Addressing MRL Gaps in Tropical Fruits

Using Existing Data to Expand Access to Minor Use Solutions



Minor Use Foundation



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Sasireka Rajendran, PhD* and Anna Gore, Minor Use Foundation

*Corresponding author: sasireka.rajendran@minorusefoundation.org

1. Introduction

Tropical fruits are among the most economically significant agricultural commodities in the developing world. They account for approximately 98% of global tropical fruit output, with Asia and the Pacific region leading at 56% of total production, followed by Latin America and the Caribbean at 32% and Africa at 11%. Despite this dominance in production, developed countries account for approximately 80% of world import trade, creating significant economic dependency for the millions of smallholder farmers who rely on tropical fruit cultivation for their livelihoods. Minor tropical fruits such as durian, lychee, rambutan, passion fruit, and longan represent approximately 24% of total world tropical fruit production, with market shares expanding rapidly in recent years. However, these crops face significant and growing pest and disease pressure, including aggressive fungal diseases, emerging insect pests, and quarantine-level threats such as fruit flies, which can devastate yields and restrict market access. A critical challenge compounding this pressure is the absence of officially registered crop protection tools for many tropical fruits; leaving farmers with limited safe and effective options. In the absence of registered solutions, farmers often resort to older, broad-spectrum pesticides or apply registered chemicals off-label[1]. These challenges collectively undermine the livelihoods of smallholder farmers and threaten the food safety and trade prospects of tropical fruit producing nations. Central to this challenge is the issue of missing maximum residue limits (MRLs), which determine whether a pesticide-treated crop can legally enter an export market.

A Maximum Residue Limit (MRL) is the maximum concentration of a pesticide residue (expressed as mg/kg), to be legally permitted in or on food commodities and animal feeds. MRLs are based on Good Agricultural Practice (GAP) data and foods derived from commodities that comply with the respective MRLs are intended to be toxicologically acceptable. An MRL is considered 'missing' when the import market does not have an MRL for the pesticide/crop combination used by the exporter. The market to which farmers export may not have an MRL in place for the pesticide/crop combination they use for several reasons :

- The pesticide is not registered for use in the importing country, meaning no domestic MRL has been established;
- Although the pesticide is registered in the importing country, local farmers do not use it on that particular crop, so no MRL for that specific crop has been set;
- A pesticide manufacturer has not applied for an import tolerance because the crop is a specialty or low-volume product that does not justify the financial burden of conducting the field trials and generating the data required to support an MRL application;
- Although a Codex MRL[2] (CXL) exists for the pesticide/crop combination, the importing regulatory authority has not adopted it nor established its own MRL;

[1] unintended crops or pests due to the absence of registered alternatives

[2]The Codex MRLs (CXL) provide scientifically established limits for pesticide residues in food based on risk assessments by FAO/WHO expert bodies (JMPR)

- Although the importing country generally adopts CXLs, no CXL exists for that particular pesticide/crop combination;
- In the absence of an established MRL, the regulatory authority has not set a default residue level, effectively implying a zero-residue tolerance whereby no trace residue levels are permitted on imported produce.

Thus, missing MRLs indicate a lack of available crop protection tools officially registered in the country and challenges with the regulatory systems to support minor use crops. Inconsistent MRL coverage disrupts trade and creates uncertainty across export markets. Regulatory tools such as crop grouping (the practice of extending a registration from one crop to related crops within the same botanical group), data extrapolation, and foreign data acceptance (the use and approval of residue data developed by another country with similar agroecological conditions) offer significant opportunities to streamline pesticide registration processes. However, with the changing global regulatory landscape, the regulators often face difficulty understanding and adopting these techniques. These gaps in the regulatory capacity lead to delayed approvals, persistent pest pressure, and continued off-label use.

The Minor Use Foundation (MUF) works at the intersection of science and policy to address the issues of missing and misaligned MRLs by operating under the One Health principles, which recognize the intrinsic links between human, animal, and environmental health. MUF receives priority requests to work on persistent challenges for key pests and diseases from farmers, researchers, and exporters working with specialty crops like tropical fruits. MUF engages with the crop protection industry to prioritize possible solutions, address gaps, and secure registration of solutions for tropical crops. To this end, MUF works with the regulatory authorities in the low- and middle-income countries to strengthen the regulatory capacity to fast-track registrations for minor crops, utilizing the existing data on MRLs and adopting the FAO registration toolkit.

This paper discusses the approach to address the MRL gaps by reviewing the current gaps in MRLs registered for tropical fruits across different countries and regions. The paper also discusses three potential pathways as part of a broader health check framework for tropical fruit crop protection: 1) identifying and addressing the CXL gaps, 2) mapping existing registrations across the globe for the pest or disease of concern, and 3) assessing the risk to existing CXLs. The paper is methodological in focus and provides a framework applicable to the stakeholders working to address the crop protection gaps in tropical fruits globally.

2. Background: Minor Uses, MRLs and Tropical Fruit Context

According to the OECD guidance document on addressing minor uses, minor use is the use of conventional pesticides for crop protection where the potential use is on a scale not sufficiently large to justify registration of that use from an applicant's perspective alone. The primary factor underlying minor uses is the insufficient economic incentive for applicants to pursue registration, particularly given the substantial costs associated with generating the data necessary to obtain and maintain regulatory approval. Typically, minor uses involve crops grown on a small scale (minor crops) and are often high-value crops that have cultural importance, or are important for trade and economic growth in low- and middle-income countries. Additionally, minor uses can involve uses within major crops in terms of controlling minor pests and diseases. As a result, specialty crop industries often lack sufficient access to pesticides to adequately protect their crops.

MRLs are legal and enforceable limits set for the different combinations of pesticides and foods, or crops. MRL setting in minor crops is challenging because of the high costs involved in generating data to support registration. Because of the limited financial returns of the registration, the pesticide industry has little incentive to support MRL establishment and domestic registration. Mechanisms such as crop grouping and data extrapolation have been developed to reduce these costs, though their adoption remains inconsistent across jurisdictions.

The MRL gaps faced by low- and middle-income countries can be partially addressed when governments adopt CXLs as domestic benchmarks and actively contribute to their establishment. The CXLs help minimize the non-tariff trade barriers that result from different national MRLs by providing a harmonized reference accepted internationally. A survey by Bryant Christie Inc. on national policies revealed that a significant number of countries continue to rely on CXLs, and that even those with their own established national standards still



reference CXLs as part of their regulatory framework. While the CXL standard remains a critical reference point, the way in which these MRLs are interpreted and applied differs considerably from one country to another. The variability in CXL adoption and interpretation is particularly consequential for tropical fruit exporters in low- and middle-income countries, where regulatory capacity to navigate these differences remains limited.

Tropical fruits represent one of the commodity groups most underserved in terms of crop protection tool availability. An analysis of existing MRLs was conducted using the Homologa® database. It should be noted that the values presented are preliminary and based on data available within the Homologa® database. A more in-depth comparison using actual country-level regulatory data will be conducted on a commodity-by-commodity basis to validate and supplement these findings. A detailed analysis of the MRL gaps in tropical fruit is discussed below.

3. Current State of MRL Coverage for Tropical Fruits

Consistent with the challenges outlined above, the number of MRLs established remains a challenge for the low- and middle-income countries as many have yet to fully adopt crop grouping or data extrapolation mechanisms. Countries with dedicated minor use programs and robust regulatory guidelines in place to support the specialty crops have significantly more MRLs registered for the selected tropical fruits. USA and Australia, with strong minor use programs, have established MRLs for the selected tropical fruits even where the cultivation of these crops remains limited (Figure 1). This is largely achieved through the adoption of regulatory practices such as crop grouping, engagement with industry through national minor use programs, domestic prioritization processes for minor crops, and established pathways for accepting foreign residue data. Together, these mechanisms enable countries to systematically expand access to crop protection tools without requiring new data generation for every crop.

A further notable pattern is the MRL gaps between the major and minor tropical fruits. Longan, durian, dragon fruit, and passion fruit, which are listed as minor crops by FAO have very few or no MRLs established in the low-

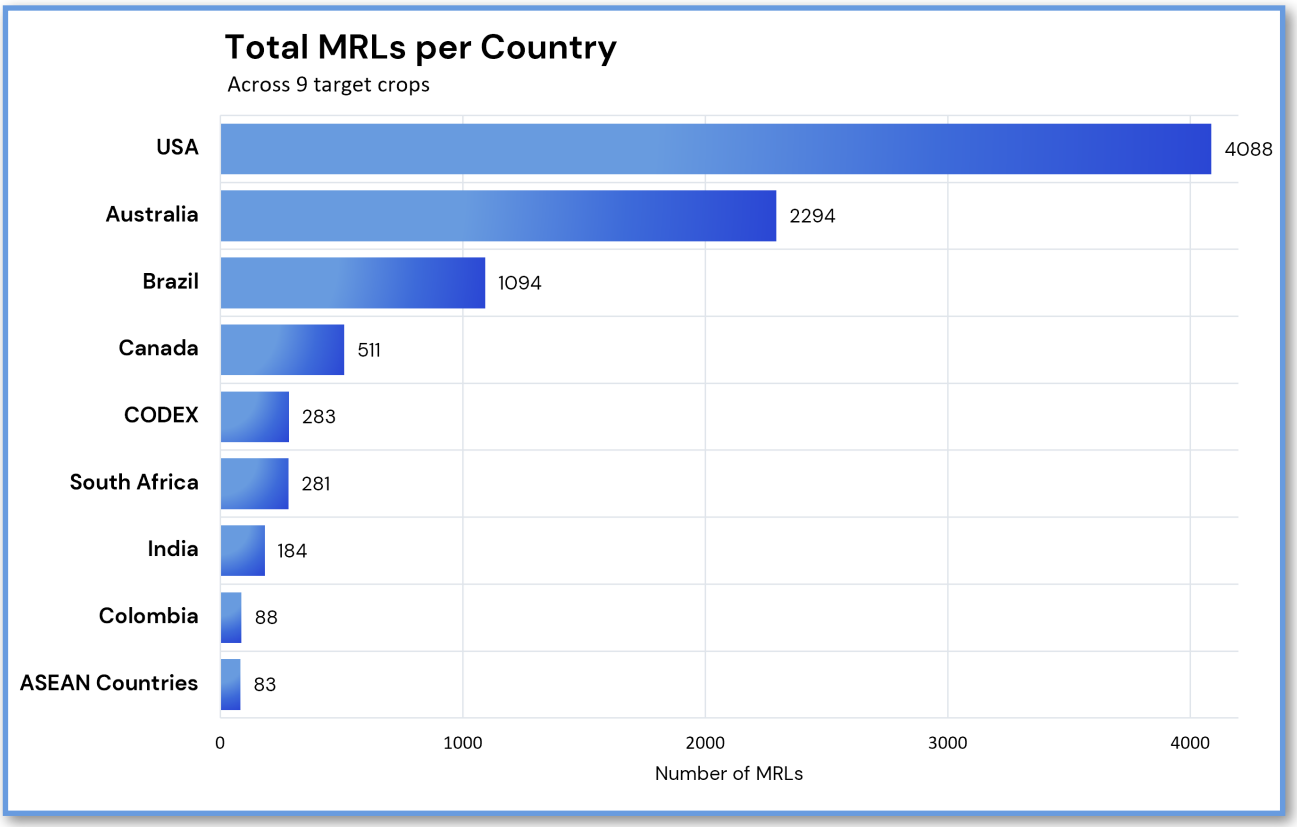


Figure 1. MRLs for selected nine tropical fruits across different countries



and middle-income countries. This contrasts with Australia and the USA, which apply crop grouping for MRL establishment. In these countries, the MRL coverage is consistent across all commodities within the same crop group. By contrast, countries that do not adopt a crop grouping system face significant MRL gaps across tropical fruit commodities. The heatmap (Figure 2) highlights the disparity in MRL coverage across countries relative to cultivation scale. Paradoxically, even countries where these commodities are grown abundantly have few or no MRLs registered.

To illustrate this disparity, two crops are examined as examples: banana, a globally significant tropical fruit, and durian, a regionally important minor tropical fruit. Durian is regionally cultivated and consumed but is gaining significant global market interest owing to its nutritional value. Overall, all the countries of focus have MRLs registered for banana (Figure 3). In contrast, there are no or missing MRLs for durian in half of the selected countries (Figure 3). This pattern likely extends across low- and middle-income countries more broadly. Even though Australia and the USA do not produce durian, there are significantly more MRLs registered compared to the Southeast Asian countries where durian is an economically important crop. This disparity is further driven by the pesticide industry's limited incentive to register products for minor crops and the lack of regulations strictly governing the off-label pesticide usage in the commercial market. Notably, an MRL for durian could potentially be established through existing CXLs for atemoya and pineapple under Codex Subgroup 006C, a concept explored further in Section 4.



Figure 2. MRL heatmap: crop x country

Farmers growing durian face significant challenges in exporting their high-quality produce to importing countries due to a lack of MRLs. Where crop grouping policies are in place, MRL coverage for durian mirrors that of banana, demonstrating that these gaps are driven by regulatory policy rather than scientific limitations. The following sections present a diagnostic framework to address these gaps, examining potential pathways through existing data, registered solutions, and regulatory mechanisms. As noted, these findings are preliminary and will be refined through detailed commodity-level analysis in subsequent work.

4. The Three Diagnostic Pillars

In this section, a brief discussion of the options available to address the missing MRLs and MRL gaps across different commodities of the same crop group is provided. Drawing on proven approaches in minor use programs for specialty crops, the following three pillars form the diagnostic framework presented in this paper.

- **Pillar 1**: Identifying Codex MRL (CXL) gaps and assessing feasibility of addressing them
- **Pillar 2**: Mapping existing global registered solutions to bridge technology gaps
- **Pillar 3**: Assessing risk to existing CXLs under periodic review

Pillar 1: Identifying Codex MRL (CXL) gaps and assessing feasibility of addressing them

As discussed earlier, CXLs can play a key role in addressing the missing MRL issues. As an international standard, Codex encourages its member countries to adopt the MRLs set by Codex based on scientific principles. One of the key recommendations of the FAO pesticide registration toolkit is for countries to use CXLs and data packages to register pesticide active ingredients for national use. Establishing CXLs is also cost-effective as countries can collaborate to generate shared datasets for submission to JMPR. Codex crop grouping guidelines outline clear principles and minimum data requirements to establish an MRL for minor use crops benefiting farmers producing minor tropical fruits and other specialty crops. Building on the banana and durian comparison presented in Section 3, an MRL for durian could potentially be established through existing CXLs for atemoya and pineapple, which serve as representative crops for Codex 'Subgroup 006C - Assorted Tropical and Sub-tropical Fruits, Inedible, Rough or Hairy Peel, Large'. This highlights how crop grouping principles could address this gap without requiring new data generation.

The MUF will conduct a systematic analysis of CXL gaps by comparing existing CXLs against national MRL databases based on the nominations received from the Global Minor Use Priority Setting Process. This will help in understanding whether data has previously been generated or used by countries to support national MRL establishment. Tools such

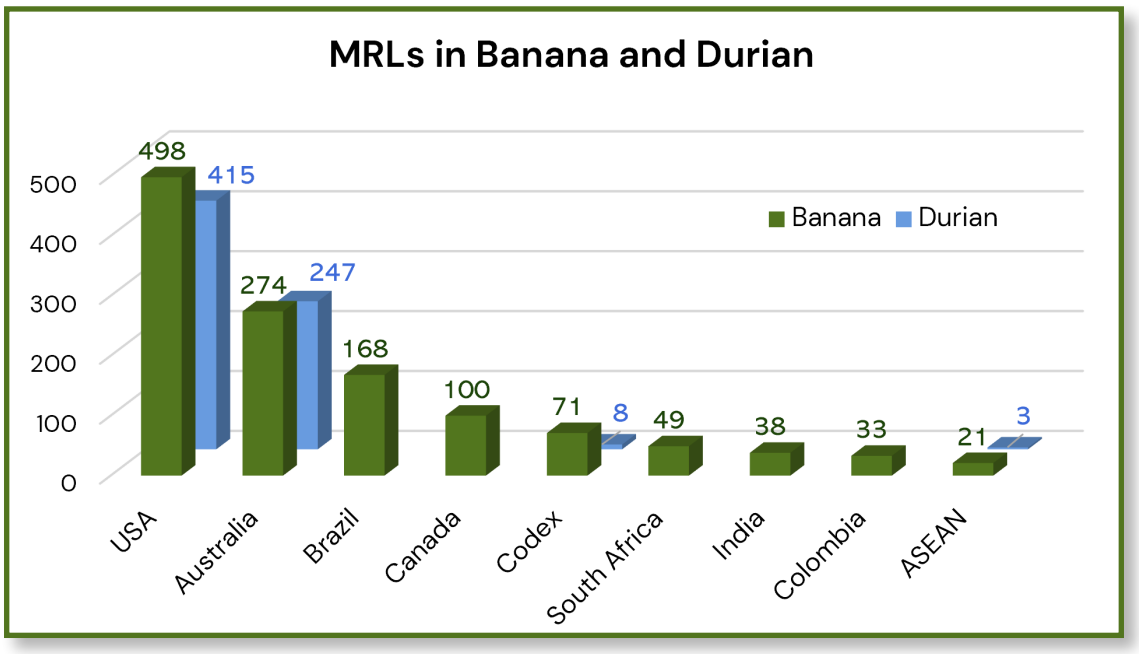


Figure 3. Comparative analysis of MRLs in banana and durian



as Homologa® will be used to identify these gaps across Codex and national MRL databases. As part of the analysis, it will also be important to assess the minimum residue data required to support an MRL submission to JMPR, taking into account production and consumption profiles of the relevant specialty crops. Where data gaps exist, MUF will collaborate with interested countries to complete and submit a data package to JMPR.

Pillar 2: Mapping existing global registered solutions to bridge technology gaps

In the priority setting nomination process, MUF identified that crop protection solutions registered in one country are frequently inaccessible to farmers facing the same pest or disease challenge in another country. MUF refers to the gap whereby products registered against a pest or disease in one country remain unavailable in another country facing the same challenge as the 'technology gap' in crop protection accessibility – a challenge made more acute by the emergence of new pests and diseases. Underlying this technology gap is the recognition that data needed to register a solution in one country can often be shared with the country facing similar needs and agroecological conditions. Key regulatory barriers that make technology bridging challenging include the non-recognition of data generated and approved in countries with similar agroecological conditions, the absence of policies to extrapolate MRLs using crop grouping principles, and a lack of awareness of solutions already registered for similar pest and disease challenges in other jurisdictions. Fast-tracking registrations within well-established regulatory systems have provided farmers with timely access to effective crop protection tools. However, such mechanisms are limited or absent in countries lacking robust regulatory frameworks for specialty crops.

Facilitating cross-border access to these technologies through coordinated registration efforts is therefore a critical priority. This will be addressed by collaborating with the pesticide industry, farmers, and regulators across target countries to facilitate registration of solutions that have demonstrated efficacy in other jurisdictions. To identify these solutions, the registered products across countries will be mapped using the Homologa® and CABI Bioprotection databases. Solutions will be prioritized based on their alignment with the 2025 Global Minor Use Priority Setting Process nominations. Once registered solutions are identified across jurisdictions, the efficacy data and registration dossiers will be reviewed in consultation with the technical experts relevant to the target country. In parallel, MUF will engage with national regulators to strengthen pesticide registration guidelines, particularly around foreign data acceptance and data extrapolation mechanisms. To implement this effectively, MUF will build strong relationships with national regulators while fostering understanding among regulators and farmers of the benefits these solutions offer. In a resource-constrained environment, addressing these technology gaps becomes critical, as existing data packages from countries where solutions are already registered can be leveraged to support applications in new markets. The expected output of this pillar is a mapped database of registered solutions by pest, crop, and jurisdiction, accompanied by country-specific recommendations for cross-border registration pathways. Regional economic communities are encouraged to leverage this framework as a basis for coordinated cross-border registration efforts, sharing resources and regulatory capacity to accelerate access to crop protection solutions across member states.

Pillar 3: Assessing risk to existing CXLs under periodic review

There are older active ingredients (AI) that farmers continue to use for the commodities. Regulatory authorities and Codex periodically evaluate older AIs to assess whether available information is current and whether continued use remains safe against pests and diseases. Each year JMPR publishes the list of AIs for periodic review. During this periodic review, if the data are found safe the existing CXLs are retained; if concerns such as new toxicological findings or inadequate data packages to address emerging safety questions arise, the established CXLs may be revoked. When an existing CXL is deleted through periodic review, countries that relied on it lose their reference standard. This creates a ripple effect including trade disruption, loss of registered tools, and pressure on farmers. For minor tropical fruits, losing even one CXL can be particularly damaging given how few exist to begin with.

MUF will proactively monitor the JMPR periodic review schedule, working with industry and regulatory experts to identify AIs scheduled for review that are relevant to tropical fruit crop protection and assess the likelihood of CXL revocation. Where an AI is confirmed safe, MUF will communicate outcomes transparently to farmers and maintain open channels to address their concerns. Where CXLs are revoked, MUF will work to identify and facilitate access to safer alternative solutions. This monitoring process will be conducted annually in alignment with the JMPR work program, with findings feeding into the broader Health Check Framework discussed in the following section.



5. The Health Check Framework and Pathways to Action

The three diagnostic pillars outlined in this paper are designed not only to identify gaps but to guide strategic investment decisions. Together, these pillars provide a science-based pathway to increase the availability of registered crop protection solutions for minor crop farmers (Figure 4. Decision tree). For regulators and organizations that are resource-constrained, this approach helps identify low-hanging fruit to better support minor crop farmers rather than relying on the conventional approach of waiting for industry to voluntarily submit data and registration applications for minor crops. The combined outputs of the three pillars feed into a decision tree that determines the most appropriate pathway forward: 1) Codex MRL (CXL) establishment, 2) leveraging existing data packages to support registrations in new markets, and 3) proactively monitoring older AIs under periodic review and identifying safer alternatives where needed.

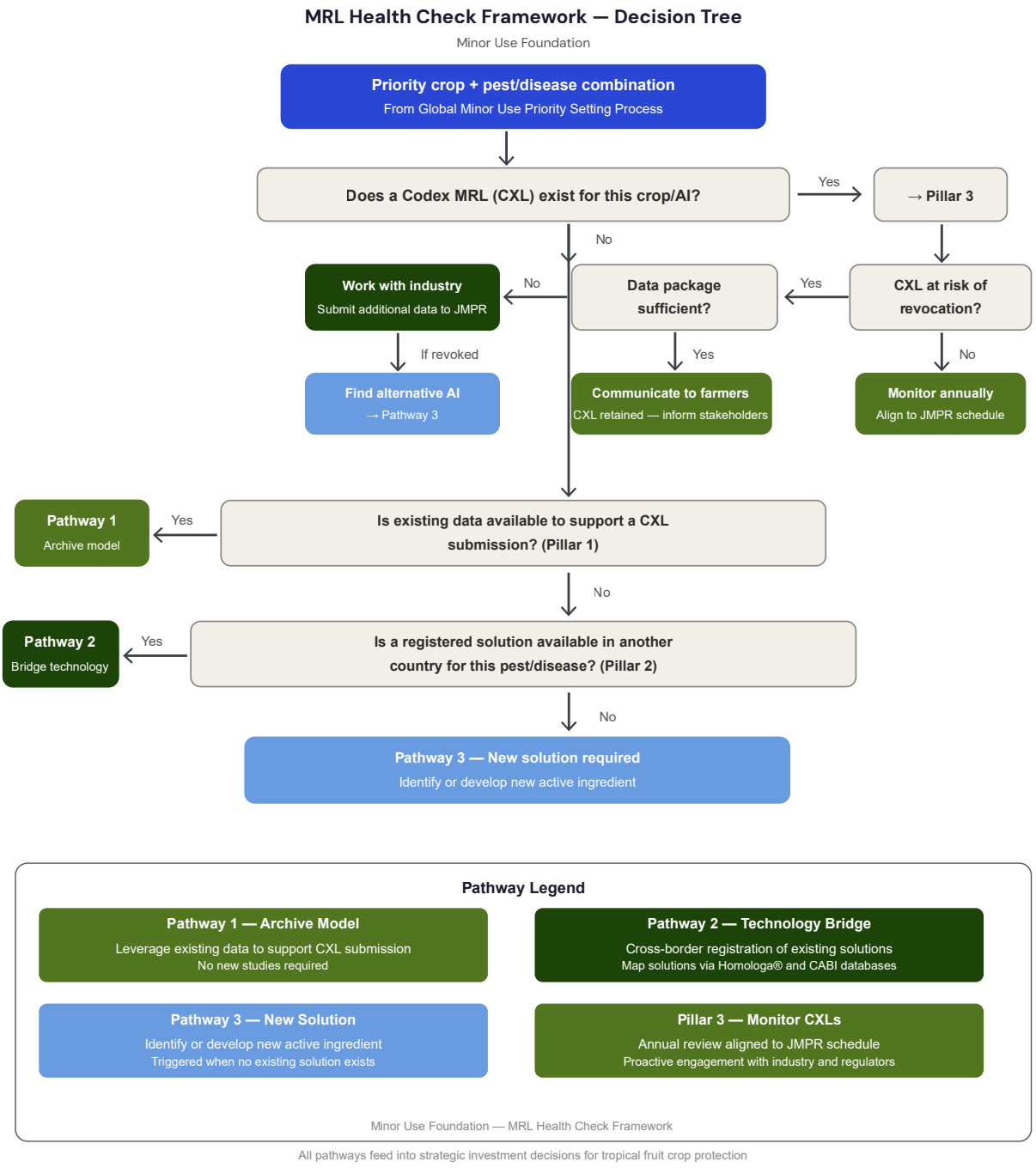


Figure 4. Decision Tree



To illustrate, consider an annual budget of USD 1,000,000 allocated across the three pathways to maximize impact. The highest priority allocation (approximately 60% of the funds) targets technology gaps that do not require additional data generation, leveraging existing data packages to support registrations in new markets. Where no existing registered solution is available, MUF will collaborate with multiple countries to generate shared datasets supporting CXL establishment that can subsequently be adopted across multiple jurisdictions (approximately 20% of the funds). Finally, a portion of the budget is dedicated to routinely monitoring AIs under periodic review (approximately 20% of the funds). These allocations are indicative and may be adjusted based on decision tree outcomes and priority rankings emerging from the Global Minor Use Priority Setting Process.

Each priority crop and pest or disease combination will be individually analyzed using the three diagnostic pillars, generating a structured document that captures technology gaps, CXL establishment challenges, and periodic review risk to serve as a roadmap for addressing crop protection needs. This document will also compile existing data, registered solutions, and supporting information for the relevant pest/crop/AI combination, providing countries with a practical reference to support domestic registrations and MRL setting without the need to generate new data from scratch.

6. Conclusion

This paper demonstrates the importance of innovative approaches to addressing the crop protection needs of the minor crops using tropical fruits as a representative case, and highlights the role of the Minor Use Foundation in addressing those challenges. With millions of smallholder farmers in low- and middle-income countries depending on access to effective crop protection tools, addressing MRL gaps in minor crops is not merely a regulatory exercise but a matter of agricultural equity and global food security. The three diagnostic pillars and the corresponding decision tree help identify the core barriers to registration and address them strategically. For regulators, this framework offers practical options to increase registrations for minor crops without relying solely on industry to submit dossiers. Regulatory involvement and incentives would encourage the pesticide industry to prioritize minor crop registrations, ultimately expanding the tools available to farmers. Farmers can benefit from timely access to newer solutions while adhering to national regulatory guidelines to avoid trade barriers. Farmers' access to safer, registered pesticides for minor crops is fundamental to food safety and security across producing and importing nations. While this paper focuses on tropical fruits, the framework established and the methodologies for addressing needs apply to a wider set of crop groups as well. This framework can be implemented in collaboration with the Minor Use Foundation, which has already established the groundwork, ensuring the pesticide industry and regulators do not need to start from scratch. The minor crops are not a minor problem anymore.

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SIANI Stockholm Environment Institute, Linnégatan 87D, Box 24218, Stockholm, 104 51, Sweden

The Minor Use Foundation (MUF), created in 2018, operates with a mission to support growers of specialty crops in the service of a commitment to making global agriculture more regenerative and increased economic return for smallholder farmers. We do this by facilitating access to crop protection tools for fruits, vegetables, nuts, and spices. Find out how you can take part at www.minorusefoundation.org.

Minor Use Foundation, 1250 Revolution Mill Dr., Suite 228, Greensboro, NC 27405, USA

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