



The benefits of glyphosate to New Zealand

NZIER Report to Agcarm
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Foreword

Agcarm is the voice of the animal and plant health industries of New Zealand. We represent the companies that manufacture, distribute and sell plant protection and animal health products. Our mission is to embrace innovation and drive sustainable food production.

Glyphosate is widely used in New Zealand by farmers, land managers and consumers. This report highlights the value and importance of glyphosate to the New Zealand economy and environment.

For more than 40 years, farmers have depended on glyphosate as an efficient and cost-effective tool for the safe control of problematic weeds. The estimated attributable value of glyphosate based on its use to the agriculture sector is between \$2.7 billion and \$8.6 billion.

In addition to its economic benefit and ability to control a broad-spectrum of weeds, it has extensive environmental benefits for farmers and consumers.

Glyphosate has helped farmers adopt 'conservation tillage' which allows them to disturb less soil and minimise their time on the tractor. This has significant benefits for soil health and minimising nutrient runoff.

It is the product of choice for most regional councils because it offers effective and safe weed control, is low-volatility and degrades quickly in soil.

Glyphosate has been the subject of over 800 studies, all of which have confirmed its safety. It continues to be rigorously tested by regulators in New Zealand and throughout the world, with over 160 countries approving its safe use.

Regulatory agencies agree that glyphosate, when used per label directions, does not present an unreasonable risk of adverse effects to humans, wildlife or the environment.

That doesn't mean that you should be careless with crop protection products. Care is still needed in the use of all agrichemicals as it is for many other everyday substances. It's important to use them according to label directions - keep them out of the reach of children, avoid spray drift and wear the correct protective equipment.



Mark Ross
Chief Executive, Agcarm

Key points

Objective

This report provides a preliminary estimate of the benefits of glyphosate for New Zealand land-based industries.

Main findings

Glyphosate is one of the cornerstone tools of New Zealand land-based industries and has multiple benefits:

- » Glyphosate is a broad-spectrum herbicide that can eliminate nearly all weeds, which many other herbicides cannot.
- » The costs associated with glyphosate are low, and its effectiveness is much greater than alternatives.
- » It is an alternative to more toxic herbicides, which are being removed, particularly in forestry.
- » It has many indirect environmental benefits since it avoids ploughing and leaving the ground fallow (e.g., reduces dust, reduces nitrate runoff, increases soil moisture, reduces compaction, and reduces breakdown in the soil).

Table 1 summarises the likely contribution of glyphosate. To examine the importance

of glyphosate to New Zealand's land-based industries, we have looked at the impact of all herbicides and their contribution. While stopping the use of glyphosate is not equivalent to stopping the use of all herbicides, the impact is likely to be similar because¹:

- » If glyphosate is removed from use, other more toxic herbicides would potentially also be removed. Less toxic herbicides may remain but are likely to be less effective.
- » Glyphosate is low cost compared to other weed control options and effective (because of its broad-spectrum nature).

Note that the quantitative estimates detail current production attributable to herbicides, based on current use.

The quantified section does not seek to set out changes in practice that may partly offset the absence of herbicides. However, the non-quantified section does comment on what the use of glyphosate avoids.

¹ The outcome of removing glyphosate will be difficult to predict, e.g., more toxic chemicals could be used; less toxic ones could be used with less effectiveness; there could be a change in farming practice that results in lower production/higher costs; or some combination of these options.

Table 1 Total contribution of herbicides
Average 2018–2020. NZ\$ billions

Crop	Estimated attributable value based on current use	Impact ratio on crops using herbicides	Degree of reliance ¹
Horticulture	Not estimated	Between 0 - 5%	Lesser, but important reliance on herbicides
Vegetables	\$0.5 billion and \$0.6 billion	Between 25 - 30%	Large herbicide reliance
Forestry	\$0.53 billion and \$2.0 billion	Between 7 - 27%	Medium to large reliance on herbicides
Pasture	\$1.4 billion and \$5.6 billion	Between 5 - 20%	Medium to large reliance on herbicides
Field crops	\$0.3 billion and \$0.4 billion	Between 14 - 19%	Large reliance on herbicides
Total	\$2.7 billion and \$8.6 billion	Between 6 - 19%	

Notes

(1) The higher the reliance, the higher the impact.

Source: NZIER

Specific benefits of glyphosate

Use	Impact	Comment
All land-based industries	Broad-spectrum	Reduces costs and increases the competitiveness of New Zealand agriculture. Kills most weeds, particularly perennial weeds, which many herbicides do not.
Forestry	Broad-spectrum	Seen as a replacement for other more toxic chemicals.
Amenity ² – urban pathways, parks etc. Land around essential facilities e.g., railway land	Cost, safety, and aesthetics	Control costs likely to increase fourfold with worse outcomes. Other benefits include aesthetics and safety, with weed removal improving visibility on roads/intersections.
Direct drilling	Broad-spectrum	Used in tandem with direct drill causing minimal soil disturbance.
Environmental benefits	Minimises ploughing. Improves sustainability of native species by removing competing weeds	Reduces dust and nutrient runoff. Increases moisture loss, compaction, and soil breakdown. Useful for conservation purposes.

Notes
(2) Amenity land is a plot of land used for parks, gardens and other public areas.

Source: NZIER

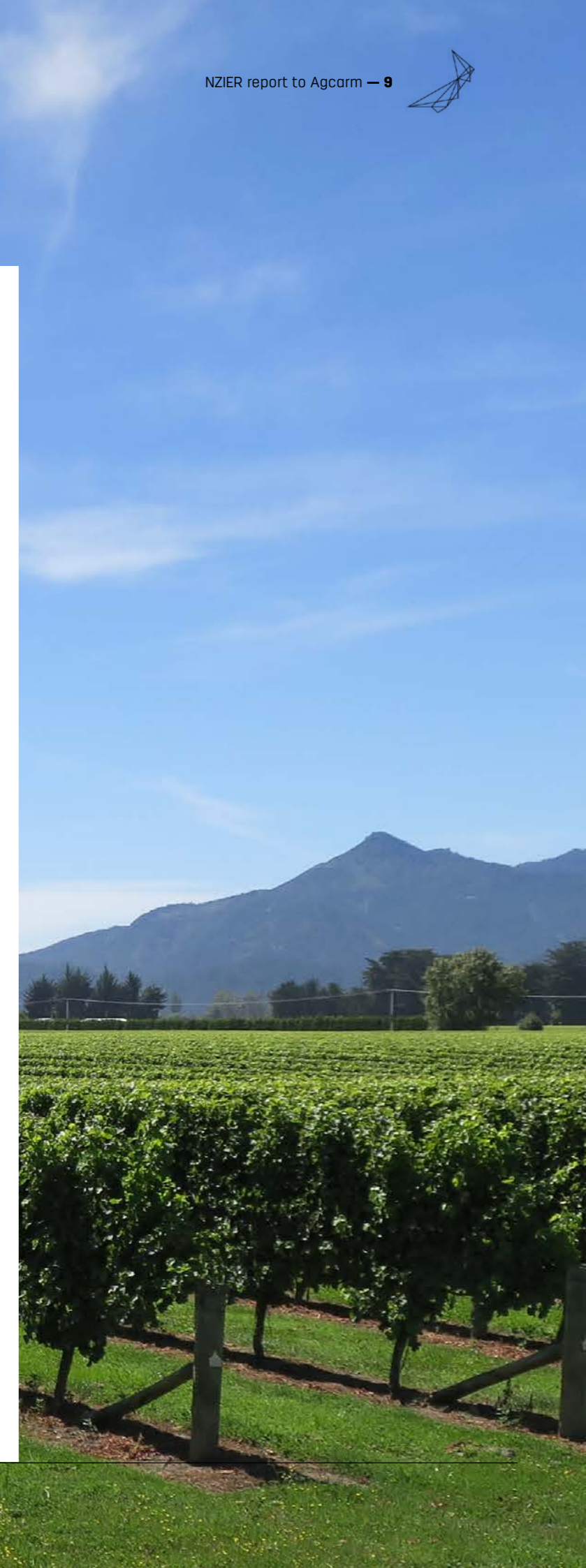
Caveats

We must stress that the scope and detail of the quantified analysis is constrained by limitations on the available information on different aspects of the use of herbicides.

We have indicated the likely quantitative and qualitative impact of removing glyphosate from use.

The potential bias can influence the robustness of the analysis in the information provided and the potential magnitude of unquantified benefits, such as the impacts of minimising ploughing (from using glyphosate).

The figures in this report should be regarded as an order of magnitude calculation rather than a definitive measure, since there is uncertainty about how land-based managers would behave in response to a change in the availability of herbicides.





Contents

1.	The importance of glyphosate	12
2.	Overview of the sector	15
2.1.	New Zealand agriculture is required to be efficient	
2.2.	Crop protection underpins efficient agriculture	
2.3.	What is glyphosate used for?	
3.	Following previous methodologies	18
4.	Reliance on herbicide	20
4.1	Approach	20
4.2	Counterfactual	20
4.3	Stakeholders	21
5.	The benefits of glyphosate	22
5.1	Adjustment factors required	23
5.2	Impact of removing all herbicides	24
6.	Implications	32
6.1	The unique importance of glyphosate to New Zealand farmers	32
6.2	Removing glyphosate will have the same impact as removing all herbicides	34
7.	Conclusions	35
8.	References	37

Tables

Table 1	Total contribution of herbicides	7
Table 2	Total crop value and estimated impact ratio of the reliance on herbicides	24
Table 3	Herbicide contribution to forestry	25
Table 4	Herbicide contribution to pasture	26
Table 5	Herbicide contribution to vegetables	28
Table 6	Contribution to field crops	29
Table 7	Total contribution of herbicides	31
Table 8	Specific benefits of glyphosate	34



1 | The importance of glyphosate

Agcarm has asked the NZIER to investigate and consider the value of the crop protection product glyphosate to the New Zealand economy. In particular, the contribution of glyphosate as a cornerstone tool for farmers in modern agriculture.

Glyphosate is the active ingredient in a large number of different herbicides. It is used to get rid of unwanted plants. It interrupts a metabolic pathway within a plant and prevents the production of certain amino acids that the plant needs to survive. By cutting off that pathway, it kills the plant.

In New Zealand, it is primarily used to get rid of weeds on pasture and for crop renewal. In forests, it is used to get rid of competing vegetation, i.e., any kind of vegetation that will directly compete with trees grown as a crop. It is also used in amenity weed control and to clear corridors for trains and around other essential infrastructure.

According to the Agricultural Compound and Veterinary Medicine (ACVM) register, 21 companies have between them 92

glyphosate-based products on the New Zealand market. Based on Agcarm sales data, glyphosate is estimated to represent 11 percent of total herbicide sales and 5.5 percent of all pesticide sales. Overall, herbicides are estimated to represent 45-50 percent of all agricultural sales.

This report identifies glyphosate's contribution to the New Zealand economy and investigates the potential economic impacts of stopping glyphosate use.

Glyphosate is important for New Zealand for these reasons:

- » Its broad-spectrum non-selective nature and ability to kill annual and, more importantly, perennial weeds.
- » Glyphosate is rapidly absorbed by the soil² and binds very tightly to sediment and soil. For this reason, glyphosate residues are not likely to leach into groundwater.
- » Glyphosate's properties and its low toxicity have revolutionised agriculture in New Zealand. Its efficiency in killing weeds and its use in tandem with direct drilling has streamlined pasture renewal processes, increasing productivity and production.

The purpose of this report is to demonstrate the benefits of the continued use of glyphosate and its contribution to the efficiency of farming.

Our analysis draws on information from the Crop Protection Product industry, peer-reviewed journals, industry information, previous reports, and other sources.

The analysis is intended to give policymakers an indication of the costs of withdrawing glyphosate from the market.

² <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/glyphosate>



2 | Overview of the sector

2.1 New Zealand agriculture is required to be efficient

New Zealand agriculture operates in an unsubsidised environment which requires farmers to be as efficient as possible. Unlike farmers in Europe and the United States, there are few subsidies.

In those regions, it may be possible to remove substances such as glyphosate and compensate farmers (more likely in the United States).

In New Zealand, we rely on glyphosate as a low cost, safe and efficient way to renew pasture and croplands, allowing the quick and effective introduction of new technology into our land-use through improved grasses and crops.

In this way, New Zealand has maximised its farming potential and competitive advantage.

2.2 Crop protection underpins efficient agriculture

The use of crop protection products underpins New Zealand agriculture and forestry because of their impact on productivity (labour productivity and yields).

Over the long term, the withdrawal of those products would undermine New Zealand's comparative advantage in land-based products.

Further, the industry is continually pushing to provide new active ingredients with lower toxicity.

2.3 What is glyphosate used for?

Glyphosate was first patented in the United States and has been used in New Zealand since the 1970s. It is sold under many different brand names, but Round-up is the most recognisable.

Glyphosate is used in several markets:

- » Pasture renewal
- » Crop rotation
- » Tree and vine horticulture
- » Forestry
- » Council and corridor control
- » Private gardeners.



2.3.1 Crops and pasture are where glyphosate shines

By far the biggest market is pasture renewal and crop rotation. To improve pastures, remove perennial weeds, and introduce high yielding grasses (new technologies) into pasture, farmers continually renew their pastures. While we do not have any up-to-date figures on how much pasture is renewed per annum, the Pasture Renewal Charitable Trust suggested a figure of 10 percent. Even five percent would be significant.

Reducing weeds in the crop is critical since weeds can substantially reduce crop yields. In some cases, growing fodder crops without using glyphosate makes them uneconomic.

Glyphosate is a key tool in this process since:

- » The pasture designated for renewal can be cleared of all grasses and weeds by applying glyphosate.
- » A second opportunity to remove weeds is by using the stale seedbed technique. After the first glyphosate application, a second can be applied prior to pasture or crops being planted. By waiting and allowing a new flush of weeds to come through, the farmer can maximise the weed kill³.
- » All this can be done with minimal disturbance of the soil.
- » At this point, the pasture or crop can be directly drilled into the soil.

This is a huge advance on what occurred prior to the introduction of glyphosate.

Typically, a farmer had to plough the field and leave the ground fallow for three to four months. Old ewes were then brought into the paddock to control weeds. Perennial weeds such as couch were a major problem and hampered efficiency.

Glyphosate is mainly used in New Zealand to prepare the crop/pasture for planting. It is not generally used on crops since we do not grow GMO crops bred for glyphosate resistance.



2.3.2 Use in forestry

Glyphosate is used in forestry to control competing vegetation, particularly at the establishment stage. Kogan and Alister (2010) show that under Chilean conditions, the lack of weed control at forest tree establishment results in an average of at least 60 percent less biomass accumulation during the first year of growth of radiata pines. Glyphosate offers a solution because of its broad-spectrum nature.

Kogan and Alister claim that glyphosate offers a series of advantages because of its impact on annual and perennial weed groups. Also, its efficacy on some undesirable woody vegetation makes glyphosate a very useful herbicide for the establishment of forests.

There is continued interest in New Zealand in the potential of non-residual herbicides for effective forest weed control because of the general dynamic nature of pesticide



2.3.4 Amenity use

Glyphosate is a cost-effective tool to control weeds within urban boundaries and along rail and road corridors. The urban weed control market (dominated by glyphosate) is estimated at \$30 million.

Other benefits include aesthetics. The ability to control weeds efficiently and effectively means that staff can focus on other aspects of improving public spaces. There may also be a safety issue where weed removal improves visibility on roads/intersections and essential infrastructure.

We note that the Christchurch City Council, after banning glyphosate three years ago, now has to increase its weed control bill by over four and a half times. Further, there are complaints that weed control is much less effective⁴.



2.3.5 Private gardeners

The use of glyphosate by private gardeners is popular, with 66 percent of garden herbicides listed on the two main DIY retailer websites (Bunnings, Mitre 10) containing glyphosate, thus making it by far the most common active ingredient. The remaining 34 percent of herbicides are a combination of selective, natural, and woody-weed type weedkillers.

regulations globally. This interest is partly attributed to the requirement for certified forest growers to continually strive to reduce dependence on the use of herbicides for weed control.

In New Zealand, Rolando et al. (2017) demonstrate that glyphosate could potentially replace more toxic chemicals, such as terbuthylazine and hexazinone.



2.3.3 Use in tree and vine crops

Glyphosate is the main herbicide used in New Zealand for weed control under fruit and vine crops. The use of glyphosate to control ground cover between vines and trees is highly effective, especially if using animals to control ground cover is not possible due to the various sprays used on trees/vines.

Glyphosate is important when establishing new blocks as some weeds can potentially smother new trees.

There are benefits from biosecurity and phytosanitary use in horticulture (fruit) production e.g., growers are motivated to control weeds that could harbour disease or insect pest populations.

Tomatoes New Zealand has said that control of nightshade weeds around glasshouses is important as they present a transmission pathway for diseases and pests to infect/infest crops that are also solanaceous.

Berry production also requires the use of glyphosate as a means of controlling weeds.

³ See for example: <https://extension.umd.edu/resource/stale-seedbed-technique-relatively-underused-alternative-weed-management-tactic-vegetable-production>

⁴ <https://www.stuff.co.nz/environment/110484203/weedkiller-ban-busting-christchurchs-budget-for-pest-plant-eradication>



3| Following previous methodologies

The methodology set out in this report is similar to work on crop protection products (CPPs) used overseas and in New Zealand. The main difference between this report and other reports is that we focus on herbicides while others look at the potential impact of the full range of CCPs.

Below we examine some of these studies.

Giera and Bell (2009), in a study for the then New Zealand Ministry of Agriculture and Forestry (MAF), estimated the total cost of pests and weeds was approximately \$2.1 billion. While no estimate was given to show the impact of CPPs, the large scale weed

and pest problem suggest that the beneficial impacts of CPPs in suppressing weeds and pests are substantial. This shows the magnitude of the issues that land-based industries face as they combat weed problems.

In the United States, Mark Goodwin Consulting (2011) values selected crops that are significantly supported (and therefore attributable) to CPPs. Using Gianessi and Rieger (2006) methodology, they determined the proportion of crop value attributable to CPPs.

The impact in the United States is large. The direct contribution of CPPs is approximately US\$81 billion, with flow-on benefits of US\$166.5 billion across at least 20 industries, and about one million domestic jobs depend on these products.

Along the same lines, CropLife Canada (2011) examined CPP's contributions and plant biotechnology. It quantified the yields between conventional and organic crops. The difference in yields multiplied by the price of the crop illustrates the impact of CPPs. This is approximately CA\$8 billion⁵.

In Australia, a cost-benefit approach was taken to weed management in Queensland (AEC Group, 2002). For every A\$1 spent on pest and weed management, the return was between A\$10 and A\$27.

Other studies in Australia found similar results. Deloitte Access Economics (2013, 2018) estimated the contribution of the CPPs in Australia using the Mark Goodwin Consulting (2011) methodology. Estimates suggest a worth of A\$2.3 billion to the Australian

economy and that A\$20.6 billion of agricultural output can be attributed to the use of CCPs.

NZIER (2019) examined the importance of CPPs for the New Zealand economy. It showed that while the CPP industry was relatively small, its reach across the New Zealand economy was significant, particularly in pasture. The impact of removing CPPs from use would cost the New Zealand economy between \$7.5 and \$11.4 billion per annum. The bulk of this cost is associated with the withdrawal of herbicides.

In all these cases, the impact of CPPs is substantial. The literature demonstrates that CPPs underpin land-based industries in Canada, Australia, United States, and New Zealand, to the point where the CPP industry is one of the cornerstones of success in modern agricultural production.

⁵ Note that this is the impact of synthetic/non-organic CPPs only, not the impact of CPPs as organic production still uses some CPPs, so saying that it is the impact of all CPPs, is an underestimate.



4| Reliance on herbicide

4.1 Approach

We have used a benefit framework to examine the value of glyphosate for New Zealand.

It is a long-established technique intended to identify the economic efficiency of a proposed project, proposed action, or policy change. Efficiency is broadly about maximising outputs obtained from available inputs, but different variants are considered in economics:

- » Technical efficiency refers to the most cost-effective way of providing a product. If removing glyphosate increased costs, it increases the costs per unit of food, increases Council rates for control of weeds, and reduces international competitiveness of domestic agriculture.
- » Allocative efficiency refers to the ease with which resources can move across businesses to their most productive uses. For instance, the removal of glyphosate reduces the capacity to use land since it is required to remain fallow. Alternatively, increased labour to remove weeds prevents resources from moving to other parts of the business where they could be usefully employed.
- » Dynamic efficiency refers to innovation and changing to new activities over time. Removing glyphosate is likely to limit farmers' abilities to innovate as costs increase.

If banning glyphosate increases costs, it will reduce technical efficiency. To the extent that it halts the movement of resources to productive activities, it also reduces the allocative efficiency of resource use. If it introduces less efficient ways of farming, it also reduces dynamic efficiency over time.

The benefit analysis compares effects and outcomes associated with removing glyphosate from use against what would have occurred under a counterfactual, without the proposed change.

This counterfactual can be described as a projection of the status quo into the future as supply and demand conditions change.

4.2 Counterfactual

A scenario is required where benefits 'with' glyphosate is measured (the counterfactual). This involves examining in detail the current status quo. It includes a commentary on what exists on the ground now (i.e., the use of glyphosate and existing practice).

The counterfactual also includes examining the likely future policy developments. To establish a realistic base case, the aim is to identify how policies are likely to change over the next ten years.

The counterfactual used here is a business as usual approach where the withdrawal of glyphosate is used as a baseline to measure benefits associated 'with' glyphosate.

Setting up the counterfactual assumes:

- » New Zealand farmers still have access to glyphosate.
- » The current settings around its efficacy remain at a similar level.
- » The costs remain unchanged.

There are potentially several credible counterfactuals. The one we assume here is open to question and should be treated as a 'work in progress'. We treat this counterfactual as a tentative 'peg in the ground'.

We assume that glyphosate continues to be used the same way it is now. We understand that there will be variations in use across regions and industries.

4.3 Stakeholders

This is a 'partial' benefit analysis as some effects will be too difficult to quantify reliably. For instance, there may well be benefits along the marketing chain from the increased volumes of product 'with' glyphosate. While we can describe these benefits (i.e., reduced cost per item), it is not feasible to quantify them in economic terms, given time and resources.

For practical reasons, the analysis has concentrated on effects that are readily quantified, valued and described qualitatively. Not the effects that cannot be readily quantified or valued.

From the feedback on previous work, international literature, information from the CPP industry, and other published material, several benefits have been identified that need to be considered, whether they can be quantified or not.

Several groups are important:



Farmers.

They are a major beneficiary of glyphosate. Glyphosate has revolutionised farming over the past 40 years, improving efficiency and improving competitiveness.



General public.

A benefit in lower food prices as glyphosate has allowed farmers to increase the volume of produce with lower production costs.



Improved economy.

It has allowed the New Zealand economy to grow as international demand for New Zealand products has grown. This provides benefits for the government (increased tax take) as well as individuals.



Regulators.

Regulators need to weigh the costs and benefits of the withdrawal/continued use of chemicals given the current scientific knowledge, the context of products used, and their economic, social, cultural, and environmental impacts.



5| The benefits of glyphosate

This section examines the impact of herbicides on New Zealand's land-based industries. It estimates the reliance of these industries on herbicides⁶.

For some land-based industries (e.g., fodder crops), it would be difficult to grow commercial quantities of a crop without glyphosate. In most other cases, it would be possible, but costs would be much higher, and yields would be much lower (therefore, less profitable), and the impact on the economy would be substantial. The estimates of land-based production reflect this fact.

To illustrate the impact of glyphosate, we will run a scenario setting out the contribution of all herbicides (including glyphosate) to land-based production. We are not seeking to run an experiment to remove herbicides from the economy since the economic

impact would be difficult to gauge. Such a scenario would involve changes in practice that may partly offset the absence of herbicides e.g., farmers might switch to importing much more palm kernel to compensate for reduced use of pasture and cereal crops.

We will report estimates that show the current production attributable to herbicides, based on current practice.

To illustrate the attribution, we have used the United States, New Zealand, and Australian studies (Deloitte Access Economics 2013, 2018; Gianessi L., 2009; and Mark Goodwin Consulting, 2011; NZIER, 2019) as guides to the approximate value as well as domestic estimates. Those reports detail the value of selected crops attributable to herbicides.

This is discussed in the following subsections.

5.1 Adjustment factors required

NZIER (2019) sets out the modifications required given the different agricultural industries in Australia, New Zealand, and the United States. To recap, these issues revolve around:

- » New Zealand having a temperate climate with higher rainfall than many parts of Australia and the United States. This means some weeds grow well relative to warmer climates, such as Australia.
- » New Zealand is a small island (relative to Australia). Despite increasing amounts of trade, many invasive weeds are not present in New Zealand.
- » New Zealand has a wide variety of soils from very young to old (although not as old as Australia). The wide variety of soils has implications for fertiliser use, competition from weeds, and the use of herbicides.
- » Farmers in both Australia and New Zealand have, over recent decades, sustained incremental increases in crop and livestock production. At the same time, there have been adjustments in industries towards economies of scale, mechanisation, specialisation, and higher use of inputs.

- » New Zealand agricultural labour costs are about 70 percent of their Australian counterparts. Australian producers are more likely to substitute herbicides for labour. New Zealand agricultural labour costs are higher than those in the United States.

The differences set out above translate into differences in herbicide use. Application rates for all herbicides differ per unit between countries. Also, as New Zealand has a large number of different soil types and micro-climates, applications of herbicide products may vary between regions.

5.2 Impact of removing all herbicide

To gain perspective of the New Zealand situation, we interviewed staff of crop protection companies and considered the Australian and United States data. Further, New Zealand agriculture has a different mix of products with a strong emphasis on pasture and forestry use of herbicides.

These differences are accounted for in the calculation of the proportion of the total value of production of each broad category attributable to herbicide use in Table 2 overleaf.

⁶ This is a gross value analysis, not a GDP impact analysis.

Table 2 Total crop value and estimated impact ratio on the reliance on herbicides
Average between 2018–2020: Estimated total value domestic and exports.

Crop	Estimated value of total crop: domestic and export value (NZ\$)	Impact ratio on crops using herbicides	Degree of reliance
Horticulture	\$6.5 billion	Between 0 - 5%	Small reliance on herbicides
Vegetables	\$1.9 billion	Between 25 - 30%	Large herbicide reliance
Forestry	\$7.6 billion	Between 7 - 27%	Medium to large reliance on herbicides
Pasture	\$27.9 billion	Between 5 - 20%	Medium to large reliance on herbicides
Field crops	\$2.1 billion	Between 14 - 19%	Large reliance on herbicides
Total	\$46.4 billion		

Source: NZIER

We have used data from a variety of sources to estimate impacts. These include:

- » Domestic spend on production crops (NZIER 2015).
- » Statistics NZ and Fresh Facts (various years) for current export value.
- » Forestry journal articles.

The aim was to average the crop value, processing, and exporting over several years to estimate likely impacts. This also helps to take account of year-to-year fluctuations in weather conditions.

5.2.1 Value of herbicides: methodology

In this study, we have examined six categories. The average herbicide contributions to the production of each crop category have been estimated based on the mix of individual crops. Adjustments have also been made based on interviews and overseas impacts.

Below we look at each sector separately.

Forestry

The main plantation forestry crop is *Pinus radiata*, comprising 90% of the area planted and 93% of the harvested volume. Douglas fir is 4% of the planted area with other exotic forests of California Redwoods, Eucalyptus, Cupressus, and other minor species.

Controlling vegetation that competes with the establishment of forests planted for timber or fibre production is vital. Wagner et al. (2006)

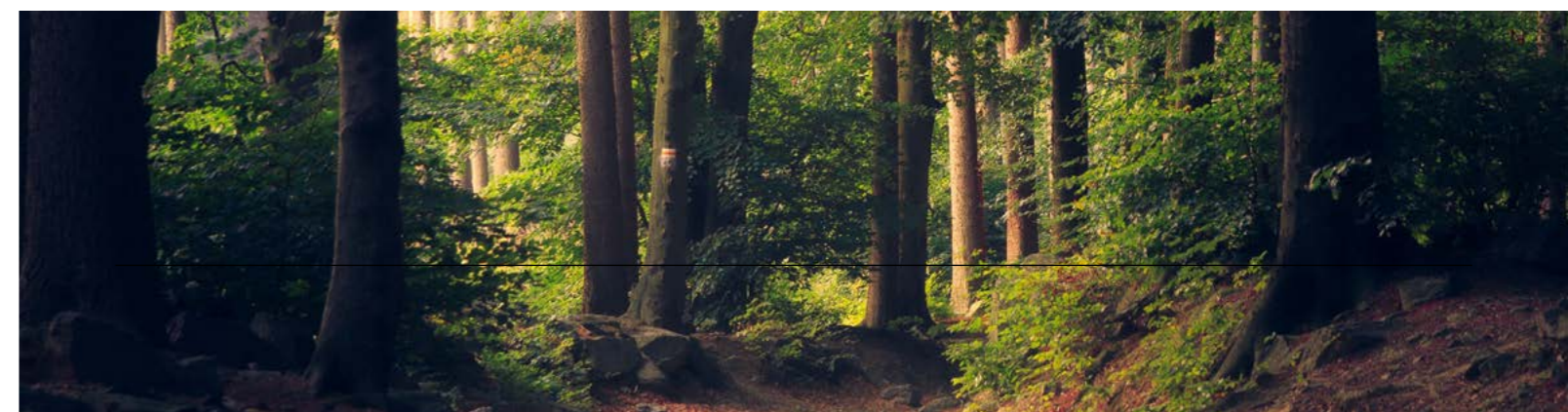
report that the volume improvements from early weed control are between 7% and 27% in New Zealand conditions.

According to Rolando (2013), glyphosate is the most widely used active ingredient in pre-plant weed control. In addition, forestry is becoming more reliant on glyphosate (Rolando et al. 2017).

Table 3 Herbicide contribution to forestry
Average between 2018 and 2020.

Crop	Estimated value (NZ\$)	Impact ratio on crops using herbicides	Degree of reliance
Forestry	\$0.53 billion and \$2.0 billion	Between 7 - 27%	Medium to large reliance on herbicides

Source: NZIER, Rolando et al. (2013)





Pasture

Pasture is essential to the New Zealand economy. Without productive pasture, the economy would struggle to deliver the economic growth gains it has enjoyed over the past twenty years.

Ryegrass, clover, plantain, chicory, browntop, cocksfoot tall fescue etc., have a major impact on New Zealand livestock farming. Pasture provides around 90–95% of dietary/energy requirements for livestock.

A recent AgResearch report (Ferguson et al. 2019) highlights the importance of pasture and puts pasture losses at between \$1.7 billion and \$2.3 billion. It reinforces the importance of herbicides for keeping production at current levels, given the constant struggle to keep weeds under control.

Herbicides, particularly glyphosate, are the cornerstone of modern pasture

management and are used chiefly in pasture renewal – removing all vegetation areas targeted for new pasture.

The benefits of herbicides (particularly glyphosate) in supporting pasture could be in the range of 5–20% of livestock production, processing and exporting (interviews).

We believe that this is conservative, given that controlling weeds in one year assists in controlling them in subsequent years.

Typically, the more intensive the agriculture (e.g., dairying), the more likely that impacts will be higher because the returns are higher from using herbicides.

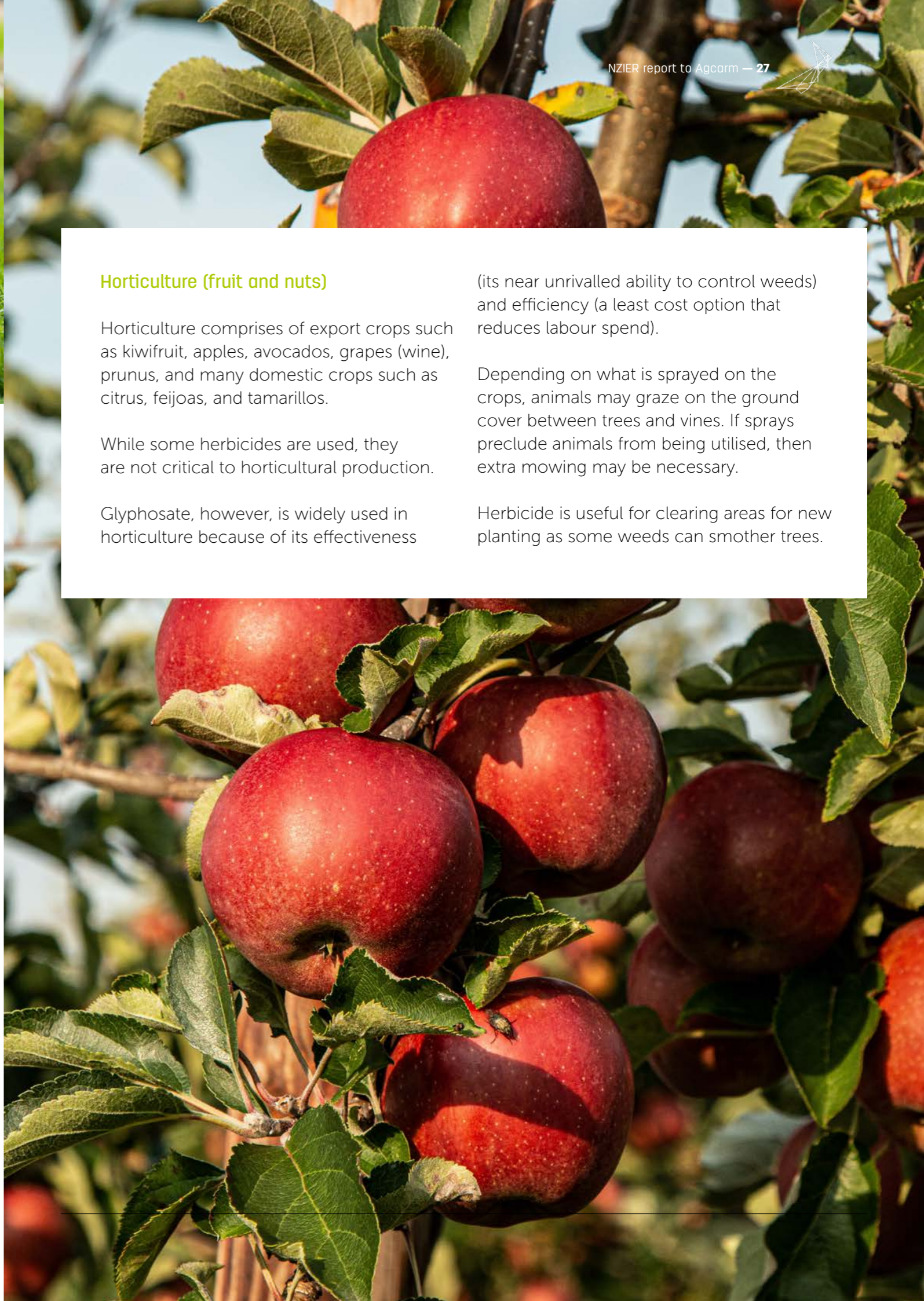
In this situation, we have not compared the Australian and the United States use of pasture since their livestock systems are quite different (grain-fed). Therefore, the importance of pasture is much less.

Table 4 Herbicide contribution to pasture

Average 2018–2020. This includes the impact on animal production (dairy, sheep and beef, wool, deer, and other livestock)

Crop	Estimated value (NZ\$)	Impact ratio on crops using herbicides	Degree of reliance
Pasture	\$1.4 billion and \$5.6 billion	Between 5 - 20%	Medium to large reliance on herbicides

Source: NZIER



Horticulture (fruit and nuts)

Horticulture comprises of export crops such as kiwifruit, apples, avocados, grapes (wine), prunus, and many domestic crops such as citrus, feijoas, and tamarillos.

While some herbicides are used, they are not critical to horticultural production.

Glyphosate, however, is widely used in horticulture because of its effectiveness

(its near unrivalled ability to control weeds) and efficiency (a least cost option that reduces labour spend).

Depending on what is sprayed on the crops, animals may graze on the ground cover between trees and vines. If sprays preclude animals from being utilised, then extra mowing may be necessary.

Herbicide is useful for clearing areas for new planting as some weeds can smother trees.

Vegetables

Vegetable crops are mainly for domestic consumption and include broccoli, carrots, onions, and potatoes. Vegetable exports (mainly through Australian supermarkets) have increased dramatically over the past 20 years.

In many cases, the contribution of herbicides is large since weeds are a significant problem. Without herbicides to clear the weeds, the chance of weed problems is very high. Production without herbicides could be restricted by up to 50% in some cases (interviews).

Table 5 Herbicide contribution to vegetables
Average between 2018 and 2020.

Crop	Estimated value (NZ\$)	Impact ratio on crops using herbicides	Degree of reliance
Vegetables	\$0.5 billion and \$0.6 billion	Between 25 - 30%	Large herbicide reliance

Source: NZIER

Field crops

Field crops include wheat, barley, fodder crops (fodder beet, maize, corn) and other crops.

Within this category of crops, the proportion of value attributed to herbicides ranges from 20% for maize to 100% for fodder beet. The value contribution of herbicides is estimated at between 14 - 19%.

Table 6 Contribution to field crops
Average between 2018 and 2020.

Crop	Estimated value (NZ\$)	Impact ratio on crops using herbicides	Degree of reliance
Field crops	\$0.30 billion and \$0.40 billion	Between 14 - 19%	Large reliance on herbicides

Source: NZIER

Others

A small number of crops, mainly flowers, seeds and bulbs, are also dependent on herbicides. We have not valued these.

Other uses

Glyphosate is particularly effective for amenity uses. Many councils use glyphosate as a cheap and effective weed control tool. Those who control essential facilities also use glyphosate e.g., for rail corridors and control of weeds around power lines.

Councils that have banned the use of glyphosate have had significant increases in their budget and poor-quality results⁷.

This mirrors farmer concerns that their costs will go up and their ability to control perennial weeds will diminish.

5.2.2 Total contribution of herbicide to crops

The total value of herbicides to New Zealand land-based industries is the sum of the contribution to each of the categories discussed.

In aggregate, it is estimated that between NZ\$2.7 billion and NZ\$8.6 billion of vegetable, forestry, pasture, and cropping production is attributable to the use of herbicides, or between 6% and 19% of the total value of production, processing, and marketing (see Table 7).

Table 7 Total contribution of herbicides
Average 2018–2020. NZ\$ billions.

Crop	Estimated contribution of herbicides to domestic and export value	Impact ratio on crops using herbicides	Degree of reliance
Horticulture	Nil	Between 0 - 5%	Small reliance on herbicides
Forestry	\$0.53 billion - \$2.0 billion	Between 7 - 27%	Medium to large reliance on herbicides
Pasture	\$1.4 billion - \$5.6 billion	Between 5 - 20%	Medium to large reliance on herbicides
Vegetables	\$0.5 billion - \$0.6 billion	Between 25 - 30%	Large herbicide reliance
Field crops	\$0.30 billion - \$0.40 billion	Between 14 - 19%	Large reliance on herbicides
Total	\$2.7 billion - \$8.6 billion	Between 6 - 19%	
Amenity	Four-fold increase in control costs likely, with worse outcomes.		Heavy reliance on herbicide.
Private garden	Small user		

Source: NZIER

⁷ <https://www.stuff.co.nz/environment/110484203/weedkiller-ban-busting-christchurchs-budget-for-pest-plant-eradication>



6 | Implications

In the previous section, we looked at the contribution that herbicides make to land-based industries. This section explores the importance of glyphosate as the most critical herbicide that land-based industries have and why it is seen as one of the cornerstones of modern agriculture in New Zealand.

6.1 The unique importance of glyphosate to New Zealand farmers

Glyphosate has unique properties as one of few herbicides that can deal with perennial weeds (e.g., couch). Other more toxic herbicides can 'burn down' foliage, but they do not kill the roots of perennial weeds⁸. This makes glyphosate very useful when combined with direct drilling of the soil, i.e., under direct drilling, there is minimal soil disturbance with seeds sown directly into the ground. Direct drilling would be almost impossible without prior clearance of weeds using glyphosate since weeds are likely to compete directly with crops.

'Without' glyphosate would require:

- » The use of more toxic herbicides.
- » Removal of an option to replace more toxic chemicals, e.g., in forestry
- » Other more traditional methods would have to be employed, such as increased cultivation (ploughing).

This would:

- » Increase the costs of farming since more labour would be required to remove weeds
- » Increase nutrient runoff from farms
- » Increase factors that reduce soil quality including dust, moisture loss, compaction, and breakdown of the soil.
- » Will increase the costs and reduce the effectiveness of dealing with weeds, resulting in reduced yields and higher food prices.

Not only will the removal of glyphosate make farming a lot more difficult but:

- » The dynamic nature of the regulatory environment strongly suggests that removing glyphosate from sale means it is very likely that many other herbicides would be banned. Control of weeds will become less effective⁹.
- » Farming would have to be re-thought since glyphosate has been the key ingredient that has improved the efficiency and competitiveness of farming. Farmers without glyphosate would have to resort to farming methods such as ploughing (which creates further environmental pressures/problems) and reduces the effectiveness of weed removal.

⁸ This is also important to stop disease and pest transmission since it reduces underground host material that can carry-over soil borne diseases and pests.

⁹ There could be other outcomes, e.g., more toxic chemicals could be used, or less toxic ones could be used with less effectiveness, or there could be a change in farming practice that results in lower production/higher costs or some combination of all of those.



6.2 Removing glyphosate will have the same impact as removing all herbicides

While we cannot say that removing all herbicides is equivalent to removing glyphosate, the result is likely to be similar (Table 7). It is very unlikely that once glyphosate is removed from use, other herbicides will remain in use because of their higher toxicity.

Table 7, therefore, is a good representation of the likely attribution of the glyphosate impact.

Table 8 Specific benefits of glyphosate

Use	Impact	Comment
All land-based industries	Broad-spectrum	Reduces costs and increases the competitiveness of New Zealand agriculture
		Kills nearly all weeds, particularly perennial weeds, which many herbicides do not
Forestry	Broad-spectrum	Seen as a replacement for other more toxic chemicals
Direct drilling	Broad-spectrum	Used in tandem with direct drilling causing minimal soil disturbance
Environmental benefits	Minimises ploughing	Reduces dust, nutrient runoff, increases moisture loss, increases compaction, and increases soil breakdown

Source: NZIER

Table 8 below sets out glyphosate’s other important contributions. It is these benefits which:

- » make glyphosate one of the cornerstones of New Zealand land-based industries
- » sets glyphosate apart from other herbicides.



7 | Conclusions

To examine the importance of glyphosate to New Zealand’s land-based industries, we have looked at the impact and contribution of all herbicides. While removing glyphosate is not equivalent to removing all herbicides, the impact is likely to be similar. Removing glyphosate would also remove other more toxic herbicides.

The main benefits of continued glyphosate use:

- » Glyphosate is a broad-spectrum herbicide that can eliminate nearly all weeds, which many other herbicides cannot.
- » The costs associated with glyphosate are low, and its effectiveness is much greater than alternatives.
- » It is an alternative to more toxic herbicides which are being removed, particularly in forestry.
- » It has many indirect environmental benefits since it avoids ploughing and leaving the ground fallow (e.g., reduces dust, reduces runoff, increases soil moisture, reduces compaction, and reduces breakdown in the soil).



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