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PERSPECTIVE

Multi-party assessment of pesticide risks in Aotearoa New Zealand: Current challenges and potential steps forward

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HIGHLIGHTS

Exporting agricultural produce is vital for the economy of Aotearoa New Zealand, and pest management, typically reliant on pesticides, ensures high productivity and quality. However, due to human health and environmental risks, pesticide use is increasingly regulated internationally and influenced by consumer attitudes. This paper summarises the recommendations from a workshop held in Auckland, New Zealand in April 2023 within the context of the topic at the time of publication. The workshop involved members of regional and national government, researchers and various commercial sectors, and aimed to identify challenges related to pesticide risk assessment and management in New Zealand. Key recommendations to strengthen government policies and reduce risks included establishing secure national data-sharing systems for pesticide use, modernising the regulatory framework with time-bound approvals, and introducing incentives for agricultural pesticide users to transition to more sustainable practices. Increased government funding would enable timely pesticide (re) assessments and more targeted pesticide monitoring in the environment.

Keywords Pesticide monitoring, pesticide regulation, data gaps, collaboration, communication

BACKGROUND

Pesticide use has been a critical aspect of agriculture for decades, helping to protect crops from pests, diseases and weeds that could otherwise threaten yields and quality of commodities. Climate change is expected to have a significant effect on pesticide use in agriculture through increased pest pressure and weed growth, changes in pest and disease distribution and reduced pesticide effectiveness (Delcour et al. 2015; Deutsch et al. 2018; Yang et al. 2024). With Aotearoa New Zealand's primary industries being major contributors to the country's economy (MPI 2025a), efficient control of disease, pests and weeds is essential. While New Zealand growers predominantly still rely on synthetic pesticides because of their cost-effectiveness, efficacy, ease of use, integrated pest management practices that aim to reduce pesticide use are increasingly adopted, particularly in horticulture (Walker et al. 2017).

However, while pesticides have clear benefits for growers and the economy, their widespread use comes with a host of challenges including concerns around environmental contamination, potential human health risks and emergence of pesticide resistant pests and weeds. Balanced pesticide

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management and regulation are required to mitigate the risks of pesticide use while still safeguarding agricultural productivity.

At the national level, New Zealand is faced with major issues in pesticide regulation and monitoring. Its unique regulatory challenges include outdated risk assessment tools and non-expiring pesticide approvals. For example, the modelling tools available to New Zealand regulators to support environmental risk assessments require updating, to include New Zealand-specific scenarios (PCE 2022a; Loan & Woock 2023). The only mechanism to change or decline existing approvals is through the New Zealand Environmental Protection Authority (EPA)'s reassessment process (EPA 2025a), which can be triggered if grounds for reassessment can be established (e.g., significant new information available about the substance's effects).

Furthermore, effective implementation of pesticide risk assessments and enforcements are hindered by major data gaps. Resource constraints lead to shortcomings in existing environmental monitoring programmes and to the current dearth of pesticide exposure data in New Zealand. Groundwater is the only compartment of the environment that has been regularly tested for pesticide residues every 4 years since 1990 (Close 1993, 1996; Close & Flintoft 2004; Gaw et al. 2008; Close & Skinner 2012; Close & Humphries 2016; Close et al. 2021; Close & Banasiak 2023). Even data regarding the quantities of pesticides used in New Zealand are difficult to obtain and are highly uncertain, as historically New Zealand has not had a standardised process for gathering and recording data on the quantities of pesticides imported, manufactured, sold, or used at the national scale (e.g. Kueh Tai et al. 2025). In fact, until 2025 New Zealand was the only OECD country without a national framework for collating chemical usage data via a Pollutant Release and Transfer Register (PCE 2022a).

In view of this situation, a bilateral project funded by the Royal Society of Aotearoa was launched with Denmark in 2022, in recognition that Denmark is a world leader in pesticide monitoring and management through its unique Pesticide Leaching Assessment Program (PLAP; https://www.vap.dk/language/en/; Rosenbom et al. 2015). The aim of this project was to identify specific shortcomings in New Zealand pesticide-monitoring schemes and tools available to regulators with responsibilities to manage the hazards associated with pesticide use in New Zealand. A principal activity of this project was a workshop, held in Auckland in April 2023, that was attended by a wide range of pesticide stakeholders along with the project's Danish collaborator. Key objectives for this workshop were to: (i) explore policy shortcomings for the reduction of environmental and health risks from agricultural pesticide use in New Zealand; (ii) identify key problem areas; and (iii) identify pathways to advance pesticide risk assessment and management in New Zealand. A summary of the discussion and consensus is captured below, categorised under six key current policy challenges with suggested solutions along with recent literature on these topics.

POLICY CHALLENGES AND POTENTIAL STEPS TOWARDS MORE EFFICIENT PESTICIDE REGULATION AND USE

1. No national framework for capturing pesticide use and disposal statistics

Context

Statistics on the use and disposal of pesticides are critical to informing policy decisions regarding agrochemical registration and international trade agreements, enabling pesticide source inventories and risk assessments, and helping maintain market, consumer and broader public confidence in their use and safety.

As of January 2025, data on the quantities of pesticides imported, manufactured, or formulated locally, sold, or used in the field, have rarely been collated at a national scale in New Zealand. Historically, infrequent *ad hoc* surveys on pesticide use have been undertaken (Wilcock & Close 1990; Holland & Rahman 1999) with the most recent assessment carried out more than twenty years ago (Manktelow et al. 2004). Recent changes to the EPA Importers and Manufacturers Notice 2015 now allow for the collection of data on identified substances, which includes agrichemicals (EPA 2015).

Challenges

A national framework for recording of spatial and temporal pesticide use would support more targeted pesticide monitoring and risk management, especially if combined with vulnerability maps (weather, catchment characteristics, crop, and soil types) and modelling, and could indicate changes in land use, production systems, and pest and disease pressures. Data on pesticide usage in New Zealand is currently collected informally by different organisations. For example, industry bodies, such as Zespri International Ltd and New Zealand Winegrowers collate spray diary records from individual member growers, which growers are required to collect for compliance and market -access audits. However, the collection of these data varies among industries, and these data are not publicly available owing to ongoing industry sensitivities regarding pesticide use.

Solutions

As part of the chemical mapping programme run by the EPA, data on national imports of agrichemicals will be able to be cross-matched with information on crop locations to assist pesticide monitoring, risk management and reassessment prioritisation (EPA 2024). In the longer term, a more active and transparent engagement between local/national government and industry would allow the collection of data throughout a pesticide's lifecycle to be universal and simplified. Data sharing (e.g., the establishment of a safe, consistent, and transparent way to share spray schedules, including data protection and privacy considerations) is also a critical step to improving current pesticide management.

2. No policy regulations or incentives to reduce pesticide use

Context

New Zealand does not have a formal policy platform to direct and/or incentivise pesticide reduction targets despite growing international momentum to reduce pesticide use. A recent attempt to reduce pesticide use in the EU was through the proposed regulation on the sustainable use of plant protection products that would have required a reduction of the overall use and risk of pesticides by 50% by 2030 (European Commission 2025). Although this legislation was not passed, its submission highlights growing global expectations. Another example is the newly established EU regulation on import restrictions that will take effect in 2026 (European Parlement 2024). This regulation will include stringent standards for imports into the EU of products that contain residues of pesticides that are banned in the EU. For example, the maximum allowable residues of neonicotinoids in foodstuffs will match the lowest concentrations in foodstuffs that existing technologies can measure. This requirement will ultimately affect the use of selected pesticides and their application protocols in New Zealand. While these global shifts towards regulating more sustainable pesticide use can affect practices in New Zealand, these external pressures alone have proven insufficient to drive domestic government policy change.

Further, the global retail sector continues to develop their own food safety standards to proactively reduce the flow of pesticides through agri-food supply chains from a distance, without taking on additional legal or financial obligations (Rao et al. 2021). For instance, many European supermarket chains require fresh vegetable and fruit producers to be certified to GLOBALG.A.P., which has established food safety standards that are additional to, and more stringent than, those stipulated by EU regulations and law. Other examples include the UK operations of the supermarket chains Co-op and Lidl, which limit the number of pesticides and require residue concentrations in the food products they sell to be 30–80% below the maximum residue levels approved in Europe (Co-op 2025; Lidl 2025). In comparison to these international initiatives to reduce pesticide use, New Zealand's response can be viewed as being reactive —meeting foreign standards only when it is required to maintain international market access for exported foodstuffs —rather than strategically aligning national regulations with international initiatives. Without formal trade requirements or strong civil society advocacy, global trends alone are proving insufficient to shift New Zealand's internal approach.

Challenges

To date, successive New Zealand governments have not established any pesticide -reduction targets, or integrated pest -management-adoption targets. This year the Ministry for Primary Industries (MPI) proposed to increase some Maximum Residues Levels (MPI 2025b). New Zealand Government inaction stems from the country's heavy economic reliance on agriculture, where pesticides are perceived as essential for maintaining yields and the quality of exported produce. Politically, there are a few drivers for change, but pesticide use is not a major public concern. Influential local industry stakeholders' interests discourage stricter regulation of pesticide use while favouring sector-led voluntary initiatives to reduce pesticide usage, sometimes with partial government funding support (e.g. Cameron 2007; Walker et al. 2015; Lo et al. 2024). A major incentive for New Zealand growers to reduce their use of pesticides is cost while residues and compliance stimuli originate from commercial and regulatory measures established overseas. Pro-active government regulations, combined with support of growers to develop and adopt more sustainable use of pesticides in their growing practices, are going to be crucial to ensuring future international market access and growth for New Zealand's primary food exports.

Solutions

Incentives to adopt more sustainable practices in the use of pesticides could take the form of receiving a premium for produce grown or farmed in this way. In 2019, the Linking Environment And Farming (LEAF) assurance system was launched in the UK, aiming to recognise and highlight more sustainably farmed products (Mills et al. 2010). The scheme details requirements for certification, including control points across various farm management areas such as soil, crops, pollution, animals, energy, water, and landscape conservation. The standard emphasises Integrated Farm Management (IFM) principles, using a whole-farm approach. It is now a globally accessible scheme and is designed to complement GLOBALG.A.P. LEAF-accredited produce is packaged with the LEAF marque, which often obtains a significant price mark-up in supermarkets. While this is an assurance scheme New Zealand growers could apply for, it has received little promotion in New Zealand to date and no premium returns for compliant produce are paid to growers in supermarkets in New Zealand. AsureQuality, who oversees food quality assurance programmes and certification in New Zealand, provides GLOBALG.A.P. auditing and certification services to New Zealand growers (AsureQuality 2025).

Substantial research has been undertaken over many years in some industries that has led to reduced pesticide residues on crops e.g., apples (Walker et al. 2017; Wearing 2019). All avocado growers must be compliant with the AvoGreen® integrated pest management system (https://industry.nzavocado.co.nz/about-us/compliance/avogreen/). Other examples of research initiatives and industries embracing integrated pest management practices include Zespri system policies regarding kiwifruit (https://www.zespri.com/en-NZ/zespri-system-assurance-program), plant protection requirements for New Zealand wine (https://www.nzwine.com/en/sustainability/sustainability-focus-areas/pest-disease/) and integrated pest management for potatoes (https://potatoesnz.co.nz/news-info/articles/integrated-pest-management-in-potatoes/). Compliant produce may not command a higher price but access to overseas markets is often not possible if residues exceed international limits. Since 2015, a government-industry initiative 'A Lighter Touch' (A Lighter Touch – Horticulture New Zealand) has been working to reduce the reliance of New Zealand's primary sectors on agrochemicals. However,

greater engagement of growers in the development of Integrated Pest Management (IPM) strategies and teaching of the underlying ecological concepts of these techniques could enhance further adoption. More stringent regulation, taxation and control of pesticide sale and use in New Zealand could promote and support these changes.

3. Limited monitoring of pesticide residues in the environment

Context

Only a minimal fraction of pesticides applied reach the target crop (Pimentel & Levitan 1986), while the largest fraction is emitted into the surrounding environment. With time, this is further transported off-site via runoff, wind and soil erosion, leaching and volatilization (Sarmah et al. 2004). Programmes to monitor pesticide residues in the environment differ widely in their: spatial and temporal sampling resolution; sampling techniques; sample storage and preparation methods; pesticide extraction techniques; choice of active ingredients and metabolites analysed; types of measurement techniques used; and resulting detection and quantification limits (Gimsing et al. 2019).

Challenges

Monitoring of the status, and temporal and spatial changes of pesticide residues in soil, water, and air in New Zealand has been and continues to be extremely sparse. Groundwater is the only environmental compartment that has been monitored regularly across New Zealand since 1990, with samples obtained from shallow unconfined aquifers every four years, and most recently in 2022 (Close & Banasiak 2023). Over the last three decades, these groundwater surveys have sampled groundwaters from between 82 and 279 wells, and analysed them for a range of acid herbicides, organochlorine, and organonitrogen and organophosphorus pesticides with changing detection and quantification limits. For the first time, glyphosate and its breakdown product, aminomethylphosphonic acid (AMPA), were included for analysis in the 2018 survey (Close et al. 2021). No comprehensive surveys of pesticides in New Zealand's rivers and lakes have been undertaken (MfE 2023), but in 2017–2018 a survey of pesticides in 36 agricultural streams, conducted as part of a PhD research project, detected two or more pesticides in waters at 78% of the sites (Hageman et al. 2019). The concentration of pesticide residues in New Zealand soils remain largely unknown. The few available reports include: a survey of pesticide residues in horticultural soils in the Auckland region (Gaw 2002); a survey on agrichemical residue concentrations in soils in the Bay of Plenty (SEM 2004); and a survey specific to neonicotinoid insecticides in soil in New Zealand (Pook & Gritcan 2019). In the last-mentioned study, concentrations exceeded the Environmental Exposure Limits (EELs) established in New Zealand in eight of the nine maize fields sampled. Some regional councils have begun complementing their regular Soil Quality Monitoring Programmes with ad hoc pesticide analyses, but results obtained are difficult to interpret beyond their very local scale. A limited number of specific catchment and field research studies determining the fate of pesticides after typical pesticide applications have been completed (Close et al. 1998; Sarmah et al. 2004; Duwig et al. 2006; Müller et al. 2006) The scope of these studies was narrow and, furthermore, they were completed almost 20 years ago and thus the data produced are of limited value for informing contemporary pesticide soil residue levels. Their sole value is to inform which legacy pesticides could be considered in a monitoring programme, or to compare the persistence and vertical mobility of contemporary and newly introduced pesticides in soil with pesticides that have been historically used in New Zealand.

A review of eighty worldwide monitoring studies and surveys of current use pesticide residues in soil published since 1972 specifically identified the paucity of studies from the Oceania region (Sabzevari & Hofman 2022). Importantly, this review highlighted the global occurrence of modern pesticides in agricultural soils and validated the importance and need for long-term soil -monitoring programmes. A recent review on measuring pesticides in the atmosphere highlighted the increased interest in pesticide residues in air and related exposure risks since 2000, with a focus in Europe and North America (Brüggemann et al. 2024).

The limited monitoring of pesticides in agricultural areas in New Zealand has been identified as a significant data and knowledge gap by the New Zealand Parliamentary Commissioner for the Environment (PCE 2022a). More recently, the PCE identified that the comprehensiveness and quality of environmental monitoring and data reporting in New Zealand are not fit for purpose and the data that are collected are ineffectively used/adopted by primary industry bodies and appropriate Government departments to develop pesticide reduction targets (PCE 2022a). These data gaps in pesticide monitoring are attributable to insufficient funding, technical constraints, and fragmented institutional responsibilities leading to inconsistent and poorly targeted monitoring, plus poor transparency on where and when pesticides are used.

Solutions

New Zealand needs more frequent and targeted monitoring of pesticides within surface and groundwater, soil, sediment, and the organisms they support. A prioritisation exercise based on pesticide usage and consultation with research, central and local government, and the relevant industry sectors is needed to ensure the efficient use of limited resources (e.g., in terms of target pesticides/metabolites, analysis capability and capacity, environmental compartments and possible hot spots). Research and capability building are needed to develop, validate and implement appropriate pesticide monitoring strategies and analysis capability (including all relevant pesticides and metabolites) in New Zealand. Coordination between government agencies will help define clear objectives for monitoring programmes that could be locally targeted but nationally coordinated. Data from the monitoring that is undertaken need to be fed back to researchers, regulators and industry. Appropriate regulations could eliminate

pesticide usage from identified highly vulnerable areas. Using the information obtained, New Zealand-specific EELs could be developed, together with legislative refinement, compliance responsibilities, and corrective actions in the case of exceedances of pesticide threshold values. This could be financed through local and national government, taxation upon users of pesticides, and the agrochemical industry.

4. Limited use of New Zealand-specific parameters to underpin environmental risk assessments

Context

Pesticide risk is a combination of the (eco)toxicological properties (hazard) and the potential exposure of humans, flora, and fauna to the pesticides. This means that risk depends not only on how hazardous a chemical is, but also on how it is used, where it is used, how much of it is used, and how often it is used. The fate of pesticides within the different environmental compartments is crucial for determining the risks associated with pesticide usage (Müller et al. 2016).

Challenges

In their pesticide registration or reassessment, the New Zealand Environmental Protection Authority (EPA) seeks to predict environmental concentrations based on parameter values sourced from validation studies principally carried out in Europe and North America. The lack of New Zealand-specific fate parameters and scenarios (climate/soil/crop) used in the modelling, combined with the environmental fate screening tools, leads to outputs that may not always be protective of New Zealand environment and values (PCE 2022a; Loan & Woock 2023).

This situation is unlikely to improve in the short term as the New Zealand EPA introduced the Rapid International Regulator Pathway to streamline the application and assessment process to import or manufacture hazardous substances in New Zealand. This new registration pathway was implemented to remove the requirement for applicants to provide New Zealand-specific fate parameters and scenarios for hazardous chemicals. To date the five hazardous substances assessed and approved for registration under this scheme are all pesticides (EPA 2025b). The fast-tracking of the registration and approval of new pesticides for use in New Zealand is expected to accelerate as stakeholder groups representing New Zealand primary industries lobbied for and supported the current New Zealand Government to introduce this regulation to facilitate the rapid introduction and supply of new agrichemical products into the New Zealand market.

The (eco)toxicological properties of a pesticide and/or its metabolites, determine its hazard. The toxicity of pesticide residues is quantified under controlled conditions in laboratory or field experiments with increasing complexity and ecological realism by measuring how much of an individual active ingredient is required to kill or otherwise affect test organisms (i.e., acute and chronic effects). In their pesticide registration or reassessment, the New Zealand EPA evaluates ecotoxicity studies for aquatic and soil organisms, non-target plants, birds, bees, and non-target arthropods. All organisms used in these assessments are standard species from overseas. Previous work has shown that data from overseas may not protect all culturally significant species, in particular, reptiles, fungi, amphibians (EPA 2019) and nontarget insects, including native bees in New Zealand and other countries (Kueh Tai et al. 2022). Research has demonstrated that New Zealand species exhibit different sensitivity to pesticides compared to overseas species of the same genus (Stringer et al. 2012; Charry et al. 2019). Booth et al. (2017) concluded that there are insufficient data to robustly evaluate whether New Zealand native species are more or less sensitive to contaminants than exotic and/or standard test species. Based on international studies, it is likely that some native species will be more sensitive than international standard test species of similar genus, while others will be comparable or more tolerant, and that this sensitivity will alter for different chemicals.

Solutions

The trust in, and robustness of, pesticide risk assessments in New Zealand could be improved by:

- Governmental Ministries adopting the recent recommendations of the PCE (PCE 2022a, b)
- Establishing New Zealand-specific environmental exposure scenarios. A point of recognised difference to overseas is the consumption of wild foods in New Zealand, especially by Māori. Therefore, future monitoring of pesticide residues in New Zealand should specifically address residues in wild foods
- Further recognising the limitations of applying data derived from other countries and assessing whether current assumptions are protective (i.e., going beyond applying conservative values in the exposure assessment regarding environmental degradation and safety factors for protect vulnerable species)
- Developing and incorporating EELS into latest generation risk-assessment models and protocols
- Establishing New Zealand-specific data requirements for next-generation risk assessment, which would need consultation with the general public and iwi. One factor to keep in mind is that new ecotoxicity data for endemic species would be extremely challenging to generate owing to the complex animal ethics requirements for higher organisms (e.g., salmonids and other vertebrates), the need to include different life stages of the organisms, possible iwi concerns, and high costs without a willingness from the industry to pay
- Replacing currently used risk assessment models with the latest generations/versions and improving modelling capabilities within relevant government/ regulatory organisations. Such actions would reflect international best practice combined with developing New Zealand-specific baselines and scenarios required

for this novel environmental fate modelling approach and the derivation of environmental concentration limits to protect ecosystems impacted by pesticides

- Ensuring early meaningful engagement and consultation with iwi/Māori and researchers to obtain approval to conduct fate studies in their rohe or to use taonga species in ecotoxicological assessments. Several studies (e.g., Ataria et al. 2023; Sevicke Jones et al. 2025) could guide the interactions with iwi and the integration of indigenous worldviews and matauranga Māori into these decision-making processes.

All suggested steps listed above require improved linkages between government agencies, researchers, productive sector industries, iwi, private sector interests and the public. New models of working together and sharing capabilities could include joint appointment schemes between government, research, and private and industry bodies, as well as building interdisciplinary committees with the involvement of international experts. Specific funding is required, practicalities and feasibility need to be discussed, roles and responsibilities clarified, and capability and capacities within organisations assessed.

5. Limited biomonitoring

Context

Human exposure to pesticides occurs via ingestion of food and water, inhalation of polluted air and dust particles, and dermal contact. Modelling for human and environmental exposure is a fundamental approach used by chemical regulatory agencies globally to assess risk and determine effective controls (where applicable). Ideally, it is a scientifically defendable, repeatable, consistent, cost-effective, and a publicly acceptable process. The modelling approach is needed to allow the original approval, but modelling is associated with assumptions and uncertainties. Thus, follow-up with environmental monitoring and biomonitoring is required to ensure that the controls in place are fit for purpose. Biomonitoring can directly assess animal/human exposure to currently used and banned pesticides at individual and population levels.

Challenges

Only a few studies have used biomonitoring in New Zealand to assess pesticide exposure in farm workers, public, and children (Mannetje 2020; Campbell et al. 2022; Li et al. 2022). Urinary pesticide metabolites were measured for the first time in New Zealand schoolchildren in 2021 (Li et al. 2022). While the measured concentrations were comparable to those reported by other countries, they were 2.2–7.3 higher for 3,5,6-trichloro-2-pyridinol (TCPy, organophosphate metabolite of the herbicide triclopyr and insecticides chlorpyrifos and chlorpyrifos-methyl) than in other countries. Samples from New Zealand also tended to have higher concentrations of pyrethroid metabolites than those from North America and Poland (Li et al. 2022). The reasons behind those discrepancies remain unknown, as the understanding of sources of exposure is limited. A unique feature of New Zealand diets is the consumption of wild foods in New Zealand, especially by Māori, which might increase the exposure of Māori to pesticide residues via the indigenous practices of hunting, foraging and kai gathering. Pesticide residue monitoring programmes for produce and foodstuffs in New Zealand are overseen by the Ministry for Primary Industries and include the National Chemical Residue Programme (MPI 2022), which tests farmed and wild animals, the National Chemical Contaminant Programme (MPI 2023), which monitors contaminants including pesticide residues in milk and dairy products, the New Zealand Food Safety (NZFS) Food Residues Survey Programme, which monitors pesticide residues in plant-based foods grown and imported for sale in New Zealand (FRSP 2023). While wild animals are tested for pesticide residues, other foods from foraging and kai gathering are not covered by these programmes.

Solutions

More appropriate/targeted biomonitoring (human and wildlife) data are needed to inform regulatory decisions, provide awareness of temporal trends, identify vulnerable groups, and assess the effectiveness of regulatory measures and promote more comprehensive and accurate health impact assessments.

6. Limited public awareness

Context

The New Zealand Ministry for the Environment (MfE) has long been involved in developing policies aimed at reducing the risks associated with pesticide use. In 2002, they published a discussion document titled 'Towards a Pesticides Risk Reduction Policy for New Zealand (MfE 2002), which emphasised the importance of providing information, training, and education to both users of hazardous substances and the general public. The New Zealand Agrichemical Education Trust (NZAET) was formed in 1992 by the primary producer group with the aim of facilitating the approved safe use of agrichemicals in New Zealand, consistent with sustainable land management and environmental protection, through advocacy and education for pesticide users. NZAET developed the Code of Practice for the Management of Agrichemicals (NZS 8409), which serves as a guide for the safe, responsible, and effective use of agrichemicals. Educational resources, such as case studies on specific pesticides like neonicotinoids, are available through platforms like the Science Learning Hub (https://www.sciencelearn.org.nz/). These resources provide insights into the environmental impacts, regulation, and monitoring of pesticides in New Zealand.

Challenges

While the above actions have enhanced safer handling of pesticides, there is still a lack of public awareness about the scarcity of data and existing knowledge gaps on the state of pesticide residues and their degradation products in the environment, and/or the potential impacts on humans (Mannetje 2020; Eng et al. 2023). Also, public awareness

of the presence of pesticide residues in locally grown and imported foods in New Zealand is obscured because the Food Survey Residue Programmes only report residues for those pesticides found to exceed their respective maximum residue levels rather than any detectable residues (MPI 2024, 2025c). Hence, these issues have not received the needed attention from policymakers to channel resources into this important area of concern.

Solutions

To increase awareness on these issues, high quality data from the New Zealand environment need to be gathered and presented directly in media for public transparency, in the interests of broader awareness of the need for environmental protection. Denmark provides a good example: monitoring results of pesticide residues leaching from agricultural fields to the groundwater/drinking water (The Danish Pesticide Leaching Assessment Programme, led by researchers in close dialogue with regulators) have been published in public media and have informed the wider public of the risks presented by pesticide leaching and groundwater contamination. Policymakers and regulators of pesticides had to act, and this resulted in their adopting a very conservative approach to regulating pesticides (Rosenbom et al. 2015; Baran et al. 2022). To reveal the wider human exposure to pesticide residues through food intake, Food Survey Residue Programme reports could include all pesticide detections regardless of whether respective maximum residue levels are exceeded or not.

To achieve more balanced views (benefits vs risks) on pesticide use in New Zealand, an effective and inclusive communication strategy needs to be developed. This needs to involve end-users and Māori communities, and collaboration between all parties and the media. The EPA has maintained a Māori Advisory Group, Ngā Kaihautū Tikanga Taiao, since the late 1990s, to provide a Māori perspective and advice to the EPA on their policy, progress, and decisions, including hazardous chemical regulation (EPA 2025c). This group played a critical role by holding hui throughout the country to involve Māori in discussion and decision-making on the continued use of 1080 to control vertebrate pests in New Zealand. This broader consultation underpinned the EPA decision to reassess and subsequently maintain the registration for the continued use of 1080. A report capturing the outcome of the hui and making recommendations for future successful consultation with Māori/indigenous communities was produced (Ataria 2004). The recommendations are also relevant to enacting meaningful consultation with the public in New Zealand regarding the use, management, and regulation of all pesticides in this country.

CONCLUSIONS/FUTURE IMPLICATIONS

This workshop (re)connected members of regional and national government, researchers and various commercial sectors with the aims of providing guidance and governance on reducing pesticide harm in New Zealand and seeking to secure more funding to support this important work. All the challenges identified can be explained by: (i) the decades-long limited investment in pesticide research and risk management in New Zealand; and (ii) the limited resources allocated to chemical risk management within regulatory organisations in this country, in comparison to those of EU member states and other Western countries. In addition, New Zealand regulators face the challenge of having to regulate all hazardous substances rather than those that are strictly agrichemicals. In addition, regulators must reassess older chemistries and assessing new, safer chemistries, while updating the risk assessment process with the latest knowledge (based on science and monitoring results), being cognisant of New Zealand-specific conditions, and incorporating Māori cultural viewpoints. As New Zealand is a small market, there is a risk of missing access to newer and safer chemicals if the EPA takes too long to assess new products or sets requirements for specific data that are not required to support registration of new products in other regions of the world. Resourcing for regulators in New Zealand presents another challenge. The current New Zealand Government has reduced the operating budgets of government ministries responsible for assessing/managing the risks associated, increasing the pressure on these regulators, and increasing the risks of shorter- and longer-term impacts of pesticide use on the New Zealand economy (e.g., clean green reputation and tourism, market entry) as well as human/environment health, and cultural consequences.

The current review of the legislative framework for pesticides (MfR 2024) provides an opportunity to ensure appropriate investment into improving pesticide risk assessments, in line with latest science, while also accounting for New Zealand specificities. Increased funding investment could support timely pesticide (re)assessments based on improved monitoring approaches and research, and efficient prioritisation (e.g., using the framework environmental pressure, harm, and scale). Other specific policy recommendations include modernising the regulatory framework by introducing time-bound pesticide approvals aligned with international best practice, for example, by phasing-out pesticides approved in New Zealand but banned in other developed countries. Monitoring needs to go hand in hand with promoting safer alternatives and supporting growers with financial and technical assistance to transition away from hazardous pesticides, e.g., incentives such as tax breaks combined with mandatory pesticide-use reporting. The modernisation of the framework should not be rushed. Risk assessment science is complex, and the profound changes needed should integrate international best practice with local data. The latter are scarce due to decades of underfunded research. For instance, the introduction and validation of new predictive environmental fate and ecotoxicological models must use local data, and this will require ongoing funding to ensure the reform leads to a more robust, respected and resilient framework, and not only to faster or easier assessments. The framework needs to be sufficiently flexible to embrace and incorporate evolving scientific knowledge into practice, e.g., adaptable enough to accommodate the assessment of future alternatives to conventional pesticides such as biopesticides, RNAi, nanopesticides, which may help reduce the footprint of our agriculture.

Inaction on pesticide regulation in New Zealand or hasty reforms not only threaten the country's international reputation and public trust in regulatory institutions, but also national environmental quality. Failure to strengthen regulation risks sustained environmental degradation, including contamination of water and soil resources, and loss of biodiversity, while exposing communities to long-term health risks from chemical exposure. Considering the current focus on economic growth, it is also worth noting that a weak framework means that growers might miss opportunities to access premium export markets demanding low-pesticide or organic produce.

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