SOLUTION

SUPPORTING FARMERS THROUGH BETTER AGRICULTURAL SCIENCE

MAKE NEW ZEALAND HEALTHY

THE PROBLEM: The government proudly proclaims that farmers, growers, foresters, fishers and primary processors are breaking records with exports set to exceed $60 billion.

Yet the Ministry of Business, Innovation and Employment's science policy prioritises research and science which favours innovation and commercialisation. This *sidelines* essential public-good science, and it has done so for a long time. Government directives to prioritise innovation over everything else have been happening since the reforms of the 1990s and 2000s, and the systems are fragmented.

Much of the research needed to sustain soil function, plant health, animal resilience, and nutrient quality cannot generate patents or proprietary technologies. As a consequence, this 'public-good' research gets pushed down the funding ladder, especially if it is long-term and complex.

Farmers and growers have been consistently painted as the polluting bad guys, but they've been working without an integrated science research that is funded over the long term, and that reviews the latest information and feeds back to farmers and growers. An integrated science system works beyond sector interests. It can flexibly respond to real-time challenges, and prioritise soil quality, nutrition (for health and disease resistance) and productivity and local contexts, the capacity to shift away from synthetic chemical and fertiliser dependence has been limited.

If the goal is enduring productivity and export resilience, the policy question is not whether innovation matters, it does, but whether MBIEs long-term policies adequately funds the maintenance of the biological systems on which innovation depends.

What is evident: MBIE can't see innovation as a factor inside a wider system. This has resulted in policies which fragment any long-term integrative system approaches and prevent long term research. This is the policy problem researchers, scientists, farmers and growers have been faced with – but which the government has chosen to ignore, even in a latest science system update.

THE SOLUTION: Refocus and reorientate agricultural science to prioritise public good, integrative research. This includes: the implementation of high level principles that guide our science system to support public-good research; dedicated, long-term ring-fenced funding away from commercial incentives; farmer and grower say in what research is desperately needed; the reintegration of extension services for sector and cross sector challenges; and an integrated pest management approach across the entire agricultural system.

New Zealand's agriculture sector requires intelligent, informed and dynamic two-way feedback loops between science and research and farmer and grower groups to support knowledge transfer, and scientists who can secure funding to address challenges in long-term multidisciplinary projects, to serve the interests of farmers and growers, local communities and export markets.

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MNZH POLICY RECOMMENDATIONS:

1. Establish a Guiding Principle: Science in New Zealand should be guided by kaitiakitanga: the stewardship and protection of soils, waters, ecosystems, and human wellbeing for present and future generations, through knowledge that sustains resilience, restores biological integrity, and supports enduring prosperity.

2. Ring-fence public-good systems science. Dedicated funding is needed for soil health, pest ecology, nutrient cycling, pasture resilience, nutrient density, and climate variability adaptation, the biological infrastructure that underpins productivity.

3. Restore farmer and grower co-design with scientific communities. Structured participation ensures research priorities reflect field realities and enables early detection of systemic stress signals.

4. Rebuild extension as a two-way knowledge loop. Sustained extension capacity is essential to translate science into practice and to feed farmer observations back into research design.

5. Strengthen independent IPM and resistance research. Public research is needed to evaluate spraying thresholds, resistance management, and the real-world impacts of chemical mixtures.

6. Recognise resilience and durability as export infrastructure. Soil function, ecological stability, and postharvest quality retention underpin market performance and long-term sector viability.

BACKGROUND TO THIS POLICY

A. PATH-DEPENDENCY WHEN 'INNOVATION' IS PRIMARY

[1] BRAND NEW SCIENCE FUNDING PROGRAMMES HAVE BIG GAPS

What is the point in putting 'innovation' at the top of research priorities if we don't have the research and science community that can understand the problems in the first place?! Without ring-fenced funding, foundational research streams cannot compete with projects promising innovative and commercial pathways.

Researchers and scientists require long-term resources to synthesise global evidence and to work with farmers and growers to monitor on-farm and on-site systems over time. This includes the resources to conduct multidisciplinary research and experimentation with inputs, to understand how to optimise the biological health of the system, and appreciate how systems are shifting over time, and the complex influences that are at play over longer time periods, as farmers and growers have to plan over the long-term, in order to balance budgets. Science and research information then needs to be translated and disseminated to farmers and growers, and then we can build the technologies to solve our problems.

This work has been happening piecemeal, as scientists and industry sector bodies struggle for funding, while big multidisciplinary projects that can look at complex systems over the long-term are rarely, if ever funded. The reformulated science system for the agriculture sector shake-up is limited, because the focus continues to be on innovation, tech development and patents.

New Zealand's primary-sector science system is framed around productivity, market advantage, and growth. At the same time, agriculture faces shared systemic pressures that manifest differently across regions because climate, soils, and landscapes shape biological responses across forestry, horticulture, dryland pasture, dairy, and arable systems. Effective solutions therefore require place-based, systems-level approaches integrating soil, water, plant, animal, pest, climate, and financial data.

Funding criteria centred on export value and innovation leave a gap: sustained investigation into soil biological decline, pest dynamics, micronutrient depletion, pasture persistence, nutrient density, seasonal volatility, and whole-farm resilience. Postharvest durability, flavour, and nutritional quality in export markets are tied to nutrient availability and plant uptake, issues of system function rather than invention. Yet this work is largely out of scope as funding frameworks prioritise innovation. Scientists can't propose this research because it falls out of scope of funding frameworks.

The Gaps Show that Farmers & Growers Weren't Consulted

Farmers and growers were basically written out of consultation when the recent science funding priorities and research frameworks were being reshaped, even though they're the ones doing the mahi. Sector bodies and peak organisations are often engaged, but producers had little opportunity to discuss challenges or comment on gaps in soil health, pest ecology, nutrient density, resilience, and extension support. Without strategic, integrative, and interdisciplinary ground-up input, funding priorities risk reflecting institutional or commercial agendas rather than field realities.

[2] MISSING: LONG-TERM FUNDING FOR PLANT AND ANIMAL HEALTH DISEASE PREVENTION

Genomic traits attract research investment because they can deliver proprietary products and measurable gains, but plant and animal health is built first on nutritional sufficiency and soil function.

Soil structure, microbial activity, trace minerals, and nutrient balance determine root development, plant immunity, pasture persistence, and the mineral composition of feed. When soils are depleted, imbalanced, or biologically impaired, plants experience stress that increases susceptibility to pests and disease; animals grazing those pastures may in turn face metabolic stress, reduced immunity, and higher disease risk. Conversely, well-functioning soils support resilient plants, balanced forage, and healthier livestock.

For example, a resilient arable system rotates cereals and vegetables with legumes, cover crops, and deep-rooted or pasture phases to rebuild soil fertility, break pest and disease cycles, and reduce reliance on fertiliser and chemicals.

Sustaining livestock health depends on the interaction of nutrient-rich pasture and soils, adequate trace minerals, clean water, low parasite and disease pressure, appropriate stocking and shelter, and management that reduces metabolic and environmental stress.

Research that integrates soil chemistry, microbiology, plant nutrient uptake, and biomarkers of nutritional status in plants and animals is therefore central to disease prevention. Monitoring trace elements, metabolic indicators, and pasture nutrient profiles can provide early warning signals of emerging health risks before clinical disease or yield loss appears. Strengthening soil health and nutrient pathways is often a lower-cost, lower-risk intervention than treating disease after it emerges. In this sense, soil and nutrition science are not peripheral to productivity — they are foundational to plant resistance, animal health, and the durability and quality of food production systems.

Agricultural problems do not wait for funding cycles. Pest outbreaks, pasture failures, nutrient deficiencies, resistance pressures, and extreme weather can emerge within a season, yet tightly programmed funding limits scientists' ability to investigate causes and provide timely guidance. Ring-fenced public-good funding preserves the flexibility to respond quickly, run field diagnostics and trials, and prevent small problems from becoming costly production and environmental crises. It protects responsiveness and resilience, ensuring science can act early rather than react late.

[3] MISSING: MASSIVE INVESTMENT IN PEST MANAGEMENT FOR AGRICULTURE

New Zealanders hear a lot about 'biosecurity', but what they don't hear a lot about is the day-to-day pest challenges facing farmers and growers that directly impact the quality of output and their productivity – whether they are livestock or dairy farmers, they are in arable and grow vegetable, cereal crops.

Pest management addresses the full spectrum of biological threats to crops and pasture, including weeds, insect pests, nematodes, plant pathogens such as fungi, bacteria and viruses, and other organisms that reduce plant health, yield, and quality.

Integrated Pest Management (IPM) offers a pathway off the treadmill by combining biological control, crop rotation, resistant cultivars, habitat management, monitoring thresholds, and targeted chemical use only when economically justified. However, effective IPM depends on region-specific ecological knowledge, monitoring systems, and independent trials comparing chemical and non-chemical strategies.

Where such research and extension support are limited, growers must make high-stakes decisions using incomplete or commercially generated data.

Meanwhile, resistance and escalating chemical use are becoming structural agronomic risks. Repeated use of a single insecticide or herbicide mode of action selects for resistant populations; susceptible individuals die while resistant survivors reproduce.

Over time, efficacy declines, costs rise, and management flexibility shrinks. This dynamic drives the pesticide treadmill: increased application rates, shortened intervals, and substitution with newer or costlier products. Beneficial insects and soil biota can be harmed, sometimes worsening pest pressure by removing natural predators.

Pesticides and synthetic fertilisers contain ingredients that can be toxic and accumulate in soil, water and air, including breakdown chemicals and heavy metals such as cadmium and lead. The toxic accumulation can impair soil health (including the health of micro-organisms), and inhibit uptake of beneficial nutrients, leading to increased disease risks and poorer productivity.

Herbicide resistance illustrates the problem starkly. Glyphosate-resistant and multi-resistant weeds are emerging in New Zealand and globally. Management recommendations include tank mixes of herbicide formulations and rotations of multiple modes of action to delay resistance.

While these mixtures can slow resistance evolution, commercial formulations include adjuvants and solvents that affect uptake and toxicity. Combining products introduces potential synergistic effects on non-target organisms, soil microbiota, aquatic systems, and operator exposure. These mixture effects are less studied than single active ingredients, and regulatory assessment has historically focused on individual actives rather than real-world combinations.

It’s not just the biology of the farming system that is impaired, farmers are at risk of a spectrum of ‘workplace-related’ health conditions, including specific cancers, inflammatory conditions, Parkinson’s disease and depression, that are associated with long-term exposures to toxic chemicals. Farmers and pesticide applicators might follow ‘best-practice’ but the big exposure risks involve simple processes like taking gloves off to answer a phone, hold a steering wheel, or eat lunch, as well as from accidental spills, which are difficult to anticipate and more common than recognised.

Encouraging conversion to organic systems can help reduce stocking pressure and reliance on synthetic chemicals. However, the transition period is demanding and risky for farmers, requiring significant changes in management and new approaches to weed and soil fertility control without herbicides. Time-limited support that recognises the costs and learning curve of conversion can reduce financial risk and make the shift more feasible.

And important point here – is that shifting to reduce stocking rates and dependency on toxic chemicals is one thing, but ensuring optimum nutrition is another! As the previous section outlined, these research paths, particularly for long-term multidisciplinary research can be extremely difficult to secure.

The benefits of conversion to organic are multifactorial, yet this is another example of a funding paths that are largely out of scope. It takes a lot of work across lots of different scientific expertise to recognise the benefit to soil, water and plant and animal systems, as well as human health - and it wouldn't produce a patent!

[4] MISSING: INTEGRATED SCIENCE-FARMER/GROWER FEEDBACK LOOPS

Agricultural science is not only about generating new discoveries; it also plays a crucial translational role. Research institutions synthesise global evidence, adapt it to New Zealand conditions, and interpret it through the lens of regional soils, climate, pest pressures, and production systems. This knowledge is then communicated in practical form: guidance on pasture management, nutrient stewardship, pest thresholds, cultivar choice, stocking strategies, and postharvest handling so that farmers and growers can make informed decisions under real-world conditions.

There is no long-term funding for such work, for the research side, and then the translation at the farmer/grower end. The sector bodies do their best, but they often have to address short term risks with small funding pots. The entire agricultural system is stymied by the lack of feedback loops to ensure that research, science and agriculture, that our farmers and growers, have the knowledge and capacity to respond flexibly to signalled challenges and risks.

Researchers and scientists have massive barriers to funding that would enable them to research and disseminate globally relevant sector based or geographic information through to local regions via broadly funded extension services, to translate new science and practice. This includes developing the long-term institutional expertise, i.e. the wisdom, to inform new generations of researchers, scientists and students over time.

Currently knowledge transfer services are fragmented across consultants, levy bodies, agribusiness suppliers, and short-term projects.

Extension services are the bridge that makes this translation possible. Extension involves specialists working directly with producers through field trials, demonstration farms, workshops, decision tools, and advisory support. The aim is not only to transfer knowledge but to contextualise it: what works in a high-rainfall hill system may not suit dryland arable farms, and pest thresholds or fertiliser responses vary by soil type and season. Effective extension reduces risk, improves uptake of best practice, and accelerates adaptive responses to emerging challenges.

Equally important, extension functions as a two-way feedback loop. Farmers and growers observe early warning signs: pasture persistence issues, shifts in pest pressure, trace element deficiencies, soil structure decline, weather-related stress, or market-driven quality demands — that may not yet be visible in formal datasets. When these observations are systematically fed back to scientists, they help refine research priorities, improve trial design, and ensure that science remains grounded in field realities.

Without sustained extension capacity, findings remain in reports rather than becoming iterative improvements in soil management, stocking strategies, crop rotations, and nutrient stewardship. Critically, the feedback loop weakens: farmer observations and field data no longer systematically refine research priorities, and the researchers and scientists are confined to following the policies and funding paths that may be well intentioned, but may not be the most well-informed.

B. WHEN & WHY POLICY WENT WRONG

[5] 30- YEAR DRIFT AWAY FROM PUBLIC-GOOD SCIENCE TO OVER-VALUE INNOVATION

In the 20th century, the former Department of Scientific and Industrial Research (DSIR, 1926-1992) played a central public-good role in New Zealand's science system. Its institutes worked directly with farmers and growers to address practical problems in soils, pasture systems, plant breeding, pests, and land management. The DSIR's role focussed on supporting national productivity and environmental stewardship rather than commercial return. The science reforms of the early 1990s dismantled the DSIR and shifted functions into Crown Research Institutes and contestable funding models intended to increase efficiency and commercial relevance. These reforms reduced New Zealand's science and research system's focus on long-term, publicly funded applied research and on-the-ground problem solving, leaving gaps in systems-level science and extension that had been a key component of the DSIR model.

Later, responsibility for science policy and funding was located in a separate Ministry for Research, Science and Technology. This was then subsumed into MBIE upon establishment of that agency, using secondary legislation in 2012.

When science funding sits inside an agency whose main job is economic growth, the priorities can tilt toward projects with clear commercial returns, export gains, or industry uptake. Those outcomes matter, but science also serves longer-term public needs, healthy soils and water, resilient farming systems, risk reduction, and public health. This involves long-term, interdisciplinary monitoring and research, and this work doesn't always produce quick financial payoffs.

When the same agency is expected to drive growth and decide research priorities, some of this quieter, foundational work can struggle to get traction. Big focuses of an agency can drown out more important issues. Climate change work connected to genetic traits and patents is more important - i.e. easier to access funding for – than long-term funding allocation for on-the-ground monitoring and research to understand changing seasonality and climate over time.

A more balanced approach would ensure science investment reflects both economic performance and the long-term wellbeing of land, people, and productive systems.

[7] PATENT BIAS IN AGRICULTURAL INNOVATION: GENETICS OVER SYSTEM HEALTH

New Zealand's science and research system is focussed on being an *innovation system* – opne that is oriented toward patentable outputs. This defaults to favour genetic solutions: new cultivars, traits, and genomic tools, because they generate intellectual property and clear commercial pathways. While these advances can be valuable, they are just a part of the picture.

Yet science funding programmes have not adequately reflected real scientific challenges that face agriculture today. Comparatively less investment has flowed into input quality (soil biology, micronutrient balance, seed health), integrated pest and disease prevention, and ecological management practices that reduce risk but do not produce proprietary products.

This focus has kept science and research's attention from strengthening system resilience to treating symptoms, even though input quality and preventive management often determine crop health, pest pressure, and long-term productivity, because there was less funding available for these lines of inquiry.

[6] CURRENT SCIENCE POLICIES WRITE OUT STEWARDSHIP IN AGRICULTURE

Over 20-30 years, successive science funding settings have emphasised contestability, commercial pathways, and measurable economic return, and that policy architecture has defined what gets studied. This is clearly outlined in the Ministry of Business and Innovation and Employment's *National Statement of Science Investment 2015-2025*.

When funding criteria privilege novelty, intellectual property potential, and industry co-investment, research that focuses on system maintenance: soil biology, resilience, nutrient density, pest ecology, extension, and regional adaptation, struggles to compete. That isn't rhetoric; it is a predictable outcome of incentive design. The real impact is that public-good research gets pushed down the funding ladder, no matter how much the funding committee may appreciate it, because it is out of the scope set by the *National Statement of Science Investment 2015-2025* which is then also outlined in terms of reference for the funding application, that the scientists have to comply with.

This shift has reflected a global fashion: long-term reforms that consolidated funding control, reduced baseline public-good capacity, and required science providers to secure external revenue (even though New Zealanders do not see evidence of analysis of return on investment for these 'innovation' research schemes).

As a consequence, programme design has increasingly favoured projects aligned with growth and innovation narratives, while the institutes have focussed on growing research that can generate royalites, so that they can sustain their business model no matter the change science policy.

This distorts the capacity of the science and research system – to in the public interest - identify and address real agricultural challenges. Knowledge that protects biological capital and reduces long-term risk is often embedded indirectly within larger programmes rather than funded as a primary objective.

International comparisons suggest alternative balances are possible. Jurisdictions such as the EU, the Netherlands, and parts of Australia maintain dedicated funding streams for soil health, integrated pest management, agroecology, and extension networks alongside innovation programmes. These are treated as productivity infrastructure, akin to roads or irrigation, rather than discretionary environmental add-ons.

Where such ring-fenced funding exists, adoption rates improve and long-term input dependence declines.

In New Zealand, the policy framework that has been set by MBIE also weakened the connective tissue between science and practice. Extension services have thinned, and the feedback loop from farm to laboratory is less institutionalised than in earlier decades. This reduces early detection of emerging system stress and slows adaptive responses.

This is why Make New Zealand Healthy (MNZH) incorporate a principle at the top of our recommendations:

> *Science in Aotearoa New Zealand should be guided by kaitiakitanga: the stewardship and protection of soils, waters, ecosystems, and human wellbeing for present and future generations, through knowledge that sustains resilience, restores biological integrity, and supports enduring prosperity.*