

Evidence synthesis

Robert Malek, Kris Wyckhuys, Neal Haddaway, Dirk Babendreier, Melanie Bateman, Lukas Wyrwal, Qingpo Yang, Sini Savilaakso, Gu Baogen, Ulrich Kuhlmann

Melanie Bateman, May 2025



Collaborative work

Problem statement

Despite growing global interest, biopesticide use remains limited compared to synthetic pesticides

Approach: Evidence Synthesis

CABI and FAO's Pest and Pesticide Management Team joined hands to uncover the challenges underlying the limited use of biopesticides









Presentation outline

- Project overview
- Types of biopesticides
- Scope and the Biopesticide Production and Uptake Pipeline
- Data extraction and screening
- Preliminary results
- Take home messages
- Next steps





Project overview

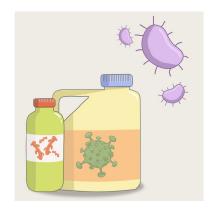
Research questions:

- What research exists on barriers and facilitators to biopesticide uptake?
- What are the **barriers** and **facilitators** to biopesticide uptake and where do they occur along the stages of the uptake pipeline?
- How do they vary by biopesticide type (e.g. microbial, macrobial), literature type and geography?



Types of biopesticides

Biopesticides in this study are defined as: A pesticide containing active substances made from living or dead microorganisms such as bacteria, algae, protozoa, viruses and fungi, pheromones and other semiochemicals, and plants or parts of plants, designed to repel, destroy or control any pest or regulate the growth of plants (<u>Codex Alimentarius</u>, 2022)



Microbials and their extracts



Macrobials (augmentative biocontrol)



Semiochemicals



Botanicals and other natural substances



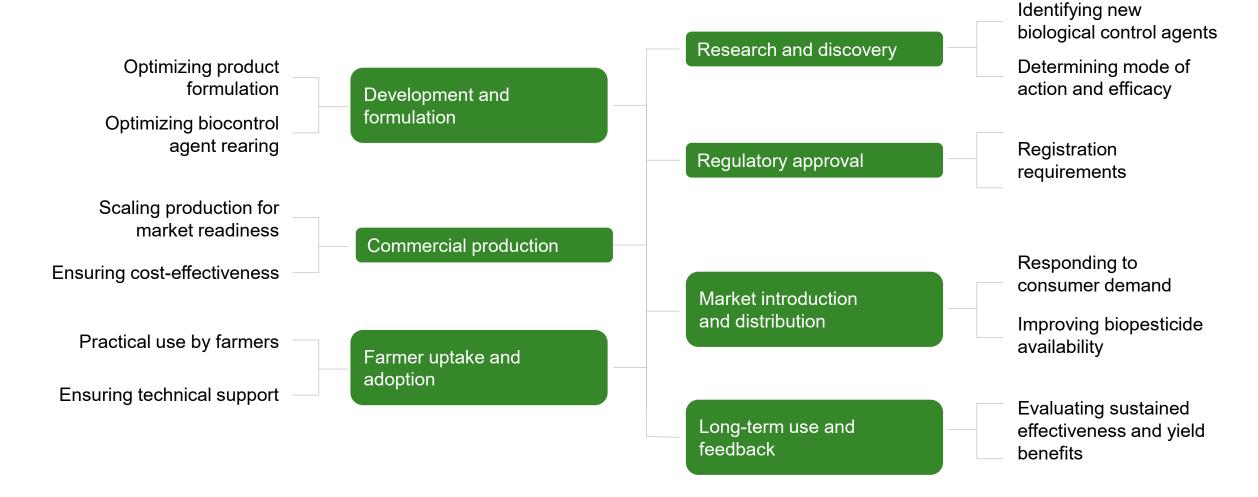


Scope of the study

- Geographical scope: Global
- **Timeframe:** 2016 present; in line with the publication of the FAO guidelines for the registration of microbial, botanical and semiochemical pest control agents (FAO and WHO 2017)
- Population: Biopesticides
- Intervention: the 7 stages of biopesticide production and uptake pipeline
- Phenomenon: Contextual barriers and facilitators across stages
- Literature type: Academic and grey literature



Biopesticide production and uptake pipeline

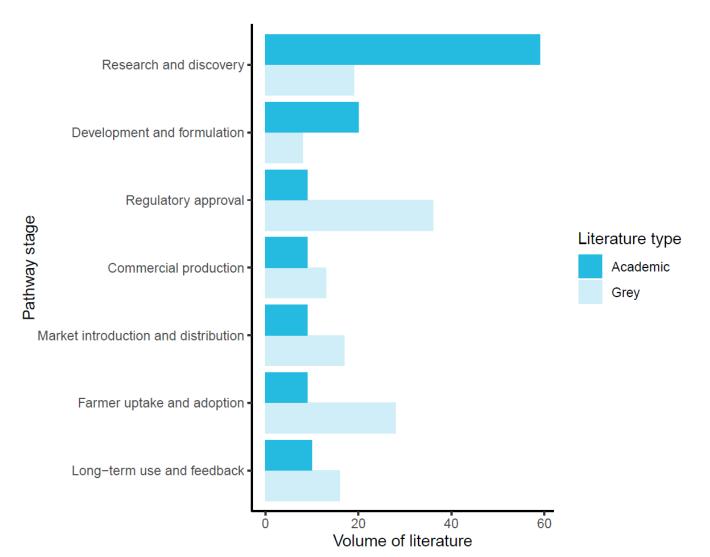


Data extraction and screening

Define **search string** (biopesticides, barriers, facilitators, timelime etc.) Identify academic records through database searching (eg CAB Total number = 19,806 Abstracts, Scopus, Web of Science) Searching Identify grey literature reports through database searching (eg Total number = 922 FAO, CABI, IBMA, UNEP, ICGEB, OECD, APAARI, STDF) Remove duplicates Abstract **consistency** checking (n= 250) Abstract labels for barriers and **Abstract** Random **subsampling and screening** of abstracts (n= 1,390) facilitators formed the Screening basis for full text 343 relevant abstracts labeled by stage, biopesticide type, analysis geography and barriers and facilitators Labelled academic full texts (n= 75) Labelled **grey literature** reports (n= 55) Synthesis Analysis and results Grouping of **labels** into distinct **themes** (n= 55)



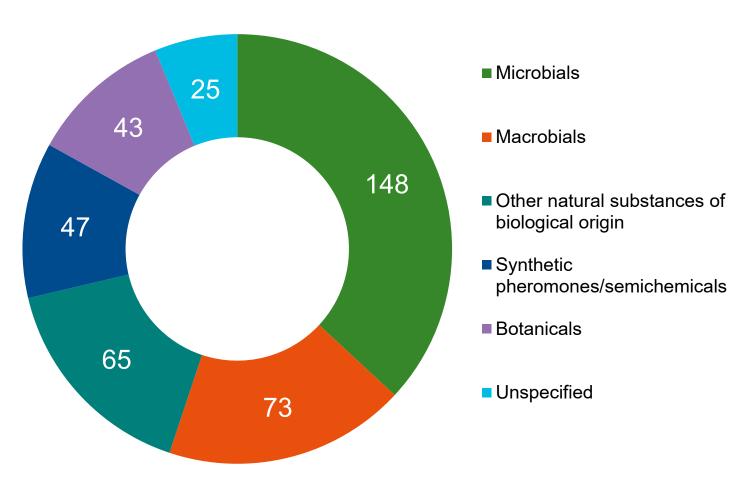
Research distribution by stage and literature type



- Vast majority of academic literature focuses on the early stages of development
- Grey literature gives more attention to regulatory approval and farmer uptake
- The transitional commercial production and market introduction stages have limited literature, likely due to private sector domination
- Overall research skewed to the early stages, highlighting a need for more systematic and interdisciplinary work, addressing regulatory, commercial and long-term dimensions of biopesticide uptake



Variation of research (grey + academic) by biopesticide type



- Microbial (148) biopesticides are the most researched, possibly due to their commercial relevance, diversity, and regulatory precedence
- Moderate attention to macrobials
 (73) and semiochemicals (47),
 possibly due to macrobial use being largely restricted to greenhouse systems and semiochemicals to specific crop-pest combinations
- Studies on botanicals may be published in regional journals and in local language, reducing their visibility in global systematic reviews

Barriers and facilitators by stage

Biopesticide production and uptake pipeline





Barrier

- Ease of field application
- Scalability
- Scalability and cost effectiveness
- Scaling production and manufacturing
- High efficacy and cost effectiveness
- Lack of technical support and incentives for adoption

Development and formulation

Commercial production

Farmer uptake and adoption

Research and discovery

Regulatory approval

Market introduction and distribution

Long-term use and feedback

High efficacy

Limited efficacy

Complex and costly registration process

Safe for humans and the environment

Improved end-user training

Lack of availability

Low shelf-life and stability

Sustained efficacy and yield benefits



Initial take home messages

- Large discrepancies by literature type:
 - Academic literature more geared towards research and discovery
 - Grey literature focuses on regulatory compliance and farmer uptake
 - Overall literature is skewed to the early stages of development, highlighting the need for more interdisciplinary work
- Global trends dominate the literature, suggesting largely common biopesticide barriers and facilitators across geographies
- Strong focus on **microbial** biopesticides across the literature suggests an advanced commercial relevance
- Efficacy, safety, scalability, end-user training and policies and institutions are some of the most common limiting factors to biopesticide production and uptake





Next steps and outputs

CABI-FAO next steps and Outputs:

- Conclude screening and data analysis
- Scientific paper
- Evidence-based policy brief published by FAO to provide recommendations that help countries:
 - Overcome the identified barriers and
 - Implement facilitators to biopesticide production and uptake





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