APAARI
Asia-Pacific Association of Agricultural Research Institutions

ABCOP
ASIA-PACIFIC BIOPESTICIDES COMMUNITY OF PRACTICE

ABCoP 2024
The Rewind

"For the promotion of biopesticides and enhancement of trade opportunities"

Prepared By

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Introduction

APAARI launched the Asia-Pacific Biopesticide Community of Practice (ABCoP) in May 2024, with the support of FAO, STDF, government agencies, private sector and international organizations such as AARINENA and FARA, to bring together stakeholders from the biopesticide sector, including industry leaders, researchers, policymakers, national representatives and other key actors.

International trade regulations often require compliance with Maximum Residue Limits (MRLs). Biopesticides, with their low or negligible chemical residues, help farmers meet these requirements, access global markets, and ensure food security.

BIOPESTICIDES

"Biopesticides are naturally occurring substances (biochemical pesticides), microorganisms (microbial pesticides), or plant-incorporated protectants (PIPs) that control pests by non-toxic mechanisms and are typically target-specific[1] (U.S. EPA, 2024).

ABCoP built on the success of the STDF project (2020–2023), titled 'Asia Pesticide Residue Mitigation Through the Promotion of Biopesticides and Enhancement of Trade Opportunities,' as part of the project's sustainability plan. This project was implemented by APAARI in collaboration with AgAligned Global, USA. The project successfully developed best practices for biopesticide use, strengthened capacities in MRL data generation, and enhanced biopesticide production and regulatory harmonization. Hence, a policy brief was developed to provide guidance and insights on the use of biopesticides to facilitate safe trade.

APAARI continued its engagement with national decision-makers, focusing on residue mitigation and the promotion of biopesticides in order to ensure the sustainability of the project outcomes.

[1] U.S. EPA, "Biopesticides," 2024, https://www.epa.gov/pesticides/biopesticides.

Objectives of the ABCoP

The ABCoP aim to:

- **Sustain regional and international collaboration** in improving biopesticide adoption, usage, and facilitating safe trade in the Asia-Pacific region,

- **Provide a platform for engaging with diverse perspectives and fostering knowledge exchange.**

About The Platform

The ABCoP platform facilitated monthly meetings that were open to all stakeholders, providing opportunities to engage with experts, exchange knowledge, and stay updated on global advancements in biopesticides.

These sessions covered a wide range of topics, incorporating insights from country-specific, regional specific, and subject-specific perspectives, ensuring a comprehensive approach to advancing the biopesticide sector.

Over 300 participants from various countries registered (Picture 1), with some taking part in the live program, while many others watched the program on YouTube. All the resources (Presentations, Abstracts), from all sessions can be viewed here: ABCoP

Picture 1. Geographical Distribution of Registered Members

Highlights from the opening remarks and Q&A

Prof. Lindsay Falvey
Commissioner for International Agricultural Research, Representing the Australian Centre for International Agricultural Research (ACIAR), and the Chair of APAARI
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The program is particularly interesting from two perspectives. Firstly, regarding biopesticides and how we can utilize them to reduce the environmental and human health impacts of some chemical pesticides. Secondly, I see this community of practice as a step forward for the region in collaborating to establish a robust regulatory system.

This program can be implemented with farmers to enhance trade access within the region and for other exports. This cooperative approach signals the future, where countries work together to learn from one another and contribute their specific expertise.

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Establishing maximum residue levels (MRLs) for pesticides in food is essential to ensure food safety and address trade concerns effectively. Biopesticides present a promising opportunity for achieving safe trade, environmental protection, and support for small-scale farmers, offering a potential win-win solution. This underscores the need for greater promotion and adoption of biopesticides at the national level.

Capacity building in the production, application, and registration processes of biopesticides is equally crucial to enhance their accessibility and usability at the community level. Strengthening these areas will ensure biopesticides become a viable and sustainable alternative for integrated pest management systems.

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In recent years, there has been a growing interest in biopesticides, emphasizing numerous opportunities and notable successes in this field. While research efforts have demonstrated significant achievements, they also highlight persistent challenges in pest control. For instance, Pennsylvania faced an invasion of the Spotted Lanternfly, an Asian pest. Laboratory trials with biopesticides achieved a 50% reduction in the pest population with a single application. However, this method proved ineffective in larger field trials, illustrating the complexities of translating laboratory success into real-world applications. Challenges in the field extend to regulatory obstacles, maintaining quality control in biopesticides, and selecting appropriate target pests.

Emerging technologies are addressing some of these challenges. For example, extensive research and development have been conducted on RNA interference (RNAi) pesticides. These pesticides are typically degrade more quickly in the environment, making them less persistent. This shorter persistence reduces long-term exposure risks, which is one reason why they face less stringent regulatory scrutiny in many jurisdictions.

Dr. Subrata Kumar Das, Additional Deputy Director (Pesticide Quality Control), Plant Protection Wing, Department of Agricultural Extension, Bangladesh

Multinational companies are making significant strides in biopesticide development in North America and Europe. However, these companies do not conduct business with biopesticides in Bangladesh or South Asia. What could be the reason for this ?

Dr. Minshad A. Ansari, CEO & Founder, Bionema Group, United Kingdom.

It's primarily a business decision. I visited Bangladesh last year for a meeting with government representatives. During the discussion, the board concluded that while Bangladesh shows potential as a market, it is not yet mature enough for biopesticides to gain traction. We also explored the idea of organizing a training program or a roundtable discussion in Bangladesh to address these challenges. Let me give an example: If I sell biopesticides for a hectare of land in the UK, let's assume I earn a thousand pounds. To earn the same amount in Bangladesh, I would need to cover significantly more hectares.

This disparity highlights the business reality. While some might argue that Bangladesh has a large market, there is still substantial groundwork needed to develop it. As a result, multinational companies often prioritize high-value regions, high-value crops, and advanced technologies.

 Anonymous

What are the limitations challenging greater adoption of biopesticides in Africa region ?

 Dr. Dennis Ndolo, Group Leader - Biopesticides, International Centre for Genetic Engineering and Biotechnology (ICGEB), South Africa.

One of the main challenges hindering the adoption and registration of biopesticides in Africa is the regulatory system. In many African countries, pesticide regulations are the same as those applied to chemical pesticides, despite the need for different requirements and information. This approach has proven ineffective for biopesticides. The primary focus in Africa has been to develop regulatory frameworks based on international standards while tailoring them specifically to biopesticides. However, achieving this alignment has been a significant challenge for the region.

Another key issue is the efficacy of biopesticides. Unlike chemical pesticides, which provide quick results and are easily accepted by growers, certain biopesticides do not deliver immediate effects. For instance, viral biopesticides are susceptible to UV radiation, necessitating application early in the morning or late in the evening—practices that differ from conventional methods. To address this, research projects have been initiated to develop products that minimize the degradation of virus-based pesticides by UV radiation. Improving the efficacy of biopesticides through targeted interventions is essential for their success. When establishing guidelines for Southern Africa, we included provisions for the efficacy testing of biopesticides in IPM systems, particularly for performance criteria related to pest control.

Key Insights from Discussion Topics

Linking academia, industry, and policymakers for advancing entomopathogenic nematodes technology in commercial applications: success story from India.

Dr. Nagesh Mandadi, Principal Scientist & Former Acting Director, ICAR-National Bureau of Agricultural Insect Resources, India
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The successful development and commercialization of Entomopathogenic Nematode (EPN) technology in India highlights its potential as a sustainable biopesticide. Supported by the National Bureau of Agricultural Insect Resources (NBAIR), the innovation has been licensed to multiple companies, contributing to the adoption of biopesticides across the country.

- **Scalable Production**: Achieved a production capacity of 10-12 tons per month.
- **Market Expansion:** Extended presence to 22 states across India.
- I**nnovation in Formulation**: Introduced a patented wettable powder (WP) formulation with a shelf life of 10-12 months.

Enhancing trade through regulatory harmonization and biopesticides-based residue mitigation in the SADC region.

Dr. Dennis Ndolo, Group Leader - Biopesticides, International Centre for Genetic Engineering and Biotechnology (ICGEB), South Africa.
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> The challenges faced by many African countries regarding pesticide residues, particularly those resulting from late-season applications that exceed Maximum Residue Limits (MRLs), were effectively addressed by replacing synthetic pesticides with biopesticides.

This innovative approach allowed early-season residues to degrade naturally. As a result, the overall residue levels at harvest were significantly reduced, improving the quality of agricultural exports and enhancing access to international markets.

The project also worked on harmonizing regulations for biopesticides in the Southern African Development Community (SADC) region, making the registration process easier and promoting sustainable pest management tools. By identifying residue issues and recommending appropriate biopesticides, the project aligned agricultural practices with international standards.

Additionally, farmer education on biopesticides was a key part of the project, raising awareness and empowering more informed pest management decisions. The importance of developing soft skills such as strategic thinking, leadership, and teamwork within the project team was also emphasized.

Fostering in-country partnerships in Asia to enhance adoption of bio-protection solutions

The CABI BioProtection Portal

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The CABI BioProtection Portal is a free online resource designed to promote the adoption of bioprotection products by addressing information gaps faced by growers and advisory service providers.

Its key features current achievements include:

- Search functionality for registered bioprotection products by country, pest, and crop.
- Detailed information on biocontrol agents, product types, usage guidelines, and pest/crop guides.
- Integration with state agricultural platforms in India, providing access to 970 registered bioprotection products and 361 manufacturing units.
- Expansion into neighboring countries like Nepal, Bangladesh, and Sri Lanka to strengthen regional outreach.

CABI collaborates with government organizations, NGOs, and industry associations such as BIPA, BASAI, and PMFAI to promote bioprotection solutions across Asia, Africa, and Latin America. By leveraging digital tools like the BioProtection Portal, CABI addresses global challenges such as food security and safety, fostering international cooperation and advancing sustainable agricultural practices.

Regulatory science: Efficacy considerations for biopesticides in Integrated Pest Management (IPM) systems

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The growing reliance on synthetic pesticides for pest and disease control has raised concerns, despite their essential role in crop protection when used appropriately. The risks associated with synthetic pesticides, including impacts on human health, the environment trade, and the development of pest resistance, have led to a shift in policies, particularly in the European Union.

The European Commission's recent guidelines focus on reducing chemical pesticide use and promoting alternative solutions like biopesticides. These changes raise questions about how EU policy shifts may affect other regions, with global agricultural companies often focusing their investments in Europe and the USA.

A shift in EU policy could influence the global supply chain, particularly research and development priorities, as investment in biologicals and biopesticides grows, signaling increased interest in integrated pest management (IPM) systems.

Despite the growing interest in biopesticides, challenges remain in their adoption, including barriers in research and development, supply chain limitations, a lack of knowledge among growers, and regulatory pathways. Addressing these challenges requires the development of new regulatory science concepts and frameworks.

Many countries' regulatory systems for biopesticides are modeled after those for conventional chemical pesticides, but some authorities like AVPMA are exploring modifications to existing regulations or the creation of new provisions specifically for biopesticides.

To tackle the challenges related to efficacy, a tiered and systems approach has been proposed, ensuring they meet safety and efficacy standards before approval.

This structured process involves progressively detailed testing phases to assess potential risks and benefits at each stage.

The role of biopesticide manufacturers and promotion

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The global biopesticide sector is expected to reach $13.6 billion by 2028, driven by increasing demand for high-value crops such as fruits, vegetables, and specialty crops. Currently, North America and Europe dominate the market, holding 71.6% of the global share.

However, emerging regions like South America and Asia are experiencing rapid growth. Brazil, in particular, leads South America with a biopesticide spend of $850 million in 2023, largely due to regulatory reforms that expedite product approval.

Bionema Group, a leader in biocontrol technology for sustainable crop protection and plant health, focuses on unlocking the full potential of biopesticides by developing advanced technologies and transferring them to partners for commercialization.

- **Key Technology:** Incapsulex® microencapsulation offers 30% higher efficacy for biopesticides with controlled-release delivery.
- **Pipeline**: Over 60 products and technologies currently under development (TRL4–9).
- **Business Model:** Emphasis on technology licensing and transfer.
- **Milestone:** Syngenta acquired three Bionema products/technologies in 2021, and a technology transfer agreement was signed with a South African company.

In Europe, biopesticide development faces significant challenges, including high registration costs ($5–10 million), lengthy approval timelines (6–7 years), and limited approvals of active ingredients (EPA: 185; EU: 142).

Beyond these regulatory hurdles, there is a critical need for promotional activities, education programs, and collaborative efforts to address misconceptions and expand the adoption of biopesticides.

The biopesticides industry is highly competitive, with 20–30 leading manufacturers, most of them are relying on technology partnerships for innovation. Significant investments, particularly in Asia also, are driving growth, with companies like UPL emerging as key players.

The biopesticides industry's future is promising, with over 300 global companies developing products for pests, diseases, weeds, and nematodes. While bioinsecticides lead the market, bionematicides are gaining momentum. Growing interest from investors, manufacturers, and consumers signals strong growth potential, driving innovation and expansion in coming years.

The role of the private sector in manufacturing and promoting biopesticides

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Biopesticides are poised to play a significant role in agriculture, driven by increasing awareness of food and environmental safety and the push for adopting Good Agricultural Practices (GAP). Despite India having 207 million hectares of farmland, only 7.53% is exclusively treated with biological solutions, while the majority still relies on chemical treatments.

India's biopesticide demand currently stands at approximately 13,000 metric tons, with fungal biopesticides leading the market at 67%. Among fungal biopesticides, Trichogramma species dominate, representing 56% of this segment. The biopesticide market in India is projected to grow by 9.78% from 2024 to 2029.

There are several ongoing challenges for the industry, including scaling up production, commercialization, market expansion, education, supply chain development, R&D investment, and regulatory harmonization. Addressing these issues is vital for advancing biopesticide adoption and effectiveness.

Despite these challenges, Multiplex Biotech Pvt. Ltd. has emerged as a key player in enhancing crop productivity by employing various advanced techniques in India.

Key Technologies:

- In-vivo production methods for NPVs (nucleopolyhedroviruses)
- In-vivo production methods for EPNs (entomopathogenic nematodes)
- Liquid fermentation for bacterial bioagents
- Solid substrate fermentation for fungal bioagents

The company has developed approximately 300 biopesticide products across various categories, including insect virus-based bio-pesticides, EPN technology, powder formulations, and consortium-based products. These innovations aim to replace chemical pesticides and promote sustainable agricultural practices.

To scale up manufacturing, robust downstream processes, such as quality control, formulation optimization, and automated bottling and packaging systems, are essential.

Strengthening public-private partnerships: A case study of biopesticides in the Asia-Pacific region to boost sustainable agriculture

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Biopesticides are pivotal for promoting eco-friendly and sustainable agriculture, especially in the Asia-Pacific region, which contributes over 52% of global agricultural output.

Despite this dominance, the region's heavy reliance on synthetic pesticides poses significant risks to human health, biodiversity, and the environment. Public-private partnerships (PPPs) have emerged as a transformative mechanism to address these challenges by fostering innovation, scaling adoption, and streamlining policies.

- **R&D Funding**

PPPs can stimulate research investments. For instance, the World Bank and FAO's 500 initiative advanced microbial biopesticides.

- **Scaling Adoption**

The FAO-World Bank partnership launched in 2019 aims to reduce pesticide use in key export crops like dragon fruit and coffee. This PPP increased biopesticide trials across 100 farms.

> In Vietnam, exports in 2024 reached US$ 64 million, a 73% increase compared to 36.7% in 2023.

- 15% Pest Outbreak Reduction

Biopesticide use led to a 15% reduction in pest outbreaks on coffee farms [2] (FAO, 2022).

- 10% Farmer Profitability Increase

Biopesticide use boosted farmer profitability by 10% [3] (FAO, 2022).

- **Policy Development**

Governments promote the adoption of biopesticides through policy frameworks. China's 2017 Green Pesticide Action Plan aims to reduce pesticide use by 30% by 2025. Partnerships with Syngenta and domestic firms have been established to expand access to biopesticides. Additionally, $200 million has been invested in biopesticide R&D, with a focus on vegetable and fruit farming

2 FAO, "Non-Chemical Pest Management in Organic Coffee: Effective and More Profitable than Chemical Pest Management," 2022, https://www.organic-center.org/research/non-chemical-pest-management-organic-coffee-effective-and-more-profitable-chemical-pest

3 FAO, "Biopesticides Boost Farmer Profitability by 10%," 2022, https://www.frontiersin.org/journals/sustainable-food-systems/articles/10.3389/fsufs.2021.619058/full.

The World Bioprotection Forum (WBF), founded in 2019 as a non-profit organization, plays a key role in bridging academia, industry, and policymakers to drive sustainable agricultural innovations.

- **Mission:** To bridge gaps between academia, industry, and policymakers, fostering collaboration and innovation to create sustainable biological solutions for agriculture.
- **Vision:** To be the leading global platform for developing and commercializing biological solutions that ensure a healthier planet.

WBF's achievements include the release of an industry white paper advocating for regulatory reform in the UK, raising awareness about the benefits of biopesticides, and driving the commercialization of innovative biological products. Additionally, the forum has developed a robust global network of advisors (30 global advisors from 12 countries) and members, fostering collaboration and enabling knowledge sharing.

Bridging Research, Governance and Commercials for sustainability in Bio-inputs: An Example of Balochistan - Pakistan

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Balochistan region has taken a pioneering step in Pakistan's organic agriculture sector by approving the Balochistan **Organic Agriculture Policy 2024,** a milestone that reflects the success of the organic cotton project in the country.

Pakistan's organic agriculture progress is marked by collaboration among research institutions, academia, government, and farming communities. The country has seen significant growth in organic cotton production and is now focusing on expanding other crops such as wheat.

- **2018:** Pakistan produced its first certified organic cotton bales.
- **2019:** Production scaled from 800 bales to 15,000 bales.
- **2023:** Organic cotton production reached 95,000 bales, with expansion to over 75,000 acres.
- **Ongoing:** Efforts to commercialize 216,000 metric tones of organic wheat.

However, challenges remain in developing certified bio-inputs, particularly biopesticides, necessitating collaboration with academia and international organizations for investments, product development and technology transfer.

While the government has advanced IPM technologies, developing financial models to support organic farmers is critical for sustaining and scaling these achievements.

Prospects of development of Biopesticides in Pakistan

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Extensive research on neem has led to the isolation of over 100 chemical compounds from various parts of the plant. Studies have revealed multiple modes of action, such as antifeedant properties, insect growth regulation, repellency, and disruption of reproductive organs.

> Neem-based biopesticides offer a sustainable, cost-effective, and eco-friendly solution for pest control, contributing to food security

- **Neem-Based Products:**
  - Biosal: Effective against sucking pests and whiteflies - A significant development.
  - Other products: Household bioinsecticides, biofertilizers, germicidal creams, and mosquito repellents.
- **Challenges in Adoption:**
  - Lack of farmer awareness regarding neem-based product benefits.
  - Need for education and support to promote neem cultivation and processing.
- **Future Strategies:**
  - Create economic opportunities in rural areas.
  - Improve the supply chain from field to market.
  - Leverage neem plantations for ecosystem restoration.
  - Scaling Production: Expand the current pilot plant into a commercial-scale facility with government and private sector support.

Food Chain ID and product solution finder: Innovative tools for product identification and residue compliance

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FoodChain ID, the parent company of Lexagri, is committed to ensuring the safety and transparency of the global food supply chain.

The "Solution Finder" is a powerful tool for advancing biocontrol solutions globally, built on the ***Homologa database***, the largest online harmonized plant protection product database on the market.

It was developed in collaboration with 30 professionals worldwide and catalogs data on registered crop protection products, pesticide registrations, maximum residue levels, trade statistics, active ingredient blocklists, and dedicated filters aligned with international standards. The Homologa database:

- Covers 92 countries
- Includes 4,200 crops
- Catalogs 10,400 pests
- Features 12,000 active ingredients
- Lists 350,000 pesticides
- Contains over 22,900 biocontrol products

It allows users to find branded formulated products, detailing their usage by crop, purpose, and timing.

The database includes various plant protection products such as fungicides, insecticides, herbicides, growth regulators, biostimulants, seed treatments, biocontrol products, and nematicides. This platform enables the identification of biocontrol alternatives to chemical pesticides, while offering an intuitive dashboard for analyzing millions of approval data entries.

Minor Use Foundation: Building global partnerships and leveraging crop protection technologies for cultivating and supplying specialty crops

Mitigating pesticide residues in Latin America using biopesticides

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Building global partnerships and leveraging crop protection technologies are essential for supporting specialty crops. The Minor Use Foundation (MUF) has been actively addressing the challenges faced by minor crops, which often lack phytosanitary solutions due to limited economic interest from companies.

Recently, MUF expanded its focus to include biopesticides. Initial work involved efficacy studies and registering biocontrol products for crops like cocoa. The Global Minor Use Summit brought together 150 experts, strengthening networks and setting the foundation for future collaborations.

The Minor Use Foundation (MUF) was established in 2019 to sustain the achievements of the IICA-led project "Fortalecer la Capacidad de América Latina para Cumplir los Requisitos de Plaguicidas para la Exportación," leveraging its success in training, collaborative projects, GLP data generation, and establishing Maximum Residue Limits (MRLs) in Latin America.

Another notable initiative, the **"Mitigating Chemical Residues in Latin America through the Promotion of Biopesticides"** project (2023–2025), is underway to replace chemical pesticides with biopesticides. This project includes training programs, harmonizing regulatory frameworks, mitigation studies, and extension activities across 12 countries, targeting government officials, growers, and industry representatives.

Ongoing studies in Latin America focus on crops pineapple, banana, mango, coffee, passion fruit, and okra, aiming to address specific pest and disease challenges. Additionally, MUF has launched **"Emerging Technologies to Address HLB/Citrus Greening: A Multi-Stakeholder Approach"** in Brazil.

Looking ahead, the Priority Setting Workshop (2025) will bring together growers, government officials, and stakeholders to determine focus areas for the next three years, prioritizing crops and pests based on their economic and environmental impacts while selecting biopesticide or chemical solutions.

Global cooperation in the authorization of biopesticides

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There is significant potential in the Joint Review system, which complies with Organization for Economic Co-operation and Development (OECD) guidelines, to advance the global harmonization of biopesticide regulations.

This system, proven effective for chemical pesticides—where 55 chemicals were jointly approved across five continents between 2000 and 2017. By leveraging the Joint Review system, regulatory processes can be streamlined, costs reduced, and market access enhanced.

The cooperation of farmers, processors, and traders in product selection, along with regulators in data review, risk assessments, and approvals, sets a strong precedent.

The key features of the OECD Joint Review System include:

- **Data Sharing:** Facilitates the exchange of scientific data across countries to reduce duplication.
- **Harmonization:** Aligns regulatory standards to streamline approval processes.
- **Efficient Approval:** Promotes faster, cost-effective product approvals through mutual recognition of data.
- **Global Cooperation:** Encourages international collaboration to address regulatory challenges and support trade.

However, the biopesticide industry, including developers, manufacturers, and sellers, must actively engage in this system.

Biopesticide companies are encouraged to participate in pre-submission meetings and utilize the Joint Review system to facilitate faster and broader product approvals.

Future Prospects for Biopesticides

The biopesticide market in the Asia-Pacific region is currently valued at 2.29 billion USD and is projected to reach 5.24 billion USD by 2028[4] *(Market Data Forecast, 2024).*

Consumer demand for organic products is driving the adoption of biopesticides in the Asia-Pacific region, leading to a projected 15.46% CAGR from 2020 to 2028[5] *(Inkwood Research, 2024).*

4 Market Data Forecast, "Asia-Pacific Biopesticides Market," 2024, https://www.marketdataforecast.com/market-reports/asia-pacific-bio-pesticide-market.

5 Inkwood Research, "Asia-Pacific Biopesticides Market," 2024, https://www.inkwoodresearch.com/reports/asia-pacific-biopesticides-market/?srsltid=AfmBOoqplLjolIB0ReQeQa8smj9nAmBX13CALjdY2kgPbPDxP7MAOCRh.

Conclusion

The ABCoP program highlights the transformative potential of biopesticides in agriculture while emphasizing the importance of continued collaboration, innovation, regulatory reform, and education. These efforts are essential to fully realizing the potential of biopesticides in ensuring sustainable food production and trade in the region

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