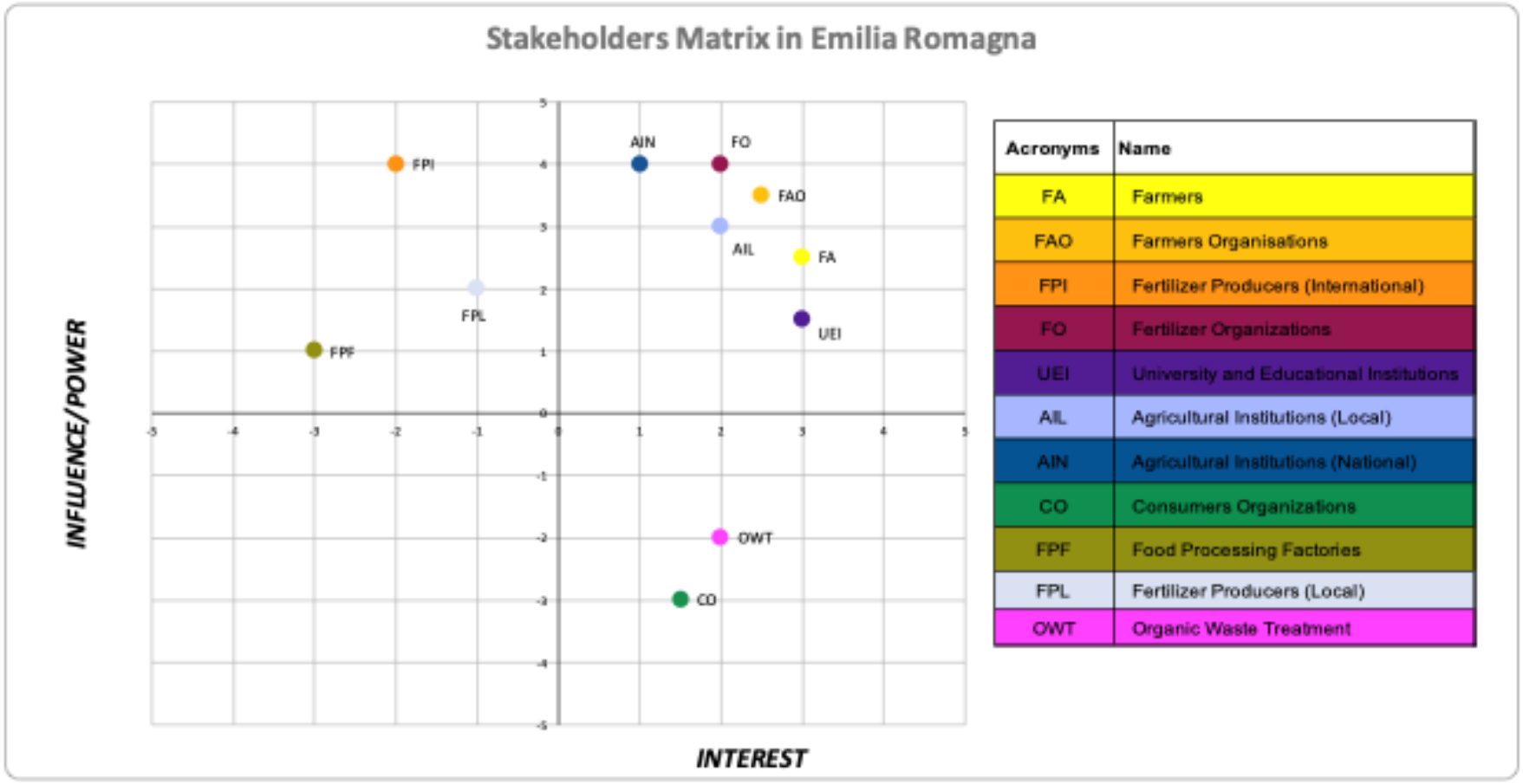


Figure 1. Overlapping roles and challenges for the stakeholders targeted in the 3 surveys conducted.

Producers and sellers must work together to improve product accessibility and affordability, while targeted education and demonstration projects can address farmers' concerns and increase trust in biofertilizer performance. Policies supporting subsidies, technical assistance, and streamlined regulations could further accelerate adoption, aligning the goals of all stakeholders and paving the way for a more sustainable agricultural future.

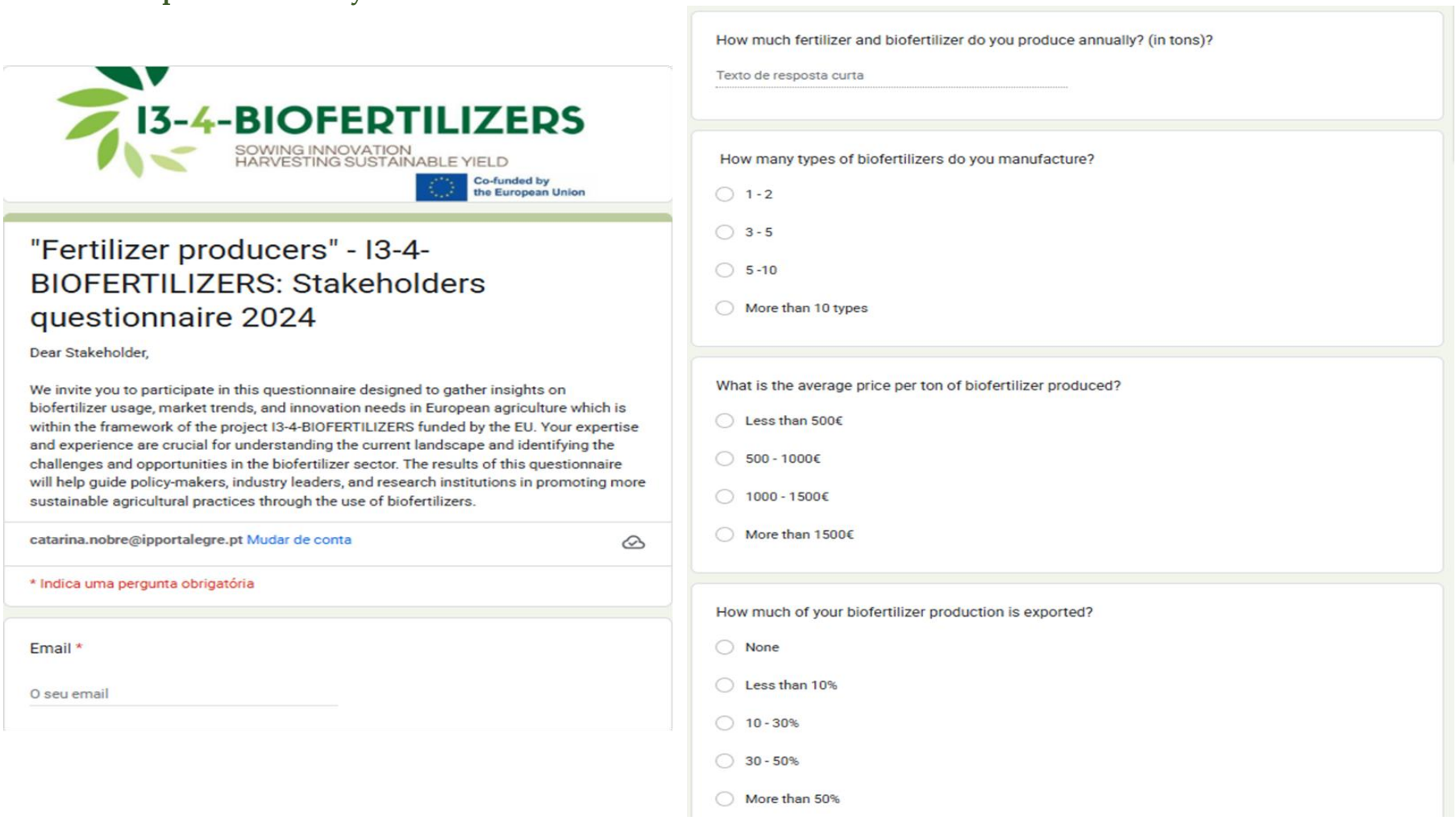
6. Annex

6.1. Stakeholder mapping



Acronyms	Name
FA	Farmers
FAO	Farmers Organisations
FPI	Fertilizer Producers (International)
FO	Fertilizer Organizations
UEI	University and Educational Institutions
AIL	Agricultural Institutions (Local)
AIN	Agricultural Institutions (National)
CO	Consumers Organizations
FPF	Food Processing Factories
FPL	Fertilizer Producers (Local)
OWT	Organic Waste Treatment

6.2. Fertilizer producers survey



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SOWING INNOVATION
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"Fertilizer producers" - I3-4-BIOFERTILIZERS: Stakeholders questionnaire 2024

Dear Stakeholder,

We invite you to participate in this questionnaire designed to gather insights on biofertilizer usage, market trends, and innovation needs in European agriculture which is within the framework of the project I3-4-BIOFERTILIZERS funded by the EU. Your expertise and experience are crucial for understanding the current landscape and identifying the challenges and opportunities in the biofertilizer sector. The results of this questionnaire will help guide policy-makers, industry leaders, and research institutions in promoting more sustainable agricultural practices through the use of biofertilizers.

catarina.nobre@ipportalegre.pt Mudar de conta

* Indica uma pergunta obrigatória

Email *

O seu email

How much fertilizer and biofertilizer do you produce annually? (in tons)?

Texto de resposta curta

How many types of biofertilizers do you manufacture?

- 1 - 2
- 3 - 5
- 5 -10
- More than 10 types

What is the average price per ton of biofertilizer produced?

- Less than 500€
- 500 - 1000€
- 1000 - 1500€
- More than 1500€

How much of your biofertilizer production is exported?

- None
- Less than 10%
- 10 - 30%
- 30 - 50%
- More than 50%

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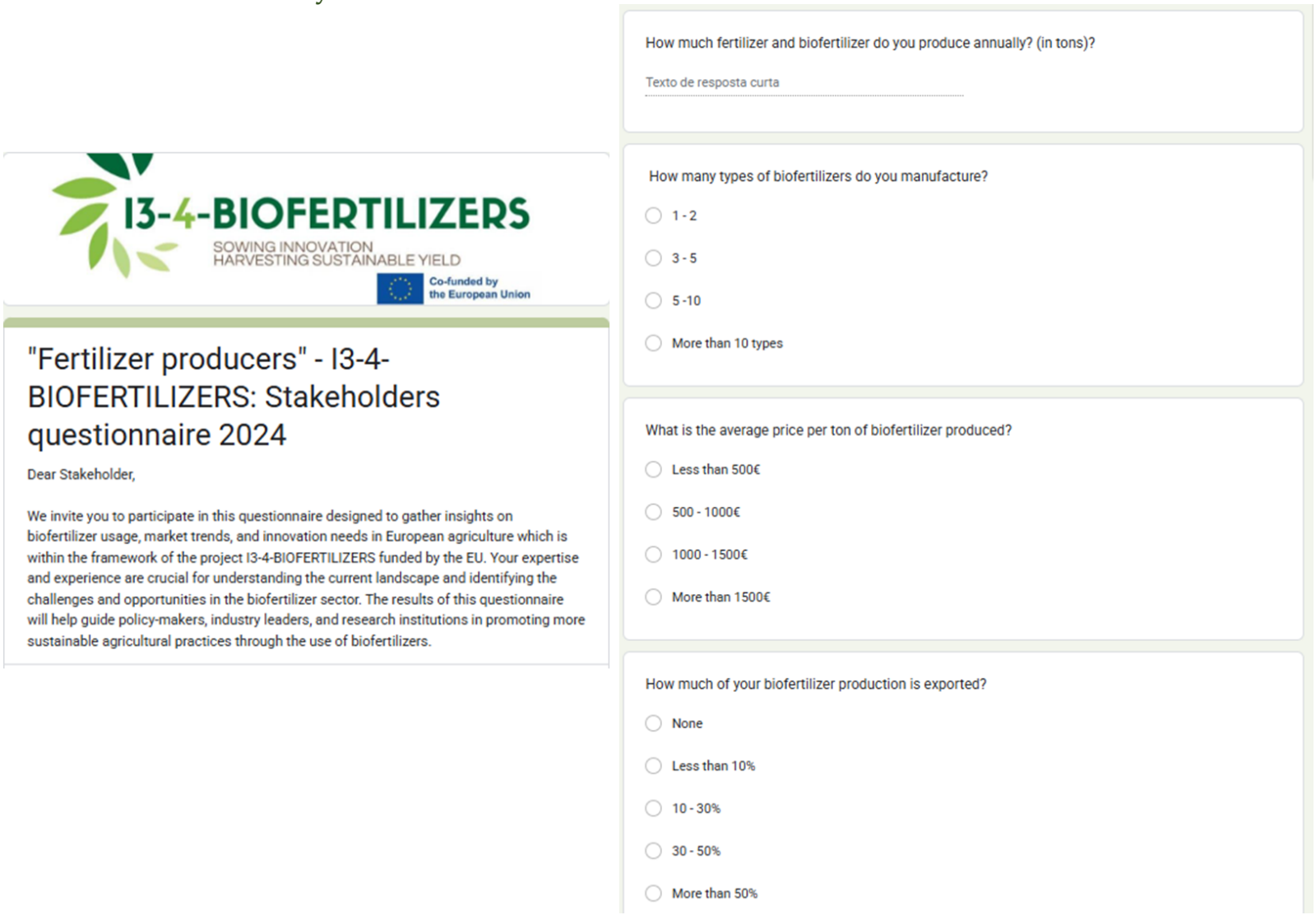
6.3. Fertilizer sellers survey



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- 10 - 30%
- 30 - 50%
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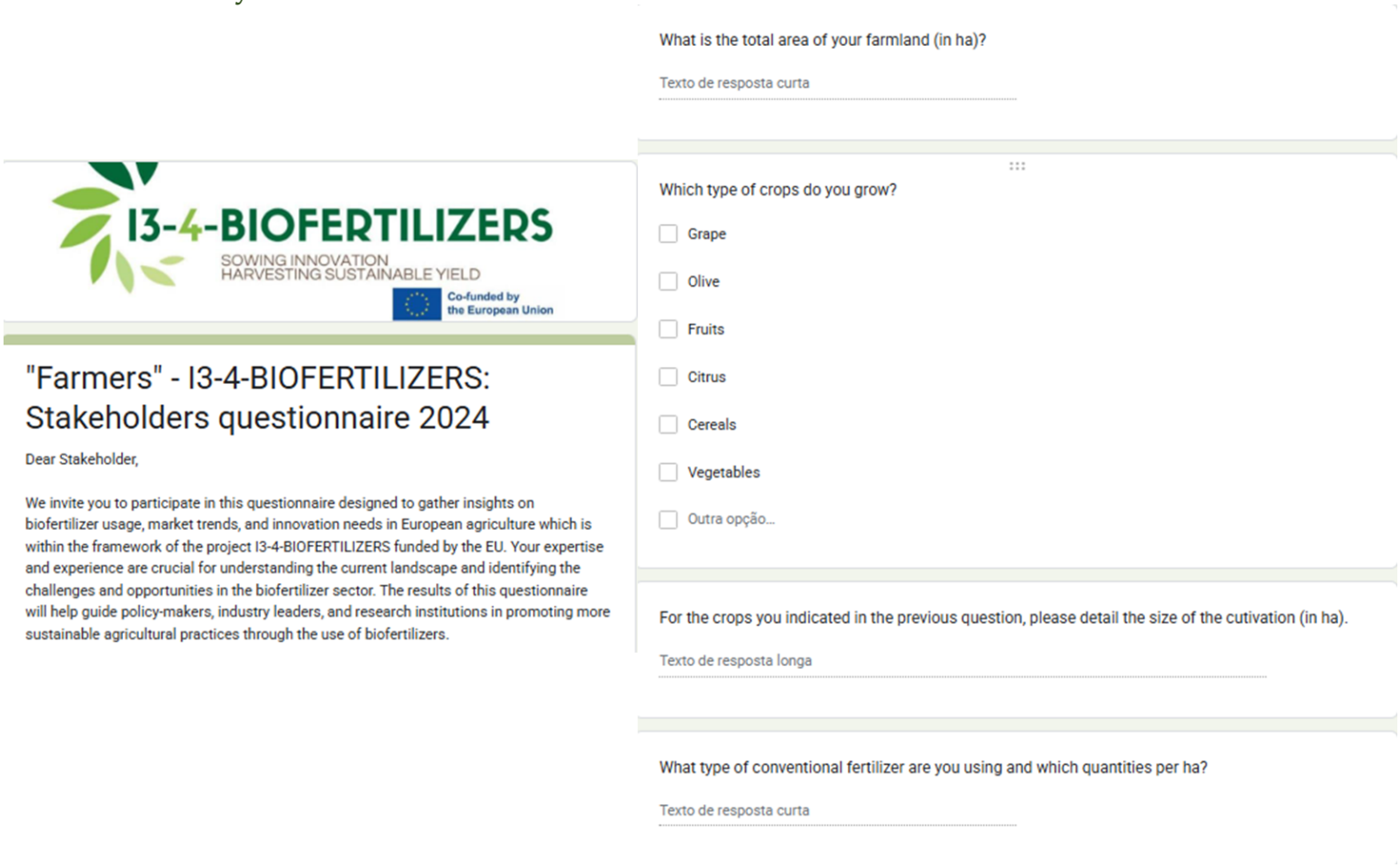
6.4. Farmers survey



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What is the total area of your farmland (in ha)?

Texto de resposta curta

Which type of crops do you grow?

- [ ] Grape
- [ ] Olive
- [ ] Fruits
- [ ] Citrus
- [ ] Cereals
- [ ] Vegetables
- [ ] Outra opção...

For the crops you indicated in the previous question, please detail the size of the cutivation (in ha).

Texto de resposta longa

What type of conventional fertilizer are you using and which quantities per ha?

Texto de resposta curta