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NEW ZEALAND INSTITUTE OF ECONOMIC RESEARCH

How valuable is that plant species?

Application of a method for enumerating the contribution of selected plant species to New Zealand's GDP

NZIER report to the Ministry for Primary Industries (DRAFT)

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Key points

This report has estimated the economic values attributable to 65 different plant species in New Zealand. To value specified plant species we have used 'contribution to GDP' as the primary measure. The values estimated are a first step in assisting MPI to assess, prioritise and manage risks to the primary sectors.

A search and review of the New Zealand and international literature on the value of plants, found no previous examples of valuing the productive value of plants, which could be readily replicated for this purpose. But we did find some examples that valued the productive role of other inputs into primary production processes (such as water) which have informed this methodology.

The methodology uses the national accounting framework to estimate sectoral contribution to GDP to provide a consistent way of identifying stages in the value chain. It attributes contribution to GDP to provide a consistent way of identifying stages in the value chain (see Table below for approach). It attributes contribution to GDP to the different species to provide an indication of the relative value should a potential threat materialise.

Framework for identifying contribution to GDP with examples

2012 year

Gross Output (price multiplied by quantity at stage of production) Column I	Impact of plant species on industry (or stage in value chain) Column II	Share of gross output (attributable to stage in value chain) that contributes to GDP Column III	Impact of the plant species on GDP Column IV
Gross Output calculation at each stage of production e.g. nursery, farmgate, processing, domestic sales, and exports	Impact on other industries e.g. the impact of rye grass on livestock production is a substantial 75%	Share of gross output1[1] equals Gross Output minus Intermediate Consumption.[2] We have estimates of the share of gross output from the Input-Output tables	Gross output multiplied by impact (%) multiplied by the share of GDP equals the contribution to GDP at each stage of production
Example one: apples: nursery stage			
Nursery sales ($7.8 million)	100% (100% impact on the apple industry since nurseries supply the apple industry)	GDP share equals 0.39	$7.8m x 100% x 0.39 = $3.0 million (rounded)
Example two: brassicas for fodder at the farmgate stage for dependent industries			
Dairy farmgate ($12,241 million)	1% (estimated impact on dairy according to DairyNZ estimate)	GDP share at farmgate for livestock is 0.48	$12,241 x 1% x 0.48 = $58.8 million
Notes (1) Share of gross output (sometimes called value added in economics) includes wages, salaries, and profit less depreciation and any subsidies. (2) Intermediate consumption includes the goods and services used in making a product or service. This includes rent on capital and land, accounting, marketing and sales activity, transport, storage, maintenance and R&D etc.. Note that we do not have a direct estimate of Intermediate Consumption. We do have an estimate of contribution to the economy for each species. The residual by definition is Intermediate Consumption i.e. (Gross Output (column I) minus Impact on GDP (column IV)) .			

Source: NZIER

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This report is not a risk assessment on individual plant species. Rather, the calculations can be used as an input into economic consequence assessments.[2] Should a threat materialise, further investigation could be done to firm up the estimates. The values provided by this method can be used to augment this work informing risk and prioritisation in ex ante settings before the details of actual threats are known.

In preparing this report we have:

- compiled annual figures for gross output and the contribution to GDP derived from particular species, which can be updated readily over time to build up a time series and is able to be adjusted for fluctuations
- investigated ways of accounting for inter-temporal value components for long lived capital stock such as trees, and for presenting this in a way comparable with the annual figures
- assembled data on all identified species, identified gaps in available information and attempted to fill them by contacting those knowledgeable in the industries or from available statistics.

Noted challenges remain in filling all the information gaps and will mean some approximation in the estimates, but with further work and a consistent approach, using this methodology should still inform the relative values of different species for the New Zealand economy.

The estimation of values for so many species has revealed that:

- the most reliable statistics are for exports and some production measures and there is a dearth of information on domestic uses of plant products. The method addresses this deficiency by using ratios from the Input-Output tables and industry experts to infer what figures to use to fill the gaps
- in general, value associated with plant species increases the more that livestock industries depend on it. The largest value is for ryegrass which supports livestock production and their dependent industries: this is several times larger than other species.
- value associated with species also tends to be greater for species with high involvement in exports.

The valuations show that although the end point is the same, i.e. a measure of contribution to GDP, the means of getting there can be quite different and customised to the particular species. For instance:

- some of the bigger industries have good data supported by Statistics New Zealand's export data and industry surveys (approximately 11% of plant species examined)
- many of the crops and some crop dependent industries are produced for the domestic market where we have only industry data or industry approximations (approximately 55% of plant species examined)
- other industries fall well below the radar of statistical collection. We have obtained estimates from industry participants where possible and made assumptions where necessary (approximately 34% of plant species examined).

[2] Any assessment of economic impact of a pest will need to take into account the potential for plant/crop substitution.

Therefore, there are gaps in the evaluation for the 2012 year (the base year used). In some cases information has not been forthcoming because of confidentiality issues or lack of data. To the extent that this understates the value attributable to that species it also implies lower value at potential risk for assessing biosecurity risks. For small sectors that may not be a material issue for national assessment, but for those with more substantial economic activity further discussion with industry may be useful in improving the information on which the valuations are based.

Despite limitations in data, the method provides a way to derive estimates of value to the economy associated with particular species. It provides a ready means of scaling the value at potential risk from different biosecurity threats to particular species in ex ante settings before the details of actual threats are known, and a base for further investigation that can be done to firm up the estimates if a specific threat materialises.

This report proceeds by outlining some factors in choice of valuation method, findings of the literature review, refinements in the methodology, and current information gathered about plant species, with estimated values.

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1. Introduction

MPI seeks a methodology that can be established, validated and published, for calculating the economic activity generated by selected individual plant species in New Zealand.

The purpose of this report is to provide an overview of the indicative value of identified economically valuable plant species and show the potential impact of those plants on dependent industries (e.g. livestock industries).

The economic values calculated in this report are 'contributions to GDP'.[3] They are intended to be used:

- as inputs into the assessments of potential economic consequences of plant pests and diseases. This will enable better decisions about biosecurity risk management in the pre-border space (Import Health Standards), and in readiness and response activities. The types of assessments that could use this data include:
  - pest risk assessments (done to inform phytosanitary measures on importation pathways)
  - rapid risk assessments (done to inform incursion responses)
  - MPI's Emerging Risks System
  - MPI's organism ranking system (a system that compares the relative risks of a number of pests)
- as an improved information source that MPI can access when developing strategies to manage the biosecurity system, and prioritise targeting of resources across the system
- to help calculate the Government Industry Agreement (GIA) cost-sharing of readiness and response activities between MPI and industry signatories, between industry signatories, and for cost-recovery from non-signatories.

We have drawn on domestic studies in peer-reviewed journals, case studies, information from growers and industry specialists, publications such as Fresh Facts, past assessments, and other sources.

There remain a number of important uncertainties on valuations particularly on domestic activity since these valuations are based on industry perceptions. And while in many cases we have taken information from one source, the depth of the analysis reflects the initial scoping nature of the assessment. Whilst this study had capacity to include only a limited number of plant species, the intention is that the method can be applied to other plants in the future.

[3] That is total gross output (price multiplied by quantity) less intermediate consumption (the dollar value of converting crops into a sellable product at each stage of the production process) equals the contribution of that crop to the economy at each stage of production.

1.1. Study requirements

The methodology has been applied to a range of New Zealand's economically important plants (65 plant species) to produce a list of plant species and their value to the New Zealand economy.

MPI has specified a work stream in two parts:

1. to develop and validate an economic methodology that will enable calculation of the economic contribution to New Zealand of individual plant species. This includes:
   - reviewing existing methodologies
   - documenting the current state of information on the economic value of plant species in New Zealand
   - an explanation of the methodology for peer review and subsequent users
   - documentation of the process used to validate the method on test plant species
   - a description of the value chains of the test plant species, and documentation of the economic value for these test species
2. calculate the value of 65 of selected plant species covering:
   - their contribution to GDP
   - a description of all value chains of the selected plant species and documentation of their calculated contribution to GDP
   - details of the limitations that apply to each species' calculations.

The output is required to provide MPI with information that can be used to prioritise, assess and manage the risks to the primary sectors.

1.2. Scope and definitions of terms used

Two issues are out of scope:

- assessments of the economic impact of pests on specific plant species
- non-market activity (such as the value of national parks) and existence value or option value.

The scope of work includes:

- the value of vascular plants for commercial production activities in New Zealand. The criteria used to choose plant species was:
  - the range of species examined may include exotic or native[4]
  - the range of species examined were thought to be currently generating the most commercial value to New Zealand, but also cover at least one example of all end product categories derived from plant species: food, fodder/forage, fibre, fuel, pharmaceuticals.

[4] Manuka was a potential candidate to include in the study because it is used to produce manuka honey. However, it was excluded from this study because of the difficulties at the current time in defining what constitutes manuka honey.

- setting out a plant's contribution to GDP. This equals gross output minus intermediate consumption at 2012 market value. Currently, the scope could include inferred values e.g. where there is an economic rent attributable to a plant species which is not currently explicitly traded or production value not fully covered by the market price
- the value chains that are referred to potentially include all routes to New Zealand's final demand markets, both domestic and export, including:
  - primary producer to final consumer (e.g. seed and farmgate sales)
  - primary producer to tertiary market intermediary (wholesaler, distributor) to final consumers
  - primary producer to secondary intermediary (processor, cannery, jam manufacturer etc.) to final consumers
  - primary producer to primary intermediary (e.g. fodder to livestock producers) to dependent products (such as livestock) to final consumers
  - multiple intermediary combinations of the above.

2. Approaches to valuation

Plants are inputs into primary production activities and clearly have economic value in the market prices of seeds and plant products produced in New Zealand. But their value to New Zealand extends beyond that private commercial value, as they support production of other industries which use them as inputs.

In approaching the valuation of individual plant species to assist MPI in evaluating and prioritising risks to primary sectors, we assume a primary purpose in valuing plants is for directing and improving investment in biosecurity. The 2012 Sapere report on PSA-V incursion suggested that MPI looks at the relative costs/benefits of reprioritising its resources towards managing the risks for economically significant industries (Moore and Loan 2012). Currently, plant-pest risk assessments used by the Ministry focuses on bio-physical considerations, with largely qualitative consideration of potential economic consequences. There is a risk that biosecurity effort may be directed at risks of low consequence, while more significant economic activity is relatively under protected.

This project is a **first step** towards developing a consistent approach to valuing individual plant species in economic terms (it is not a risk assessment of individual plant species). This focus needs to be emphasised since the aim is to:

- identify what's at stake for the economy if a particular species comes under threat from a biosecurity incursion
- identify the dependency of economic activity on particular plant species, where the species or particular links in their supply chains are under threat
- weight the options for prioritising areas of activity on biosecurity measures.

This initial step can supplement the current plant-pest risk assessment process. An economic valuation would go beyond the identification of potential impacts to quantifying the scale of their effects and placing monetary value on them, to better identify the value at risk and the level of response that is likely to be worthwhile.

Should a threat materialise further investigation can be done to firm up the estimates.

2.1. Factors which guide the choice of valuation method

Valuation is the process of assigning a weighting to objects for the purpose of comparing the relative worth of one thing with another. The value of plants used in productive activity will be a measure of the benefits obtained from that plant and all products and services derived from it.

Value is the topic of hundreds of books and scholarly articles but for this report, we are focusing on preference related concepts of value: ultimately, it is the public's willingness to pay for something that creates demand and confers value. When goods are traded in markets, demand generates price signals and incentives for supplying that demand. A key economic characteristic is that expression of value results from supply and demand that are expressed by actions (not words) and are constrained by real-world scarcity.[5]

2.2. Valuation – some basic considerations

The choice of valuation method varies with the purpose for which it is needed. It also depends on a) the perspective taken – private or societal value; and b) the timeframe for consideration – immediate or long term.

The commercial value of plant-based products depends on people's willingness to pay for those products in domestic and export markets. The sales value less the cost of all inputs used in producing the sales leaves a residual economic surplus, which provides a return on those who committed their resources to producing sales. In a private setting, that surplus is the company's profit that goes to covering the costs of capital, tax and providing dividends to shareholders. Employees may also share in the surplus, to the extent that it enables the company to pay more to secure the particular skills needed to produce the surplus.

Any residual surplus after all other inputs have covered their cost (including allowance for risks) is often treated as an 'economic rent' attributed to unpriced inputs, such as land, water or management skills. Given adequate data to understand how economic rent varies with changing mixes of unpriced inputs, statistical methods can determine an attribution of rent, or 'shadow price' for each of these inputs. However, such calculation are case specific, vary with local factors, and are problematic in determining values of plants nationwide. A simpler, higher level approach is more suited to prioritising and assessing biosecurity risks across the country.

Productive plant species are commercial goods with seeds supplied to growers at a market price. But as in any goods market, for some purchasers the market price is less than their willingness to pay for a product, providing them with an economic surplus for commercial plants over and above the observed market price. The value of plant species to New Zealand is therefore not confined to the market values of plant products, but market values provide a relatively well-documented source on which to base a valuation.

[5] See Brown TC (1984) "The Concept of Value in Resource Allocation", Land Economics 60(3) 231-246.

In a private setting, the economic value of an asset is driven by the discounted stream of net benefits it delivers over its lifetime, i.e. a net present value of benefits less costs incurred. In such a private setting or for small public projects it is appropriate to examine value through an investment appraisal framework, identifying the stream of revenues obtained against the opportunity cost of resources used in obtaining them.

A similar approach can be applied to public assets, with the scope of costs and benefits broadened to include effects that fall anywhere across the affected community. In a public setting, this gives rise to cost benefit analysis. Some in the community will gain, some will lose, but it is the net effect that counts in determining whether the activity is worthwhile. Such analysis accepts as worthwhile any project that yields gains greater than losses across the community.[6]

But for large societal issues that have widespread implications across the inter-linked sectors of the economy, 'investment appraisal' is not enough to show the full consequences across the economy. Such large issues have flow on effects that spread across the economy beyond the directly affected activities, the scale of which can be assessed through a national accounting framework that reflects inter-industry flows.

Security, whether against biological incursions or other threats, entails both ex ante and ex post components. Ex ante security is about anticipating threats, of which there are many but with little knowledge about the probability of each one's occurrence and impact. Ex ante security entails deploying resources widely, with a capability for detection and rapid response to threats as and when they materialise. Ex post security is more about response once an incursion has occurred, when it is relatively easier to assess significance and devise appropriate response measures against a known pest or disease.

From the foregoing, we assume the valuation of species for current purposes should be:

- based on a societal rather than a private perspective, i.e. consider the effects on New Zealand Inc
- capable of reflecting the differences in potential loss of livelihood caused by potential threats to different plant species
- capable of reflecting external effects and flow-on impacts from the species and activities most directly under threat
- useful in an ex ante rather than an ex post context.

On this last bullet, a valuation framework may be useful for both ex ante and ex post assessments, but the emphasis and detail differ. For ex ante purposes, valuation is about breadth of coverage of a multitude of potential threats, but for ex post valuation the critical issue is depth of understanding of the impacts of particular threats and how to ameliorate them. As resources for risk assessment are limited it is not practical to analyse all potential threats in depth, but an ex ante valuation can be useful as:

- a data input for pest risk assessments. The conclusions of which enable MPI to make decisions about what phytosanitary requirements to impose on importation of plant products (fruit, vegetables, seed, nursery stock)

[6] The theory behind this is so-called Pareto efficiency, an allocation of resources at which it is impossible to reallocate without leaving someone worse off. This is a stringent criterion to meet in practice, so recourse is made to the Kaldor-Hicks principle that total gains exceeding total losses is sufficient to determine net benefit: the gainers' gains would be big enough to compensate the losers and leave no-one worse off, but no compensation is paid.

- an input into discussions with industry over cost sharing, particularly with the GIA agreement on government/industry and cost sharing
- an improved information source that MPI can access when developing strategies to manage the biosecurity system, and prioritise targeting of resources across the system.

2.3. Review of current valuations of species

2.3.1. New Zealand literature

At present, we have not discovered any comprehensive economic valuations of individual plant species in New Zealand. Discussion on the importance of particular plant-derived industries focuses on partial measures like export values or domestic sales revenues from the principal value chains for the particular product (like wine from grapes). Sometimes this extends to a contribution of a particular plant category to gross domestic product, but existing published statistics are not set up to make this readily attributable to individual species (BERL 2011 and 2012).

In a previous report to MAF entitled *Forest and Forest Land Valuation: How to Value Forests and Forest Land to Include Carbon Costs and Benefits* (Meade et al 2008) examine a range of valuation approaches, in particular comparable sales analysis, discounted cash-flow (DCF) analysis and real options analysis, a variant of DCF that enables selection of options and their timing within an overall project appraisal to optimise overall return. Their preferred method is what they call Boot-Strapping Real Options Analysis, which involves repeated trial and error in testing results of different options and is critically dependent on the definition of options for land use. This approach is more appropriate to valuation of particular parcels of land than to valuing forestry at large or their constituent species – it is an ex post approach to valuation after alternative options have been identified, rather than a valuation suited to ex ante assessment against threats, the identity and scale of which are not known.

A search and review of previous studies of biosecurity threats has uncovered none that identify an ex ante valuation to assist with prioritisation. A number of ad hoc studies have been undertaken when a biosecurity threat materialises i.e. all ex post. These all take a similar format and identify the potential damages caused by the threat by valuing the change in outputs from the industries using the plants at risk (or in some cases damage to capital assets). Some consider other impact costs external to the productive system as well (e.g. health and medication costs for pests such as the white tailed tussock moth, which as well as damaging trees was also thought to provide an irritant to those with respiratory conditions).

These studies all consider pest impact as a change in the outputs from a counter-factual without the pest, so they focus on the marginal output changes. The total output value without the pest is considered as the counter-factual, but it is not commonly presented in the report. Moreover, there may be minor changes in the way different analysts calculate these output effects, raising the prospect of inconsistencies between these studies. Individual biosecurity impact studies do not provide a coherent lead on the valuation of particular plant species.

Two general reports have attempted to identify the aggregate cost of pests and weeds to New Zealand, which have drawn on and incorporated estimates of individual pests of plant species. One was the estimate by Bertram (1999), the other a later study by Nimmo-Bell (2009) for Biosecurity New Zealand.[7] These reports have similar characteristics to the individual biosecurity impact studies. They estimate the cost of established pests on New Zealand's productive systems, and also the cost of defensive measures to prevent new pests from becoming established, but they do not explicitly estimate the value of individual sectors contributed by particular plant species.

2.3.2. International literature

The international literature search for the value of plant species has revealed many more studies on the non-market value of species for biodiversity conservation or pharmaceutical uses than there are for general estimates of value of productive species. A notable exception to this is forestry, where the long time-frames and use of wild resources internationally has led to a tradition of valuing standing trees in terms of future revenue flows net of costs. The "stumpage value" of a standing tree consists of an assessment of the value of all products derived from it, less the costs of realising that value. It is an economic surplus attributable to the tree after all other factor inputs have recovered their costs. Primarily used by private companies to assess the value they can bid up to in making offers to suppliers, stumpage understates the value to the nation as it excludes any economic surplus earned by the various production agents, and it excludes any indirect flow on effects to other sectors. It is a value from the perspective of the forest owner, not the wider economy and dependent industries.

The OECD recognises the use of net present value of future income stream as a method for valuing standing timber. That approach has the potential advantage in accounting for future costs like replanting to provide a value in perpetuity, and it could also in principle incorporate other external effects, such as the value of standing timber for recreation purposes or its contribution to ecosystem services such as regulating water run-off. Net present value however depends on a number of assumptions about future outcomes. Real options modelling attempts to explicitly model choices over timing of undertaking irreversible actions (like felling a tree) but it is challenging to implement and also dependent on strong assumptions.

Plant species can be viewed as a basic input to agricultural production systems, and one indication of value at a farm level would be a general form of production function relating crop yield to the characteristics of species or variants:

$$Q = f(Y, PS, e).$$

Where Q is tonnes of output per hectare, Y is a vector of inputs such as labour hours, fertiliser and pesticides, PS is a particular species and e represents stochastic factors such as rainfall and temperature. The value as an input approach has also been adapted to sector wide estimates of value, and has recently been applied to valuing water[8] and also to bee populations in response to concerns about threats to bees such as varroa mite and colony collapse syndrome, which has raised the necessity of establishing what economic value is dependent on the input (Winfrey et al 2011). These studies postulate that the social value derived from the input is a function of the

[7] Nimmo Bell (2009) "Economic cost of pests to New Zealand"; MAF Biosecurity New Zealand Technical Paper No 2009/31.

[8] For example, see the Deloitte/Access Economics 2013 paper on *Economic Value of Groundwater in Australia* http://www2.deloitte.com/au/en/pages/economics/articles/economic-value-groundwater-australia.html

profit of producers in the areas affected by input loss, the profit of producers in other parts of the market, and the value to consumers – consumer surplus from changes in market availability.

2.4. Refinement of methodology in proposal

Our method is based on the assumption that species valuation is required to provide an improved source of economic data that MPI can access when developing strategies to manage the biosecurity system, and prioritise targeting of resources across the system. It proposes a quick and readily updateable means of establishing the relative value derived from different species. These values can be used as inputs into a range of analyses, but a specific use identified when developing the proposal was as a data input into pest risk assessments, which include a qualitative estimate of potential economic consequences of the pest being assessed.

The System of National Accounts (SNA) provides a consistent framework for looking at each industry's production. The basic components are:

- Gross Output Value less Intermediate Consumption equals Value Added (GDP)
- GDP equals Fixed Capital Consumption (depreciation) plus Net Indirect Taxes plus Employee Compensation plus Operating Surplus.

Operating surplus is a residual in the SNA calculation, and it approximates a return to ownership and is close to the private concept of profit. But, as a surplus, it will also implicitly include returns to all factors of production over and above the price paid for them. Thus an input, like water, that is not explicitly priced contributes to the value of Gross Output and Value Added, but the economic value it generates is absorbed within Operating Surplus. Similarly, a new seed strain which is sold at a standard price on the market but which proves exceptionally productive in certain management conditions generates an economic value in excess of its market price which, unless explicitly recognised, will accrue as Operating Surplus and return to owners.

A widespread valuation method that can be applied across species can therefore draw on these separate components:

- Gross Output generated by a species, obtainable from sector totals attributed in proportion to a species' share of inputs into the Output. This is a Gross figure, however, with no indication of costs incurred in achieving the Gross Output
- Value Added (GDP contribution), derived from sector totals, attributed to species in proportion to their share of inputs. Value Added is output net of intermediate consumption, and identifies distribution of value across different components – Fixed Capital Consumption, Indirect taxes net of subsidies, Employee Compensation and Operating Surplus. It is an indicator of sector value added and its components' dependency on the individual species.
- Economic surplus, or 'rent' accruing to individual species over and above any market value attached to them – this is the value of the species after removing the value added contribution of other inputs like labour or capital equipment, and includes an option value in species for their future genetic gains.

Another approach, the marginal valuation of deprival, is the most useful for assessing the value at risk in face of a realised biosecurity threat.[9] The impact of a biosecurity incursion depends on industry response and substitution possibilities which can be constrained by a particular pest incursion, making the deprival approach also the most difficult to apply in the absence of a clear and present threat. This is not an approach that will be used here.

The gross value of production and economic contribution approaches are closely related, using macro-economic aggregates from the System of National Accounts (SNA) and breaking them down to trace value contributions to source inputs, including plants. They may still be used to inform intervention choices in anticipation of threats, as they identify a total value at risk and a basis for estimating the value of threats that would reduce plant production by a given percentage.

These methods also give results expressed in terms of measures such as outputs, GDP and employment, which are familiar to industry and political decision makers, and are readily updateable as new statistics come to hand. These two approaches are the focus of the methodology proposed here.

2.4.1. Illustration of approach

There are a number of approaches to working out the contribution of each plant species to GDP. For data reasons we have taken the production approach i.e. building up estimates of Gross Output and then approximating contribution to the economy taking into account the impact on the industry in question and estimating the share of GDP.

The formula is Gross Output minus Intermediate Consumption equals Contribution to the Economy (per species). We also multiply the impact of dependent industries if applicable. We do not have direct estimates of Intermediate Consumption. However, from the Input Output Table we do have estimates of what each species contributes to GDP. By multiplying Gross Output by estimates of the share of Gross Output that contributes to the Economy we can obtain the GDP Impact of that species on the economy. The residual from this calculation by definition is Intermediate Consumption.

To illustrate the approach, Table 1 provides a simplified and stylised depiction of the process we have undertaken (drawn from the System of National Accounts).

From Table 1 it is possible to identify:

- **Value of production supported by plant species**: this estimates the value of Gross Output (Column I) dependent directly or indirectly on particular plant species, highlighting linkages between co-dependent economic sectors and resulting in a Gross Output value which reflects the contributions of many other input factors apart from plant species
- **Contribution of particular plant species to aggregate economic indicators**, such as Economic Value Added, also referred to as Gross Domestic Product (GDP), and associated income and employment values. As GDP is Gross

[9] This approach estimates the incremental loss of value caused by a pest incursion, the "deprival" of what was previously enjoyed caused by the presence of the pest. It uses valuation methods such as estimating the cost of the next best alternative way of obtaining what was lost, which provides a minimum estimate of the potential value loss.

Outputs less Intermediate Consumption (determined by Column III), it is a net figure that can be attributed back to the original individual plant inputs

- **Impact of dependent industries (Column II).** This is determined by industry analysis, expert opinion, and the literature.

These value estimates (particularly the contribution to economy) when viewed across all plant based production activities indicate the relative importance of each to the economy.

In each case we have compiled Gross Output figures (estimates of price multiplied quantity) for each of the plant species in each part of the value chain:

- the value that nurseries have in the development of each plant, including seeds that end up being used domestically and exported (and in the case of carrot seed exported and possibly re-imported)
- the production which is generated from the plants, either by the plants or through derived production (e.g. livestock)
- any intermediate production that occurs as plants or their derived products are processed
- final domestic and export market values.

To avoid double counting we do not add the Gross Output numbers together since value from one stage is partly created by the previous state e.g. plants sold as seeds from the nursery sector contribute to the Gross Output of the farmgate sector.

Instead what we do at each stage is to take away from Gross Output what has been consumed to create the impact of the plant species on GDP.[10] To work out what is consumed at each stage of production we have used Statistics New Zealand's Input-Output tables (disaggregated data on gross and net outputs and the transactions between them).

The impact on each industry is set out in Column II. The impact is determined from advice by industry experts (e.g. DairyNZ) and the literature.

[10] We do not have an estimate of intermediate consumption at each stage of production i.e. the items that are consumed in making the good or service (i.e. marketing, transport, storage etc.). What we do have is an estimate from the Input- Output tables of approximate share of output that each species contributes to GDP.

Table 1 Framework for identifying contribution to GDP

2012 year

Gross Output (price multiplied by quantity at stage of production) Column I	Impact of plant species on industry (or stage in value chain) Column II	Share of Gross output (attributable to stage in value chain) that contributes to GDP Column III	Impact of the plant species on GDP Column IV
Gross Output calculation at each stage of production e.g. nursery, farmgate, processing, domestic sales, and exports	Impact on other industries e.g. the impact of rye grass on livestock production is a substantial 75%.	Share of gross output equals gross output minus intermediate consumption. We have estimates of the share of gross output to the economy from the Input – Output tables	Gross Output multiplied by impact (%) multiplied by the share of GDP equals the contribution to GDP at each stage of production

Source: NZIER

The SNA accounts are typically structured around industries or sectors, so the value contribution of individual species needs to be attributed and stripped out of the industry totals. While there are comprehensive data on exports of particular plant products and some sectors (e.g. forestry) have published data on primary production, there are not regularly published data on domestic outputs, inputs and components of value added, which need to be inferred for the industries and attributed to component species, on the basis of input shares or other indications of species' role in the production system.

Using national accounting figures provides annual figures which are subject to the vagaries of such influencing variables as climate, exchange rates and fluctuating commodity prices. Tracking annual figures over time enables some evening out of such fluctuations, and an annual figure can also be projected into the future, to consider potential impacts of incursions on successive years, or damage to capital stock (such as established plants) that will endure beyond a single year. However, species characteristics differ, so an annual production value at risk plus annualised value of long lived capital stock (if appropriate) may be the most useful for a comparison across species.

The valuation approach is an exercise in inferring value components from uneven statistics, and it involves investigating details in the Input-Output tables, their sources and supplementary studies of particular plant-production systems. The method was initially tested on 5 pilot species – rye-grass, carrots, kiwifruit, maize and maize silage, and *Pinus radiata* – and has been rolled out across another 60 species.

2.5. Summary of approach

In this section we have reviewed approaches to valuation of natural resources that can be adapted to identify the value of plant species of importance to New Zealand's economy. The aim is to identify a method that can be applied or adapted to a wide variety of species with diverse statistical data to produce consistent estimates of the value at risk should biosecurity threats to particular species materialise.

There is no single valuation method that can be extracted from the literature and applied to this task. However, there are plentiful examples of ex post valuations of

specific pest damage in New Zealand but a gap in the valuation from an ex ante perspective that is required to cover a broad range of species facing non-specific threats. The international literature search has not uncovered a definitive method for valuing species, although there are various studies attributing value to some specific input for agricultural production. Some methods depend on detailed data and analytical processes that would be difficult to replicate across many species facing non-specified threats.

The literature review has confirmed that the approach outlined in our proposal is a practical way of proceeding. Statistics on even major species are rather limited to mainly export volumes and values and some information on areas planted and volumes harvested. However, our proposal is to use the system of national accounts to provide a framework in which to approach value, and Statistics New Zealand's Input-Output tables to derive ratios between key economic aggregates like output and value added, and key linkages between production, processing and distribution sectors, to construct a picture of the value chain attributable to individual plant species.

While some species (such as *Pinus radiata*) have substantial statistical documentation that can be linked to the national accounts, other species are much less conspicuous and are absorbed within a single horticultural sector in the Input-Output tables. For these smaller species other information will need to be sourced to supplement the official statistics.

3. Users guide to plant species value

3.1. General approach

The general approach is based on Table 1 and is repeated in Table 2 with examples.

Marketing chain analysis is a useful tool for tracing through estimates of the value of specified plants (Gross Output, Column I set out in Table 12). It details the value of the transformation process as plant or derived plant products move through the marketing chain: from nurseries to final sales. At each stage, we can (if credible estimates are available) estimate the GDP share of output (Column IV in Table 2).

The general approach has been to use the marketing chain to identify value being generated from seeds/nurseries to final demand to quantify economically valuable plants associated with land based industries. It also means we can contrast and compare the value across plants.

The examples given in Table 2 demonstrate the mechanics of the approach:

- example one sets out the impact of nursery sales in the apple industry. Nursery sales to growers have a 100% impact on the apple industry and a share of output of 0.39 (estimated from the Input-Output tables). Therefore, Gross Output sales in the nursery stage translates into $3.0 million in contribution to GDP
- example two shows the impact of brassicas for fodder on the dairy industry. The impact (Column II) of brassicas for fodder (estimated at 1% on advice from DairyNZ) is multiplied by the dairy farmgate value (Column I). To estimate contribution to GDP, Columns I and II are multiplied by share of output GDP (estimated from the Input-Output tables).

Table 2 Framework for identifying contribution to GDP with examples

2012 year

Gross Output (price multiplied by quantity at stage of production) Column I	Impact of plant species on industry (or stage in value chain) Column II	Share of gross output (attributable to stage in value chain) that contributes to GDP Column III	Impact of the plant species on GDP Column IV
Gross Output calculation at each stage of production e.g. nursery, farmgate, processing, domestic sales, and exports	Impact on other industries e.g. the impact of rye grass on livestock production is a substantial 75%	Share of gross output equals gross output minus intermediate consumption. We have estimates of the share of gross output to the economy from the Input-Output tables	Gross output multiplied by impact (%) multiplied by the share of GDP equals the contribution to GDP at each stage of production
Example one: apples: nursery stage			
Nursery sales ($7.8 million)	100% (100% impact on the apple industry since nurseries supply the apple industry)	GDP share equals 0.39	$7.8m x 100% x 0.39 = $3.0 million (rounded)
Example two: brassicas for fodder at the farmgate stage for dependent industries			
Dairy farmgate ($12,241 million)	1% (estimated impact on dairy is 1% according to DairyNZ estimate)	GDP share at farmgate for livestock is 0.48	$12,241 x 1% x 0.48 = $58.8 million

Source: NZIER

The Table below sets out the final summary table. It is divided into direct impact and the impact on dependent industries. In most cases plants only have a direct impact (e.g. they are sold domestically or exported to consumers). The calculation for dependent industries occurs when the plant is sold for use in another industry e.g. barley and maize into the pig and poultry industries or ryegrass and clover used in livestock industries.

Table 3 Sample final summary table

2012

Gross Output (price multiplied by quantity at stage of production) Column I	Impact of plant species on industry or stage in value chain Column II	Share of output value (attributable to stage in value chain) that contributes to GDP Column III	Impact of the plant species on GDP Column IV
Direct impact			
Nursery/seed sales	Typically 100%	0.39 (e.g. horticulture see Table 4)	Multiply Column I, II, III
Farmgate sales	Typically 100%	0.39 (horticulture see Table 4)	Multiply Column I, II, III
Processing[1]	Typically 100%	0.32 (horticulture see Table 4)	Multiply Column I, II, III
Domestic sales	Typically 100%	0.18 (horticulture see Table 4)	Multiply Column I, II, III
Export sales	Typically 100%	0.45 (horticulture see Table 4)	Multiply Column I, II, III
Subtotal (direct impact)			Sum Column IV (direct impact)
Dependent industries (only applicable when one industry acts as supplier to another industry e.g. grasses, herbs, and other fodder supplied to dairy and other livestock)			
Farmgate sales	Ranges from under 1% to 75%	0.39 (sheep, beef etc. see Table 4)	Multiply Column I, II, III
Processing	Ranges from under 1% to 75%	0.25 (sheep, beef etc. see Table 4)	Multiply Column I, II, III
Domestic sales	Ranges from under 1% to 75%	0.18 (sheep, beef etc. see Table 4)	Multiply Column I, II, III
Export sales	Ranges from under 1% to 75%	0.48 (sheep, beef etc. see Table 4)	Multiply Column I, II, III
Subtotal (dependent industries)			Sum Column IV (dependent industries)
Total			**Sum subtotals**
Note (1) Includes all costs that transform the product post-farmgate and before its arrival at the point of sale domestically and the wharf if exported e.g. packing, processing (i.e. carrots being juiced) and further processing (i.e. rye being used in breads) etc.			

Source: NZIER

3.2. GDP share of output

To avoid double counting we have used Statistics New Zealand's Input-Output tables to calculate the GDP share of output. The GDP share is then multiplied by the impact (Column II, Table 1) and the Gross Output (Column I, Table 1) at each stage of production.

The values provided by the method are estimates of value added associated with particular species, not economic rents. Value added includes returns to capital, labour

and ownership (operating surplus). Economic rents to other factor inputs are subsumed within the operating surplus. Clearly value is created or added to a species by labour and capital inputs, but without detailed information on the assets and other inputs employed to determine an appropriate return to each factor, calculation of a residual rent attributable to a species will be problematic. However, identifying the scale and distribution of value added at potential risk is useful for prioritising precautionary and preventive measures.

Table 4 sets out the GDP share of output in percentages terms for each step in the marketing chain.

Table 4 Shares of total output

Percentage, estimated from the Input-Output tables

Sector	Shares of Total Output: from Input-Output table estimate			
	Seeds, nurseries, farmgate Value Added share of Total Output	Processing Value Added share of Total Output	Domestic sales to final demand share of Total Output	Export sales (final demand) share of Total Output
Horticulture	39%	32%	18%	45%
Sheep, beef, cattle and grain farming	39%	25%	18%[1]	48%[1]
Dairy farming	48%	25%[1]	18%[1]	48%[1]
Poultry, deer and other livestock farming	24%	68%	12%	20%
Forestry and logging	35%		16%	22%
Wood product manufacturing		28%	3%	32%
Pulp and Paper		22%	4%	38%

Note (1) Because of the co-operative structure, the reported figures from the Input-Output tables for dairying and meat processing have been adjusted to reflect a more realistic processing and marketing share. The adjustments are: (a) Dairy processing has been adjusted to have an equivalent GDP share as meat processing (b) Domestic sales for meat and dairy have been adjusted to reflect the shares reported by other major exporters (e.g. horticulture) (c) Export GDP shares of meat and dairy are assumed to approximate food and beverage services in the input output tables (48%). (2) Estimates of GDP share of output are made from the Inter-industry transaction accounts, year ending March 2007 (latest available) by dividing total value added by total output. Input output tables can be accessed from Statistics New Zealand: http://www.stats.govt.nz/browse_for_stats/economic_indicators/NationalAccounts/input-output%20tables.aspx

Source: Statistics New Zealand

3.3. Assumptions and uncertainties

Most of the export data was sourced through Statistics New Zealand, various industry publications and personal communications with industry sources (Situation and Outlook for Primary Industries (Ministry for Primary Industries, various years), Fresh Facts (Horticulture New Zealand and Plant and Food Research, various years), Beef + Lamb New Zealand publications (Farm Facts, various years and personal communication with Mr Rob Davison), Foundation for Arable Research (FAR) (personal

communication with Mr Nick Pyke), DairyNZ (Mr Matt Newman) and individual reports e.g. such as Booker 2009).

The difficult part of the process is determining the share of domestic and intermediate consumption since these statistics are not collected. In the absence of this data we have used:

- the Input-Output tables to estimate share of GDP per sector
- a mixture of industry experts and available literature to calculate domestic sector activity (nursery sales, farmgate sales, domestic sales and processing).

Specifically, the difficulty is locating written material, identifying the right people in the industry, and also finding ways of verifying the information. In some tightly held sectors such as maize and nearly all its proceeding industries we were not able to obtain independently verifiable information on seed production. Further processing costs have been estimated from industry sources. Mr Rob Davison from Beef + Lamb New Zealand and Mr John Seymour at Horticulture New Zealand have been particularly helpful.

Of specific interest are the assumptions made about domestic market operations. With the guidance of Horticulture New Zealand (John Seymour) we have applied the following rule of thumb where no other information was available:

- farmgate or (grower) values are often 50% of retail value (including GST) for domestic and export sales (based on FOB value)
- processing values of plant products are typically 25% of the domestic and export (fob) value.
- processing values of products in the dependent livestock industries are actuals provided by the industry (Rob Davison, Beef + Lamb New Zealand).

In the course of the investigation we also noticed that nursery values were approximately 1% of farmgate returns. This is not the same in every industry but it does give a reasonable approximation where there is limited or no information.

4. Conclusions

This report has estimated the economic values for the productive activity of 65 important plant species in New Zealand, using contribution to GDP as the primary measure. Refer to Tables 5a-5d for results of the study. The species have a range of uses – feeding directly into consumption in domestic and export markets, supporting manufacturing sectors and energy recovery, and providing crucial input into livestock industries and their associated dependent industries.

The valuations show that although the end point is the same, i.e. a measure of contribution to GDP, the means of getting there can be quite different and customised to the particular species. For forestry there is a relative abundance of data about tree planting and production and processing, enabling estimates to be prepared largely from published sources.

The GDP contributions of other species are too small to be readily identified in the aggregate inter-industry Input-Output tables, so information has had to be assembled from a wider range of sources and with requests to industry organisations, peak bodies and others in the individual sectors.

Whereas for the forestry example, the method can be validated by reference to other estimates regarding the industry, for the other examples the highly customised sources of data make it difficult to do the same. With small industries that fall below the radar of statistical collection, we have obtained estimates from industry participants where possible and made assumptions where necessary. Even with the forestry example, some of the assumptions about, say, the proportion of different species input to particular sectors or their products may create distortions in the apparent value. However, given the dominance of *Pinus radiata* in forestry that is unlikely to make a material difference to the valuation.

There remain some issues and uncertainties around the valuations. These are shown on the main results table, Table 5d, as well as stated in the calculations in the appendices. One concerns how to deal with values that have an inter-temporal dimension in a way that enables comparison between short and long rotation crops. This is particularly apparent for forestry, kiwifruit and grapes. We examined two possible approaches to inter-temporal valuation: one being a projection of current value added production over specific future time periods, on the assumption that current production levels represent the annual average over these periods; the other drawn from physical forecasts of wood availability. Both have their limitations, and given the range of uncertainties around future market demands, prices and costs neither is likely to provide an accurate prediction of future outcomes. We present results of the wood availability forecast approach for forestry species which is the more conservative method, and which provides a magnitude of value at risk for future production that can inform the assessment of risks to the species.

Another issue is how to ensure adequate coverage of value sources that may not show up in transactions but rather avoid or reduce some other cost (such as energy recovery, which may through waste digester systems become significant for species other than trees). There is a substantial value derived from energy recovery from wood-fibre residues, most of which is used by industry and implicitly reflected in the national accounts for the sectors concerned, contributing to value added either by providing a source of sales for the supply sector or as an avoided cost of alternative energy for

industries consuming energy. But an indeterminate portion of the 12% of that energy recovery used by the household sector may be supplied through the informal grey economy and not be reflected in the transactions in the Input-Output table, and the value of that is additional to any value derived from the Input-Output table ratios.

For some species there are gaps in the evaluation because information has not been forthcoming because of confidentiality issues or lack of data. To the extent that this understates the value attributable to that species it also implies lower value at potential risk for assessing biosecurity risks. For small sectors that may not be a material issue for national assessment, but for those with more substantial economic activity further discussion with industry may be useful in improving the information on which the valuations are based.

However, despite limitations the method provides a way to derive estimates of value to the economy associated with particular species which provide a ready means of scaling the value at potential risk from different biosecurity threats to particular species. Should a threat materialise, further investigation can be done to firm up the estimates that might be used in risk assessments, but the values provided by this method can be used to inform risk and prioritisation in ex ante settings before the details of actual threats are known.

Table 5a Value added calculations with selected plant species broken down by common names

Table 5a must be used in conjunction with Table 5d, 'Data notes on each species'

	Direct impact					Dependent industry impacts				Total Impacts
Selected species data broken down: Brassicas, Curcubita, Prunus, Ribes, and Rubus										
	Seeds/nursary	**Farmgate**	**Processing**	**Domestic**	**Exports**	**Farmgate**	**Processing**	**Domestic**	**Exports**	
Apples	3,042,000	60,739,626	55,219,436	10,127,001	173,520,000					302,648,064
Asparagus	352,170	2,979,066	1,216,000	2,160,000	1,536,000					8,243,236
Aubergines	imported	1,365,000		1,260,000						2,625,000
Avocados	508,950	23,269,247	1,909,272	3,456,000	44,415,000					73,558,468
Barley	854,065	67,807,838				57,335,212	65,528,836	48,133,597	2,340,527	242,000,074
Beans (broad)	21,606	216,060	88,640	199,440		56,109		17,100	65,015	663,969
Beans (green)	932,100	12,675,000	5,200,000	3,240,000	21,150,000					43,197,100
Beetroot	148,477	2,172,690	891,360	2,005,560	292,500					5,510,587
Blueberries	588,023	6,454,500	464,000	2,592,000	8,415,000					18,513,523
Brassicas & brassics for fodder	5,785,650	55,033,368	1,284,800	16,403,400	6,363,000	58,757,688	1,463,473	1,882,080	59,893,315	206,866,774
Brassicas: human consumption	*1,833,000*	*16,575,000*	*1,284,800*	*14,454,000*	*2,115,000*					*36,261,800*
Brasscias: Fodder	*3,952,650*	*38,458,368*		*1,949,400*	*4,248,000*	*58,757,688*	*1,463,473*	*1,882,080*	*59,893,315*	*170,604,974*
Browntop	401,700			54,000	844,800	9,938,281	8,377,349	1,323,720	16,647,075	37,586,926
Capsicums	imported	12,753,000		5,274,000	16,245,000					34,272,000
Carrots	6,942,000	15,600,000	10,912,000	5,400,000	17,190,000					56,044,000
Celery	imported	975,000	32,000	900,000						1,907,000
Chicory	3,510,000			3,240,000		15,726,850	3,643,634	905,904	18,729,605	45,755,994
Chillies	imported	195,000	80,000	180,000						455,000
Chrysanthemum	5,850	585,000	-	540,000	90,000					1,220,850
Citrus	43,250	8,650,038	3,752,000	8,442,000	3,814,800					24,702,088
Lemons	*10,518*	*2,103,602*	*320,000*	*720,000*	*1,212,267*					*4,366,386*
Oranges	*8,028*	*1,605,513*	*1,240,000*	*2,790,000*	*802,533*					*6,446,074*
Mandarin	*23,228*	*4,645,563*	*2,024,000*	*4,554,000*	*1,800,000*					*13,046,791*
Grapefruit	*234*	*46,800*	*24,000*	*54,000*						*125,034*
Tangelo	*593*	*118,560*	*64,000*	*144,000*						*327,153*
Limes	*650*	*130,000*	*80,000*	*180,000*						*390,650*
Clover (red & white)	4,455,750			1,566,000	6,367,500	942,533,716	218,618,049	54,025,920	1,122,528,043	2,350,094,978
Cocksfoot	366,600			59,400	697,500	3,975,312	3,350,940	529,488	6,658,830	15,638,070
Cucurbita species	234,000	17,998,500		4,914,000	29,285,100					52,431,600
Pumpkin	*234,000*	*2,418,000*		*2,232,000*	*35,100*					*4,919,100*
Squash	*imported*	*13,240,500*		*522,000*	*29,250,000*					*43,012,500*
Zucchini	*imported*	*2,340,000*		*2,160,000*						*4,500,000*
Cypress			11,800,000	1,900,000	5,300,000					19,000,000
Douglas fir			124,100,000	19,900,000	56,300,000					200,300,000
Eucalyptus			25,600,000	4,100,000	11,600,000					41,300,000
Feijoas	23,400	370,500		306,000	96,000					795,900
Garlic	13,845	1,384,500		1,170,000	288,000					2,856,345
Grapes	2,915,250	146,568,676	114,227,200	108,831,381	529,785,000					902,327,507
Hops	45,630	780,000	976,000	540,000	4,416,000					6,757,630
Kiwifruit	3,900,000	245,809,747	105,539,817	9,661,158	471,711,429					836,622,151
Kumara	257,400	3,510,000	320,000	5,040,000	2,277,450					11,404,850
Lettuce	imported	8,463,000	1,388,800	7,524,000	768,000					18,143,800
Lillies	78,000	6,903,000		2,160,000	11,232,000					20,373,000
Lucerne	429,000	4,647,500				16,355,268	3,643,634	1,097,424	19,457,769	45,630,596

	Direct impact					Dependent industry impacts				Total Impacts
Selected species data broken down: Brassicas, Curcubita, Prunus, Ribes, and Rubus										
	Seeds/nursary	**Farmgate**	**Processing**	**Domestic**	**Exports**	**Farmgate**	**Processing**	**Domestic**	**Exports**	
Maize - Corn	3,598	150,526,740	4,960,000	3,600,000	18,900,000	255,019,421	40,727,732	37,651,552	228,958,434	740,347,477
Nuts	39,000	2,815,254	1,154,976	1,320,696	3,195,000					8,524,926
Oats	305,760	3,283,020				14,444,759	1,203,150	3,819,326	15,191,477	38,247,492
Olives	11,700	546,000	224,000	414,000	225,000					1,420,700
Onions	1,017,900	16,984,500	365,843	4,500,000	27,945,000					50,813,243
Orchids	41,925	4,192,500		540,000	8,880,000					13,654,425
Parsnip	8,775	877,500	32,000	810,000						1,728,275
Passionfruit	11,700	313,769		234,000	139,083					698,552
Pears	162,240	1,498,383	201,927	579,081	2,485,957					4,927,588
Peas	9,356,446	29,284,632	12,420,787	12,916,771	37,575,000	825,986	837,082	509,822		103,791,541
Persimmons	313,954	2,486,400	720,000	3,195,000	3,195,000					9,910,354
Pinus Radiata			2,760,500,000	443,700,000	1,249,900,000					4,454,100,000
Potatoes	4,430,400	55,380,000	37,608,000	81,180,000	52,830,000					231,428,400
Prunus	273,000	17,166,394		6,858,000	14,358,670					38,656,065
Peaches	*39,000*	*1,913,412*		*1,332,000*	*193,389*					*3,477,802*
Nectarines	*39,000*	*2,468,208*		*1,818,000*						*4,325,208*
Apricots	*39,000*	*3,897,504*		*1,098,000*	*4,597,253*					*9,631,757*
Cherries	*117,000*	*7,005,566*		*1,260,000*	*9,478,028*					*17,860,594*
Plums	*39,000*	*1,881,703*		*1,350,000*	*90,000*					*3,360,703*
Radish	2,945,800	273,000		252,000	9,900,000					13,370,800
Ribes	39,000	4,397,640	1,793,920	673,560	8,470,800					15,374,920
Blackcurrant	*39,000*	*4,372,680*	*1,793,920*	*648,000*	*8,470,800*					*15,324,400*
Redcurrant		*19,500*		*18,000*						*37,500*
Gooseberry		*5,460*		*7,560*						*13,020*
Ribwort plantain	438,750	5,070,000		405,000		15,681,963	3,643,634	892,224	18,677,594	44,809,165
Roses	40,950	4,095,000		3,780,000						7,915,950
Rubus	19,500	2,086,500	856,000	1,476,000	1,125,000					5,563,000
Raspberry	*5,850*	*604,500*	*248,000*	*540,000*	*45,000*					*1,443,350*
Blackberry	*1,950*	*78,000*	*32,000*	*72,000*						*183,950*
Boysenberry	*11,700*	*1,404,000*	*576,000*	*864,000*	*1,080,000*					*3,935,700*
Rye	214,500	1,872,000				7,863,425	1,821,817	452,952	9,364,803	21,589,497
Ryegrass	16,477,500			6,170,400	22,599,000	5,890,835,727	1,366,362,808	337,662,000	7,015,800,267	14,655,907,702
Silverbeet	7,800	409,500		378,000						795,300
Sphagnum moss		1,096,875	450,000	202,500	2,025,000					3,774,375
Spinach		760,500		702,000						1,462,500
Strawberries	1,365,000	5,089,500	2,088,000	3,834,000	2,160,000					14,536,500
Tall fescue	393,900			7,200	891,000	3,975,312	3,350,940	529,488	6,658,830	15,806,670
Tamarillos	29,250	292,500		234,000	96,000					651,750
Tea	4,399	439,922	180,481	81,216	812,165					1,518,184
Timothy	7,800			7,200		1,965,213	1,675,470	2,579,040	3,303,409	9,538,132
Tomatoes		24,921,000	1,935,360	20,340,000	6,660,000					53,856,360
Tulips	23,985	2,398,500		540,000	4,464,000					7,426,485
Wheat	1,130,765	79,282,125				186,927,552	214,631,527	145,059,533	485,871	627,517,373

Source: NZIER

Table 5b Value added broken down by scientific name(s)

[Table 5b must be used in conjunction with Table 5d, 'Data notes on each species'.]

Direct impact						Dependent industries				Total Impacts
Scientific names	Seeds/nursary	Farmgate	Processing	Domestic	Exports	Farmgate	Processing	Domestic	Exports	
Acca sellowiana (feijoas)	23,400	370,500		306,000	96,000					795,900
Actinidia spp. (8)	3,900,000	245,809,747	105,539,817	9,661,158	471,711,429					836,622,151
Agrostis capillaris (browntop)	401,700	-	-	54,000	844,800	9,938,281	8,377,349	1,323,720	16,647,075	37,586,926
Allium cepa (onions)	1,017,900	16,984,500	365,843	4,500,000	27,945,000					50,813,243
Allium sativum (garlic)	13,845	1,384,500		1,170,000	288,000					2,856,345
Apium graveolens var. dulce (celery)	imported	975,000	32,000	900,000						1,907,000
Asparagus officinalis (asparagus)	352,170	2,979,066	1,216,000	2,160,000	1,536,000					8,243,236
Avena sativa (oats)	305,760	3,283,020				14,444,759	1,203,150	3,819,326	15,191,477	38,247,492
Beta vulgaris (beetroot)	148,477	2,172,690	891,360	2,005,560	292,500					5,510,587
Beta vulgaris var. cicla (silverbeet)	7,800	409,500		378,000						795,300
Brassica spp. (2)	5,785,650	55,033,368	1,284,800	16,403,400	6,363,000	58,757,688	1,463,473	1,882,080	59,893,315	206,866,774
Camellia sinensis (tea)	4,399	439,922	180,481	81,216	812,165					1,518,184
Capsicum annuum (bell peppers/capsicums) (3)	imported	12,753,000		5,274,000	16,245,000					34,272,000
Capsicum spp. excluding *C.annuum* (chillies) (4)	imported	195,000	80,000	180,000						455,000
Chrysanthemum spp. (chrysanthemum)	5,850	585,000		540,000	90,000					1,220,850
Cichorium intybus (chicory)	3,510,000			3,240,000		15,726,850	3,643,634	905,904	18,729,605	45,755,994
Citrus spp. (5)	43,250	8,650,038	3,752,000	8,442,000	3,814,800					24,702,088
Cupressus macrocarpa (cypress)			11,800,000	1,900,000	5,300,000					19,000,000
Cucurbita spp. (6)	234,000	17,998,500		4,914,000	29,285,100					52,431,600
Dactylis glomerata (cocksfoot)	366,600			59,400	697,500	3,975,312	3,350,940	529,488	6,658,830	15,638,070
Daucus carota (carrots)	6,942,000	15,600,000	10,912,000	5,400,000	17,190,000					56,044,000
Diospyros kaki (persimmons)	313,954	2,486,400	720,000	3,195,000	3,195,000					9,910,354
Eucalyptus spp. (eucalyptus)(7)			25,600,000	4,100,000	11,600,000					41,300,000
Festuca arundinacea (tall fescue)	393,900			7,200	891,000	3,975,312	3,350,940	529,488	6,658,830	15,806,670
Fragaria x ananassa (strawberries)	1,365,000	5,089,500	2,088,000	3,834,000	2,160,000					14,536,500
Hordeum vulgare (barley)	854,065	67,807,838				57,335,212	65,528,836	48,133,597	2,340,527	242,000,074
Humulus lupulus (hops)	45,630	780,000	976,000	540,000	4,416,000					6,757,630
Ipomoea batatas (kumara)	257,400	3,510,000	320,000	5,040,000	2,277,450					11,404,850
Lactuca sativa (lettuce)	imported	8,463,000	1,388,800	7,524,000	768,000					18,143,800
Lilium spp. (lillies)	78,000	6,903,000		2,160,000	11,232,000					20,373,000
Lolium spp. (ryegrass)	16,477,500			6,170,400	22,599,000	5,890,835,727	1,366,362,808	337,662,000	7,015,800,267	14,655,907,702
Malus domestica (apples)	3,042,000	60,739,626	55,219,436	10,127,001	173,520,000					302,648,064
Medicago sativa (lucerne)	429,000	4,647,500				16,355,268	3,643,634	1,097,424	19,457,769	45,630,596
Nuts diverse species (9)	39,000	2,815,254	1,154,976	1,320,696	3,195,000					8,524,926
Olea europaea (olives)	11,700	546,000	224,000	414,000	225,000					1,420,700
Orchidaceae (orchids)	41,925	4,192,500		540,000	8,880,000					13,654,425
Passiflora edulis (passionfruit)	11,700	313,769		234,000	139,083					698,552
Pastinaca sativa (parsnip)	8,775	877,500	32,000	810,000						1,728,275
Persea americana (avocados)	508,950	23,269,247	1,909,272	3,456,000	44,415,000					73,558,468
Phaseolus vulgaris (green bean)	932,100	12,675,000	5,200,000	3,240,000	21,150,000					43,197,100
Phleum pratense (timothy)	7,800			7,200		1,965,213	1,675,470	2,579,040	3,303,409	9,538,132

Scientific names	Direct impact					Dependent industries				Total Impacts
	Seeds/nursary	**Farmgate**	**Processing**	**Domestic**	**Exports**	**Farmgate**	**Processing**	**Domestic**	**Exports**	
Pinus radiata (pine)			2,760,500,000	443,700,000	1,249,900,000					4,454,100,000
Pisum sativum (peas)	9,356,446	29,284,632	12,420,787	12,916,771	37,575,000	825,986	837,082	509,822	65,015	103,791,541
Plantago lanceolata (ribwort plantain)	438,750	5,070,000		405,000		15,681,963	3,643,634	892,224	18,677,594	44,809,165
Prunus spp. (11)	273,000	17,166,394		6,858,000	14,358,670					38,656,065
Pseudotsuga menziesii (douglas fir)			124,100,000	19,900,000	56,300,000					200,300,000
Pyrus spp. (10)	162,240	1,498,383	201,927	579,081	2,485,957					4,927,588
Raphanus sativus (radish)	2,945,800	273,000		252,000	9,900,000					13,370,800
Ribes spp. (12)	39,000	4,397,640	1,793,920	673,560	8,470,800					15,374,920
Rosa spp. (roses)	40,950	4,095,000		3,780,000	-					7,915,950
Rubus spp. (13)	19,500	2,086,500	856,000	1,476,000	1,125,000					5,563,000
Secale cereale (rye)	214,500	1,872,000				7,863,425	1,821,817	452,952	9,364,803	21,589,497
Solanum betaceum (tamarillos)	29,250	292,500		234,000	96,000					651,750
Solanum lycopersicum (tomatoes)		24,921,000	1,935,360	20,340,000	6,660,000					53,856,360
Solanum melongena (aubergines)	imported	1,365,000		1,260,000						2,625,000
Solanum tuberosum (potatoes)	4,430,400	55,380,000	37,608,000	81,180,000	52,830,000					231,428,400
Sphagnum cristatum & C.subnitens (sphagnum moss)		1,096,875	450,000	202,500	2,025,000					3,774,375
Spinacia oleracea (spinach)		760,500		702,000						1,462,500
Trifolium spp. (red & white clover)(14)	4,455,750			1,566,000	6,367,500	942,533,716	218,618,049	54,025,920	1,122,528,043	2,350,094,978
Triticum spp. (wheat) (15)	1,130,765	79,282,125				186,927,552	214,631,527	145,059,533	485,871	627,517,373
Tulipa spp. (tulips)	23,985	2,398,500		540,000	4,464,000					7,426,485
Vaccinium spp. (1)	588,023	6,454,500	464,000	2,592,000	8,415,000					18,513,523
Vicia faba (broad bean)	21,606	216,060	88,640	199,440		56,109		17,100	65,015	663,969
Vitis spp. (grapes)	2,915,250	146,568,676	114,227,200	108,831,381	529,785,000					902,327,507
Zea mays (maize & corn)	3,598	150,526,740	4,960,000	3,600,000	18,900,000	255,019,421	40,727,732	37,651,552	228,958,434	740,347,477

Notes

(1) *Vaccinium corymbosum, Vaccinium formosum* (*syn. V. australe*) (both Highbush varieties) and *Vaccinium virgatum* (*syn. V. ashei)* (rabbit eye variety).

(2) Brassicas for human consumption = (*Brassica olearacea*) cauliflower, broccoli, cabbage.

Brassicas for fodder = (*Brassica rapa*) oil seed rape, turnips; (*Brassica napus*) swede; (*Brassica olearacea*) kale.

(3) *Capsicum annuum* (capsicums or red pepper, green pepper, coloured peppers)

(4) *Capsicum frutescens, C. chinense, C. pubescens, C. baccatum*

(5) Oranges, lemons, limes, tangelos, mandarins, and grapefruit.

(6) *Curcrbita pepo* (zucchini; includes some pumpkins), *Curcurbita maxima* (buttercup squash), and *C. moschata* (butternut squash)

(7) *Eucalyptus regnans, E.fastigata, E.nitens*

(8) *Actinidia chinensis* (gold), *Actinidia deliciosa* (green), and *Actinidia arguta* (berry)

(9) Chestnut (*Castanea* spp.; *Fagaceae* family), cashews (*Anacardium occidentale*; *Anacardiaceae* family);
macadamias (*Macadamia* spp.; *Protaceae* family); walnuts (*Juglans* spp.; *Juglandaceae* family).

(10) *Pyrus communis* varieties (pears) and *Pryrus pyrifolia* (nashi pear)

(11) Peaches (*Prunus persica*) nectarines (*P. persica var. nucipersica*), apricots (*P.armeniaca*), cherries (*P.avium*)

(12) Blackcurrent (*Ribes nigrum*), redcurrant (*R. rubrum*), gooseberry (*R. uva-crispa*)

(13) Boysenberry, blackberry, raspberry.

(14) Red clover (*Trifolium pratense*), white clover (*Trifolium repens*).

(15) Including *Triticum aestivum* and *T. durum*

Source: NZIER

Table 5c Species by common name and grouped into sectors

[Table 5c must be used in conjunction with Table 5d, 'Data notes on each species'.]

	Direct impact					Dependent industry impacts				Total Impacts
	Seeds/nursary	Farmgate	Processing	Domestic	Exports	Farmgate	Processing	Domestic	Exports	
Horticultural sector										
Apples	3,042,000	60,739,626	55,219,436	10,127,001	173,520,000					302,648,064
Asparagus	352,170	2,979,066	1,216,000	2,160,000	1,536,000					8,243,236
Aubergines	imported	1,365,000	-	1,260,000						2,625,000
Avocados	508,950	23,269,247	1,909,272	3,456,000	44,415,000					73,558,468
Beans (broad)	21,606	216,060	88,640	199,440						663,969
Beans (green)	932,100	12,675,000	5,200,000	3,240,000	21,150,000					43,197,100
Beetroot	148,477	2,172,690	891,360	2,005,560	292,500					5,510,587
Berries	19,500	2,086,500	856,000	1,476,000	1,125,000					5,563,000
Raspberry	*5,850*	*604,500*	*248,000*	*540,000*	*45,000*					*1,443,350*
Blackberry	*1,950*	*78,000*	*32,000*	*72,000*						*183,950*
Boysenberry	*11,700*	*1,404,000*	*576,000*	*864,000*	*1,080,000*					*3,935,700*
Blueberries	588,023	6,454,500	464,000	2,592,000	8,415,000					18,513,523
Brassicas for human consumption	1,833,000	16,575,000	1,284,800	14,454,000	2,115,000					36,261,800
Capsicums	imported	12,753,000		5,274,000	16,245,000					34,272,000
Carrots	6,942,000	15,600,000	10,912,000	5,400,000	17,190,000					56,044,000
Celery	imported	975,000	32,000	900,000						1,907,000
Chillies	imported	195,000	80,000	180,000						455,000
Chrysanthemum	5,850	585,000		540,000	90,000					1,220,850
Citrus	43,250	8,650,038	3,752,000	8,442,000	3,814,800					24,702,088
Lemons	*10,518*	*2,103,602*	*320,000*	*720,000*	*1,212,267*					*4,366,386*
Oranges	*8,028*	*1,605,513*	*1,240,000*	*2,790,000*	*802,533*					*6,446,074*
Mandarin	*23,228*	*4,645,563*	*2,024,000*	*4,554,000*	*1,800,000*					*13,046,791*
Grapefruit	*234*	*46,800*	*24,000*	*54,000*	-					*125,034*
Tangelo	*593*	*118,560*	*64,000*	*144,000*	-					*327,153*
Limes	*650*	*130,000*	*80,000*	*180,000*	-					*390,650*
Corn	3,598	7,195,500	4,960,000	3,600,000	18,900,000					34,659,098
Currents and gooseberry	39,000	4,397,640	1,793,920	673,560	8,470,800					15,374,920
Blackcurrant	*39,000*	*4,372,680*	*1,793,920*	*648,000*	*8,470,800*					*15,324,400*
Redcurrant	-	*19,500*	-	*18,000*	-					*37,500*
Gooseberry	-	*5,460*	-	*7,560*	-					*13,020*
Feijoas	23,400	370,500	-	306,000	96,000					795,900
Garlic	13,845	1,384,500	-	1,170,000	288,000					2,856,345
Grapes	2,915,250	146,568,676	114,227,200	108,831,381	529,785,000					902,327,507
Hops	45,630	780,000	976,000	540,000	4,416,000					6,757,630
Kiwifruit	3,900,000	245,809,747	105,539,817	9,661,158	471,711,429					836,622,151
Kumara	257,400	3,510,000	320,000	5,040,000	2,277,450					11,404,850
Lettuce	imported	8,463,000	1,388,800	7,524,000	768,000					18,143,800
Lillies	78,000	6,903,000		2,160,000	11,232,000					20,373,000
Maize human consumption				10,000,000						10,000,000
Nuts	39,000	2,815,254	1,154,976	1,320,696	3,195,000					8,524,926

	Direct impact					Dependent industry impacts				Total Impacts
	Seeds/nursary	**Farmgate**	**Processing**	**Domestic**	**Exports**	**Farmgate**	**Processing**	**Domestic**	**Exports**	
Olives	11,700	546,000	224,000	414,000	225,000					1,420,700
Onions	1,017,900	16,984,500	365,843	4,500,000	27,945,000					50,813,243
Orchids	41,925	4,192,500		540,000	8,880,000					13,654,425
Parsnip	8,775	877,500	32,000	810,000						1,728,275
Passionfruit	11,700	313,769		234,000	139,083					698,552
Pears	162,240	1,498,383	201,927	579,081	2,485,957					4,927,588
Peas	9,356,446	29,284,632	12,420,787	12,916,771	37,575,000	825,986	837,082	509,822	65,015	103,791,541
Persimmons	313,954	2,486,400	720,000	3,195,000	3,195,000					9,910,354
Potatoes	4,430,400	55,380,000	37,608,000	81,180,000	52,830,000					231,428,400
Pumpkin, squash, zucchini	234,000	17,998,500		4,914,000	29,285,100					52,431,600
Pumpkin	234,000	2,418,000		2,232,000	35,100					4,919,100
Squash	imported	13,240,500		522,000	29,250,000					43,012,500
Zucchini	imported	2,340,000		2,160,000						4,500,000
Radish	2,945,800	273,000		252,000	9,900,000					13,370,800
Roses	40,950	4,095,000		3,780,000						7,915,950
Silverbeet	7,800	409,500		378,000						795,300
Spinach	-	760,500		702,000						1,462,500
Strawberries	1,365,000	5,089,500	2,088,000	3,834,000	2,160,000					14,536,500
Stonefruit	273,000	17,166,394		6,858,000	14,358,670					38,656,065
Peaches	*39,000*	*1,913,412*		*1,332,000*	*193,389*					*3,477,802*
Nectarines	*39,000*	*2,468,208*		*1,818,000*						*4,325,208*
Apricots	*39,000*	*3,897,504*		*1,098,000*	*4,597,253*					*9,631,757*
Cherries	*117,000*	*7,005,566*		*1,260,000*	*9,478,028*					*17,860,594*
Plums	*39,000*	*1,881,703*		*1,350,000*	*90,000*					*3,360,703*
Tamarillos	29,250	292,500		234,000	96,000					651,750
Tea	4,399	439,922	180,481	81,216	812,165					1,518,184
Tomatoes	-	24,921,000	1,935,360	20,340,000	6,660,000					53,856,360
Tulips	23,985	2,398,500	-	540,000	4,464,000					7,426,485
Sphagnum moss	-	1,096,875	450,000	202,500	2,025,000					3,774,375
Multiple sectors										
Brassicas for fodder	3,952,650	38,458,368		1,949,400	4,248,000	58,757,688	1,463,473	1,882,080	59,893,315	170,604,974
Maize silage	Confidential	107,944,200				217,403,446	5,414,848	6,963,696	223,309,342	561,035,532
Maize grain	Confidential	35,387,040				37,615,976	35,312,884	20,687,856	5,649,093	134,652,848
Pastoral Sector										
Browntop	401,700			54,000	844,800	9,938,281	8,377,349	1,323,720	16,647,075	37,586,926
Clover (red & white)	4,455,750			1,566,000	6,367,500	942,533,716	218,618,049	54,025,920	1,122,528,043	2,350,094,978
Cocksfoot	366,600			59,400	697,500	3,975,312	3,350,940	529,488	6,658,830	15,638,070
Chicory	3,510,000			3,240,000		15,726,850	3,643,634	905,904	18,729,605	45,755,994
Lucerne	429,000	4,647,500				16,355,268	3,643,634	1,097,424	19,457,769	45,630,596
Ribwort plantain	438,750	5,070,000		405,000		15,681,963	3,643,634	892,224	18,677,594	44,809,165
Ryegrass	16,477,500			6,170,400	22,599,000	5,890,835,727	1,366,362,808	337,662,000	7,015,800,267	14,655,907,702
Tall fescue	393,900			7,200	891,000	3,975,312	3,350,940	529,488	6,658,830	15,806,670
Timothy	7,800			7,200		1,965,213	1,675,470	2,579,040	3,303,409	9,538,132
Forestry sector										
Cypress			11,800,000	1,900,000	5,300,000					19,000,000
Douglas fir			124,100,000	19,900,000	56,300,000					200,300,000
Eucalyptus			25,600,000	4,100,000	11,600,000					41,300,000
Pinus Radiata			2,760,500,000	443,700,000	1,249,900,000					4,454,100,000
Arable sector										
Barley	854,065	67,807,838				57,335,212	65,528,836	48,133,597		242,000,074
Oats	305,760	3,283,020				14,444,759	1,203,150	3,819,326	15,191,477	38,247,492
Rye	214,500	1,872,000				7,863,425	1,821,817	452,952	9,364,803	21,589,497
Wheat	1,130,765	79,282,125				186,927,552	214,631,527	145,059,533	485,871	627,517,373

Table 5d Data notes on each species

Name	Data notes
Apples	Export data from SNZ. Good quality industry data. Reliable information
Asparagus	Export data from SNZ. Some industry data available but industry rules of thumb applied (also differing views on domestic sales). Approximate data only.
Aubergines	No SNZ data. Small number of growers with industry rules of thumb applied. Approximate data only.
Avocados	Export SNZ data available. Some industry data with rules of thumb applied. Approximate domestic data only.
Barley	No SNZ data. Good industry data being developed through AIMI surveys - no information on processing - rule of thumb applied. Data improving.
Beans (broad)	No SNZ data. Some industry data with rules of thumb applied. Approximations only.
Beans (green)	Export SNZ data available. Some industry data with rules of thumb applied. Approximate domestic data only.
Beetroot	Export SNZ data available. Some industry data with rules of thumb applied. Approximate domestic data only.
Blueberries	Export SNZ data available. Good industry data available with rules of thumb applied. Reliable industry data in a small industry.
Brassicas & brassics	Export SNZ data available on brassicas for human consumption. Approximations made for livestock dependence on brassicas. Approximate data only.
Browntop	Export SNZ data available. Approximate industry data with rules of thumb applied.
Capsicums	Export SNZ data available. Approximate industry data with rules of thumb applied.
Carrots	Export SNZ data available but some combined with other products. Some industry information available. Approximate data only.
Celery	No SNZ data. Industry estimates only. Data approximate.
Chicory	Export SNZ data available. Industry estimates. Approximate data only.
Chillies	No SNZ data. Industry estimates only. Data approximate.
Chrysanthemum	SNZ export data only. Industry data very approximate complicated by a variety of marketing channels.
Citrus	SNZ export data only. Some industry data available with industry rules of thumb applied. Approximate data only.
Clover (red & white	SNZ export data only. Some industry data available with industry rules of thumb applied. Approximate data only.
Cocksfoot	SNZ export data only. Some industry data available with industry rules of thumb applied. Approximate data only.
Cucurbita species	SNZ export data only. Some industry data available with industry rules of thumb applied. Approximate data only.
Cypress	SNZ export data only. Some industry data available. Approximate data only.
Douglas fir	SNZ export data only. Some industry data available. Approximate data only.
Eucalyptus	SNZ export data only. Some industry data available. Approximate data only.
Feijoas	SNZ export data available. Some industry data. Approximate data only.
Garlic	SNZ export data available. Some industry data with industry rule of thumb applied. Approximate data only.
Grapes	Export data from SNZ. Good quality industry data. Reliable information
Hops	SNZ export data available Some industry data with rules of thumb applied. Approximate data only.
Kiwifruit	Export data from SNZ. Good quality industry data. Reliable information
Kumara	Export data available from SNZ. Industry information available (differing views on domestic sales). Approximate data only.
Lettuce	Export data available from SNZ. Industry data available with rules of thumb applied. Approximate data only.
Lillies	SNZ export data only. Industry data very approximate complicated by a variety of marketing channels.
Lucerne	SNZ export data available on dependent industries. Some industry data available. Approximate data only.
Maize - Corn	Export SNZ data available on corn only. Approximate industry data with rules of thumb applied. Based on Booker (2009).
Nuts	SNZ export data available. Industry data very approximate with industry rules of thumb applied.
Oats	No SNZ data. Data based on dependent industries reliable, other data approximate only.
Olives	SNZ export data available. Some industry data with industry rule of thumb applied. Approximate data only.
Onions	SNZ export data available. Some industry data with industry rule of thumb applied. Approximate data only.
Orchids	SNZ export data only. Industry data very approximate complicated by a variety of marketing channels.
Parsnip	No SNZ data. Industry data only with rules of thumb applied. Very approximate.
Passionfruit	SNZ export data only. Industry data approximate with rules of thumb applied.
Pears	Export data from SNZ. Good quality industry data. Reliable information
Peas	Export data from SNZ. Industry data of good quality although rules of thumb applied for processing.
Persimmons	Export data from SNZ. Industry data of good quality. Reliable.
Pinus Radiata	Export data from SNZ. Industry data of good quality. Reliable.
Potatoes	Export data from SNZ. Industry data of good quality with rules of thumb applied on processing. Reliable.
Prunus	Export data from SNZ. Industry data of good qualty. Reliable.
Radish	Export data from SNZ. Industry data avaialbe with rules of thumb applied. Approximate data.
Ribes	Export data from SNZ. Industry data avaialbe with rules of thumb applied. Approximate data.
Ribwort plantain	Export SNZ data available. Approximate industry data with rules of thumb applied.
Roses	No SNZ data. Industry data very approximate complicated by a variety of marketing channels.
Rubus	Export data from SNZ. Industry data avaialbe with rules of thumb applied. Approximate data.
Rye	Export data available on dependent industries. No data on human consumption. Other data approximate.
Ryegrass	Export data available on dependent industries. No data on human consumption. Other data approximate.
Silverbeet	No SNZ data. Industry estimates only. Data approximate.
Sphagnum moss	Export data avalible. Scant information otherwise with rules of thumb applied. Approximate data.
Spinach	No SNZ data. Industry estimates only. Data approximate.
Strawberries	Export SNZ data available. Good industry data available with rules of thumb applied. Reliable industry data in a small industry.
Tall fescue	Export SNZ data available. Approximate industry data with rules of thumb applied.
Tamarillos	Export SNZ data available. Good industry data available with rules of thumb applied. Reliable industry data in a small industry.
Tea	Export SNZ data available. Some industry data with rules of thumb applied. Approximate domestic data only.
Timothy	No SNZ data available. Approximate industry data with rules of thumb applied.
Tomatoes	Export data from SNZ. Industry data of good quality although rules of thumb applied for processing.
Tulips	SNZ export data only. Industry data very approximate complicated by a variety of marketing channels.
Wheat	Data from SNZ. Good industry data being developed through AIMI surveys - no information on processing - rule of thumb applied. Data improving.

SNZ - Statistics New Zealand

AIMI – Arable Industry Marketing Initiative

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Appendix A Livestock reconciliation

For the dependent industries the input feed calculations are required to balance, so as to avoid overstating value. Below we have set out the reconciliation statement for each plant species and their dependent industry(ies). It should be noted that there is no definitive publication that we can point to that has all the data we needed. Therefore we have relied on industry sources for their best estimates.

Table 6 Livestock reconciliation

Livestock reconcilation	Dairy	Other livestock	Horses	Pigs	Poultry (eggs)	Poultry (meat)
Barley			9.00%	17.40%	17.40%	17.40%
Wheat				58.80%	58.80%	58.80%
Rye	0.10%	0.10%	0.10%			
Brassicas & brassics for fodder	1.00%					
Browntop		0.50%	0.50%			
Faba beans			0.25%			
Peas			0.25%			
Chicory	0.20%	0.20%	0.20%			
Clover (red & white)	12.00%	12.00%	7.20%			
Cocksfoot		0.20%	0.20%			
Oats	0.20%		12.00%			
Lucerne	0.20%	0.20%	3.00%			
Maize - Corn	3.70%		5.00%	10.00%	10.00%	10.00%
Ribwort plantain	0.20%	0.20%				
Ryegrass	75.00%	75.00%	45.00%			
Tall fescue		0.20%	0.20%			
Timothy		0.10%				
Weeds and other grasses	3.70%	10.30%	5.00%			
Protein & other supplements			11.10%			
Imports (including palm kernel)	3.70%	1.00%	1.00%	13.80%	13.80%	13.80%
Totals	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Source: approximations from DairyNZ, Gee (2012), and						
http://nzfma.org.nz/media/reference/feed-manufacture/2015-annual-nzfma-feed-overview						

Appendix B Approach to valuing plant species

The value chain analysis divides the specific plant species into:

- seeds/root stock/ trees or plants
- farmgate values
- processing (if any)
- domestic sales
- export sales.

We then determine whether other industries are reliant on a particular species e.g. the dairy industry is dependent on a number of grasses, legumes and herbs as feed sources.

The proportion any dependent industry is reliant on a plant species is determined by:

- literature from the feed industry e.g. good statistics are available on the amount of domestic maize, barley and wheat that go into the pig and poultry industries
- assumptions about feed intake into the dairy or other livestock industry. We have no firm data on dairy industry intake however DairyNZ has provided us with approximate assumptions
- other assumptions given the plant species characteristics i.e. a grass is used because of its drought tolerance or it tolerates wet and cold conditions.

The value of each segment of the value chain is determined by an approximate volume and price estimate based on:

- prices and volumes set out in the literature e.g. the Lincoln Financial Budget Manual
- industry experts who have given approximate values particularly for domestic economic activity
- rules of thumb used as an approximate value i.e. particularly for farmgate values e.g. Horticulture New Zealand assisted with this process by suggesting that farmgate returns are approximately 50% of domestic value (+GST) and export values (FOB).

While these estimates are rough approximations, they do give us an order-of-magnitude calculation that size each plant industry segment.

These 'volume-multiplied-by-price' estimates can be described as a Gross Output calculation which is then multiplied by a GDP share of output (to prevent double counting) to arrive at a valued estimate for each industry segment.

These calculations (direct and dependent industry values) are added together to equal the total value added for a plant species.

B.1 Dependent industries

A key valuation issue is the value of livestock industries that depend on the various plants for energy and to drive economic activity. Below we have set out the values provided by the various industries that represent the gross output at each stage of the marketing chain. Specifically:

- dairy, beef, sheep, wool, deer and goats estimates were provide by Rob Davison and Beef and Lamb (except for live cattle exports and domestic live cattle sales)
- live cattle and horse exports are from Statistic NZ (HS codes)
- live domestic traditional livestock sales estimates are based on Treasury estimates (Treasury 2015, p15)
- poultry egg and meat production at the farmgate are estimates provide by Mr Steven Kerr (personal communication, 24 July 2014)
- pigmeat farmgate estimates were provided by Mr Ian Braugh (personal communication, 12 August 2014)
- domestic sales of poultry (eggs and meat) and pork are based on a 28% retail mark-up from the farmgate (New Zealand Retailers Association 2013, p 16)
- processing gross output for poultry (eggs and meat) and pork are based on 33% of the retail value
- horse gross output values at the farmgate and domestic sales are estimates from the New Zealand Racing Board (IER Pty Ltd 2010).

Table 7 Gross output for livestock sectors

2012 June years, NZ dollars

	Farmgate	Processing	Domestic sales	Exports
Dairy	12,241,185,000	585,389,000	348,800,000	12,477,774,000
Beef	1,282,768,000	1,706,081,440	401,900,000	2,469,809,000
Sheep	2,963,517,000	3,941,477,610	804,600,000	3,125,971,000
Wool	618,586,000	822,719,380	43,900,000	984,693,000
Deer (incl. co-products)	174,136,000	231,600,880	8,200,000	270,974,000
Goats				6,668,000
Livestock sales (export)				119,937,761
Live sales (domestic)			871,000,000	
Horses	93,514,626		57,000,000	
Live horses exported				130,029,252
Poultry (eggs)	148,000,000	62,515,200	189,440,000	
Poultry (meat)	1,000,000,000	422,400,000	1,280,000,000	
Pigs	176,600,000	23,400,000	226,048,000	

Source: Meat + Lamb New Zealand (provided by Rob Davison), Poultry Industry Association of New Zealand, NZ Feed Manufacturers Association, New Zealand Pork, IER Pty Ltd 2010, Gee 2012 and Statistics New Zealand HS Code 0101

In some cases plants are used in some traditional livestock industries and not others or in all traditional livestock sectors. A key issue in arriving at these totals (particularly for other traditional livestock) is valuing the live export and domestic sales. The

assumption used here is that 80% of all sales are dairy cows. This allows us to split the traditional livestock sectors between dairy and other livestock. This is set out below.

Table 8 Gross output for traditional livestock groupings

2012 June years, NZ dollars

	Farmgate	Processing	Domestic sales	Exports
All traditional livestock industries	**17,280,192,000**	**7,287,268,310**	**2,478,400,000**	**19,455,826,761**
Dairy	12,241,185,000	585,389,000	348,800,000	12,477,774,000
Live sales			696,800,000	95,950,209
Total dairy	**12,241,185,000**	**585,389,000**	**1,045,600,000**	**12,573,724,209**
Other traditional livestock industries	5,039,007,000	6,701,879,310	1,258,600,000	6,858,115,000
Live sales			174,200,000	23,987,552
Total other traditional livestock	**5,039,007,000**	**6,701,879,310**	**1,432,800,000**	**6,882,102,552**
Total pigs & poultry	**1,324,600,000**	**508,315,200**	**1,695,488,000**	

Note (1) Other traditional livestock industries includes: beef, sheep, wool, deer, and goats

Source: Meat + Lamb New Zealand (provided by Rob Davison), Poultry Industry Association of New Zealand, NZ Feed Manufacturers Association, New Zealand Pork, IER Pty Ltd 2010, Gee 2012 and Statistics New Zealand HS Code 0101

The gross output numbers set out in the above two tables are large relative to the direct impacts of plants. Even significant plants such as kiwifruit are an order of magnitude lower. This has a significant impact on species such as clover and ryegrass.

Relatively minor crops such as chicory, browntop and lucerne have a significant impact because of livestock dependence on them as fodder.

Further, the value attached to plants is closely linked with the rises and falls in livestock industry fortunes. Therefore year-to-year values are quite volatile.

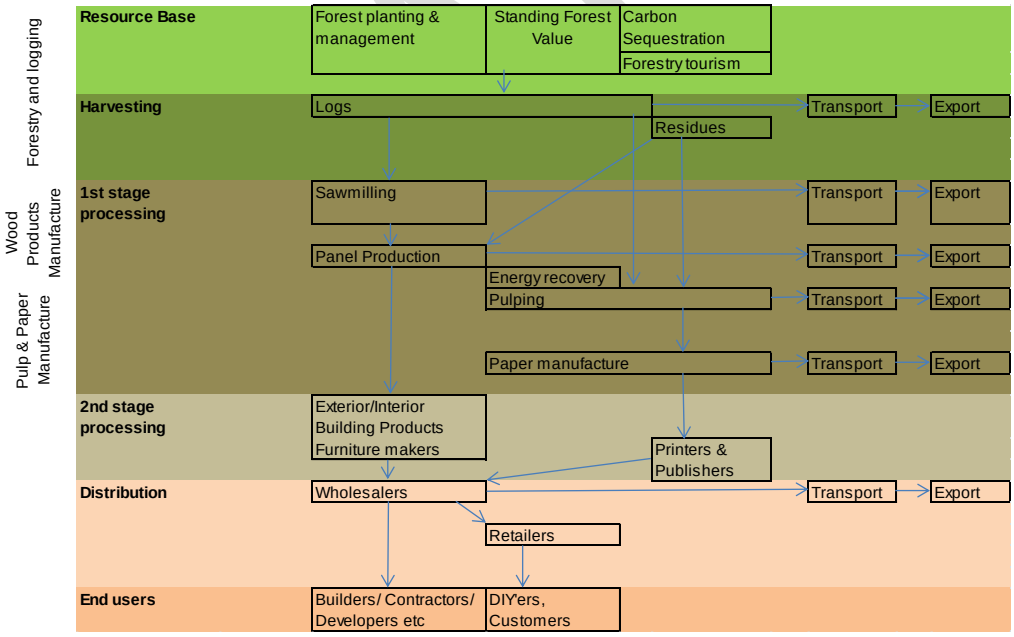
Appendix C Forestry species

Forestry is a substantial part of the New Zealand economy and in recent years the third largest commodity exports after dairy and meat production. Most commercial forestry is now derived from exotic tree species which are both fast growing in the New Zealand environment and yielding a range of wood qualities for use in sawn timber production, reconstituted panel products, pulp and paper manufacture.

Pinus radiata is the predominant species grown in plantation forestry in New Zealand, accounting for about 90% of harvest area, 93% of harvested volume and 94% of exports by value. Douglas fir is the second most important species with about 6% of planted area and 4% of annual harvested volume. The remainder of exotic forests comprise *Eucalyptus*, *Cupressus* and other minor special purpose species. Each species has its own timber qualities and product purposes, but all face a similar marketing chain between growth and use, which is described below.

The forestry sectors in the national accounts comprise forestry and logging, wood products and pulp and paper manufacture. The connections between these sectors are outlined in Figure 1 below.

Figure 1 Connections between industries in the forestry sector



Source: NZIER

Forestry and logging covers the management of the resource base – the planting and management of plantation forests – and harvesting. First stage processing sectors include the wood products industry, which produces sawn timber, veneers, plywood and reconstituted panels such as fibreboards, and the pulp and paper manufacturing industry. Second stage processing involves industries whose products have a noticeable proportion of wood-based products, including building materials and the construction industries, furniture making, printing and publishing (other than online and electronic media publishers). The term 'forestry sector' is commonly applied only

to forestry logging and first stage processing, in which forest products (wood-fibre) comprises 25% or more of the value of inputs (according to Statistics New Zealand's Input-Output tables). In second stage processing, non-wood inputs comprise more than 80% of total input value, and more substitutes exist for wood-fibre (e.g. steel framing in building, metal or plastic furniture) so the share of economic value added attributable to wood or tree species is lower than in first stage processing.

Figure 1 also shows that the wholesale and retail trade and transport operators are also involved in the distribution of forest products to domestic and export markets. If these services are specialised to distributing forest products they would face a short term hit in the event of disruption of forestry production. But such services as building supplies wholesaling and retailing often trade in more than just forest products, and in the longer term, resources in these distribution services would be redeployed to other things, so they are less directly part of the value at risk from threats to forestry activity.

Other features to note from Figure 1 are:

- while the main material flows between forestry-related sectors are of logs from forestry to wood processing and pulping, there are also large flows of residues from both harvesting and sawmilling activities that are collected and provide inputs to reconstituted wood products and pulp manufacture
- residues are also used to provide heat and power to parts of the manufacturing process, particularly in pulp making, providing value savings in the cost of energy that would otherwise be needed; and wood fibre is also being investigated as a potential feedstock for bioenergy production
- there is commercial value in standing forests, both from their role as the setting for forest-based tourism and because of their storage of carbon under a greenhouse gas accounting system. Both of these values are compromised by the harvesting of trees, at least in the short term until forest growth recovers
- forests in general can also create value or save costs by providing soil stability, reducing erosion and run-off into streams, and moderating water flows, but these effects are often experienced as externalities that do not provide commercial return to those who provide the forests.

Implications for attributing value to species

Although the valuation method applied to tree species is broadly similar to that applied to other plants, some modification is required to take account of the characteristics of tree species. In particular:

- trees are a long lived stock so threats to a species create risk of both reduced annual production and over a stream of years ahead. This is handled by presenting both an annual value and a present value of future expected harvests to indicate the scale of impact of threats to each species
- trees also produce multiple outputs of products and energy when used, and of carbon storage while standing, all of which need to be accounted as part of the value at risk in face of threats.

C.1 Outline of valuation methods

C.1.1 GDP attribution

As outlined in the pilot, we provided estimates for *Pinus radiata* in the Interim Report. The task here is to attribute values for output, exports and GDP to individual species given reliable statistics only on export volumes and values and production volumes. Areas planted by species are given in the NEFD, and these have been used to attribute the volume harvested that is not *Pinus radiata* amongst the other species. An alternative is to use the export value figures for sawn timber, which distinguish *Pinus radiata* and Douglas fir from other species, and allocate the remainder across other species in proportion to their shares of volume harvested. The choice between these species shares only has a material impact on Douglas fir, which has a much lower share of sawn timber exports than its share of harvested volume.

In the pilot, we allocated aggregate forestry figures in proportion to the shares of export value. Applying this across species may understate the attribution to Douglas fir and elevate slightly those to cypress, eucalypts and *Pinus radiata*. Accordingly, for cross species comparison we have allocated each species in proportion to estimated harvest volume. The *Pinus radiata* result has changed slightly from the pilot, but not by a material amount.

C.1.2 Recovered energy

Forestry contributes to the national energy balance in a number of ways:

- firewood collected from forests for use in domestic and industrial burners
- residues from sawmilling collected and fed into furnaces to power forest industry processes
- extracts from the pulping process (black liquor) which can be fed into furnaces to provide heat and power for other production processes
- Biodigestion of wood fibres to convert components into other biofuels, such as ethanol for blending with petrol or diesel.

While wood fibre is attracting attention as a future feedstock for biofuels, such processes are not commercially competitive at present and volumes used are at a low experimental level. Firewood is part of the outputs of the forest growing sector, but its volume and value are probably understated by transactions on the black or grey markets and by unrecorded foraging and collecting from forests for domestic consumption. The use of residues and black liquor are widely used in the industry, and these have a value in the avoided cost of other energy that would otherwise be required to be bought and that would detract from the industry's value added.

NZFOA's *Forestry Facts and Figures* records 61.1 gross petajoules of energy as being derived from forest residues in year ending December 2012. Leaving aside a slight difference in NZFOA's and MBIE's figures for 2012, 61.1 GPJ represents a sizeable contribution to New Zealand's energy needs, equivalent to about 12% of total consumer energy (i.e. energy available for consumption uses, after allowing for energy transformation processes such as oil refining). It is equivalent to about 16,908 GigaWatt hours (GWh), which valued at a wholesale price of 8c/kWh ($80/MWh) in 2012 would be worth $1.358 million. Assuming 93% if that is derived from *Pinus radiata* residues, the energy value attributed to the species is $1.265 million.

This figure is equivalent to about 8% of the Gross Output from *Pinus radiata* across the three forestry sectors. A value-added estimation is less straight forward, because the activities involved in energy recovery from woody biomass are already implicitly covered in the forestry sectors' activities in the national accounts. If there was no energy recovery, the forestry sectors would need to buy the energy to maintain the same output which, other things held constant, would reduce their value added by $1,265 million on the estimates above. The energy generation sector, however, would increase its sales by the same amount and create some value added on these sales. The Input-Output tables show the electricity generation and on-selling sector had a ratio of value added to Gross Output of 0.26, so assuming this applies to the replacement of woody biomass implies a value added contribution of $329 million.[11] This estimate assumes that electricity is the next best alternative energy source to woody biomass, but in practice that may not be the case if gas or coal is more competitive. There would be a net loss in value added economy-wide of $936 million.

In short, the industry's energy recovery provides an economic surplus for the industry already reflected in industry value added, but without energy recovery that value added would decline. In practice, should a biosecurity threat emerge to threaten production, the forest industries' demand for process energy may fall, which would lower the value of that economic surplus. Conversely, more wood may be diverted to energy recovery in the event that a threat emerged that lowered wood's value in other uses.

About 12% of the estimated value of energy recovery from woody biomass is used for residential heating, amounting to $152 million a year. While most of this is covered by the inter-industry transactions in the input output tables, an indeterminate portion may be outside it because of wood supplied informally through the grey or black economy.

C.1.3 Carbon sequestration

Forests act as a carbon sink when growing, storing carbon in their trunks until such time as they burn, die or decompose, at which point they release it back into the atmosphere. Under the Kyoto Protocol carbon accounting, new forestation since 1990 counts as an addition to New Zealand's carbon storage eligible for earning credits, but any deforestation counts as emission of greenhouse gases at the time the tree is cut down, creating liability for landowners unless they replant.

The existence of standing forest creates a valuable store of carbon which fluctuates year to year according to the rate of land use change and the extent of deforestation, replanting and new afforestation. In 2012, net removals of greenhouse gases in New Zealand under the Kyoto Protocol were 15 million tonnes of CO_2-e from land use change and forestry. Under UNFCCC reporting which includes a broader range of non-forest land categories, net removals were 26.6 million tonnes CO_2-e.

The commercial value of these sequestered stores is highly variable, depending on both the changes in the physical stock of trees and the price attached to carbon credits. Unfortunately 2012 is problematic as a base year in that it was a year which saw the carbon price fall from NZ$8.06/t$CO_2$-e in January to 0.29c/t$CO_2$-e in December. The price fall was caused by international factors, in particular excessive supply of credits in the EU and New Zealand emissions trading schemes, and the collapse of demand for

[11] Note we only consider the generation and selling of electricity as an incremental activity associated with finding alternative energy. Transmission and distribution networks have fixed capacities and a higher proportion of fixed cost which we assume will be unchanged by marginal change in electricity supplied.

credits brought on by the global financial crisis. Prices have varied a little since then, but in March 2014 were still just 30c/tCO_2-e.

We estimate the value attributable to species by calculating the net carbon removals from land use change and forestry from the MfE's Kyoto Protocol inventory, valuing this by the carbon price and attributing this to species in proportion to the volume harvested. Effectively this is the liability created by harvesting the volume of species, or the value of carbon stored by those growing trees in the year prior to felling. We provide estimates at two price levels, of $8.06 t/$CO_2$-equivalent in January 2012 before the price crash, and $0.29/tonne CO_2-e in December after the crash.

C.1.4 Forest tourism and other wider benefits

Exotic forests are not without amenity value and some may attract recreational and tourist use. Activities such as tramping, picnicking and mountain biking take place in exotic forests. There are commercial values associated with this, arising from gate fees for access to specific attractions, guiding fees for visits to the areas, or ancillary activities such as hospitality, retailing and transport services that are used in association with these forests.

Forest recreation and tourism in New Zealand is dominated by indigenous forests, and even for this, there is very patchy information on the amount of activity in the forests and the commercial value created by them. There has been relatively little study of recreation and tourism in exotic forests with which to infer general value.

Some recent studies have attempted to infer wider values for exotic forests from the ecosystem services of value they provide to other human activities.[12] These ecosystem services include values for recreation and tourism activity, contributions towards water quality improvement, micro-climate regulation and amelioration of soil erosion and flooding. Such studies infer economic values for such services with a variety of methods, such as estimating the averted losses from fewer flood events or various non-market valuation techniques to estimate the public's willingness to pay for such services. Such methods estimate a consumer surplus associated with use of these forests, but these are not generally commercial values and are not strictly comparable with other national accounting aggregates unless consumer surplus estimates are made for all other activities covered by the accounts. Accordingly this is beyond the scope of this report and not pursued further here.

We have found no reliable information on commercial values for recreation and tourism in exotic forests, and have no basis for estimating a figure for tourism, recreation or other ecosystem services attributable to individual exotic species.

C.1.5 Net present value over time

The estimates of gross output and value added in the national accounts are annual values recording activity within a single calendar year. But forest crops are long-lived assets that take years to reach harvestable stage. A biosecurity threat that attacked a tree species would affect not just the current year's activity but also that for years to come. A full measure of the value associated with tree species needs to reflect the inter-temporal impact of such threats on the growing stock.

[12] See chapters by Yao et al on Planted Forests, Simmonds on Tourism, and Clough on Recreation in Dymond J (Ed.) *Ecosystem Services in New Zealand: conditions and trends*, Manaaki Whenua Press, Lincoln, New Zealand 2013.

Assessments of forest pests once they have arrived (e.g. the white spotted tussock moth) this has been done by postulating a level of impact and projecting this as a loss of productive value in future years to estimate a net present value of potential future loss. Given knowledge of the stock of forests and the age classes and types of trees within them, modelling the availability of trees for harvest into the future can be done with some precision. Forecasting the actual production levels varies with predictions of the volume demanded, the price of products and the future level of costs of production, changes in which have in the past led to marked shifts in the rates of felling and use of wood fibre between log exports, wood processing and pulp manufacture. Broader economic influences like global growth and demand and exchange rate variations also affect the future volume and timing of forest offtake. This range of influential variables can cloud the valuation with questions around the detailed assumptions, distracting from the bigger picture of value at risk of threat.

One way to reduce this cloud would be to present the one year national accounting figures as an indicator of immediate or short term value at risk, to give some comparability with other estimates for plants with annual or shorter term rotations, then supplement this with a net present value calculation of the value of future production at risk. Different forecasts would produce different results and if a real pest emerged more effort would be directed at refining forecasts of potential impacts, but relatively simpler estimates of future values suffice for ex ante scaling of values at risk.

Wood availability forecasts exist for the period to 2010-2040 which provide an indication of how much wood is in principle available for harvest in future years.[13] The forecasts include a range of separate scenarios, but two scenarios for *Pinus radiata* are illustrated in our estimates: scenario 1, which assumes all wood is harvested at age 30 (which results in a distinct bulge in the middle years of the forecast); and scenario 3, which is described as "Non-declining yield with a target of 30 years", in which the bulge is smoothed out in a manner more in keeping with maximising the utilisation of capital equipment over the lifetime of the forest rotation. The value of such wood into the future is difficult to predict, but it would be reasonable to start with the assumption that it would earn in real terms no less than the current Value Added of $173 per cubic metre earned across the forestry industries. Combining the volume and value information in a discounted cash flow indicates a net present value for the species in question (using discount rates of 3%, 6% and Treasury's default 8% rate).

The wood availability forecasts also include one for Douglas fir, which we use to calculate the present value at risk for that species. There are no published forecasts for eucalypts or cypress species, so we compile a forecast from the age classes of plantings in the NEFD, assuming harvesting at 35 years.

C.2 *Pinus radiata* estimates

Pinus radiata is the most widely planted commercial tree species in New Zealand, with a range of uses from sawn timber for framing and building to pulp and paper and reconstituted boards. A slight revision to the pilot estimates is required because of the relativities between tree species.

[13] MAF (2010) New Zealand Wood Availability Forecasts 2007-2040, Wellington.

Attribution of industry output value and value added to *Pinus radiata* in proportion to harvested volume shares results in the following break-down of value across the forestry sectors.

Table 9 *Pinus radiata* summary

Year ending December 2012, $ M

Stage of production	Outputs used by other industry	Outputs to domestic final consumption	Outputs to export	Gross Output $m	GDP share of Gross Output (source: SNZ: Input-Output tables, Tab 4)	GDP value
Forestry & logging	4,053	1,038	1,463	**6,555**	0.35	**2,314**
Wood product manufacture	2,996	156	1,469	**4,621**	0.29	**1,321**
Pulp & paper manufacture	1,731	120	1,147	**2,997**	0.27	**820**
Total *Pinus radiata*	**8,781**	**1,314**	**4,079**	**14,173**	**0.31**	**4,454**[1]
Note (1) numbers rounded.						

Source: NZIER, using Statistics New Zealand's Input-Output tables, NZFOA Facts and Figures, Exports by product

This table implies that the annual value at risk from biosecurity threat to *Pinus radiata* is $4.5 billion in value added (2.2% of national GDP) and $4.1 billion of export value (6.5% of total New Zealand exports).[14]

C.2.1 Value outside the annual national accounts

The value added and output estimates do not cover all the potential value at risk should *Pinus radiata* be subject to biosecurity threat. Two quantifiable sources of commercial value potentially at risk are recovered energy and carbon sequestration.

Recovered energy value

Applying the methodology for value to energy generation, we estimate the contribution of *Pinus radiata* to equate to around $1.26 billion in reduced energy costs that would have created $329 million in value added for the electricity sector (other things held constant). The net value gain is therefore $936 million[15], which is implicit in, and hence enhances, the sector's GDP.

[14] GDP and total export comparisons are based on Statistics New Zealand's estimate of annual GDP expenditure, Table 19, at http://www.stats.govt.nz/browse_for_stats/economic_indicators/GDP/GrossDomesticProduct_HOTPDec12qtr/Tables.aspx

[15] This figure is not in the summary table because it is an avoided cost figure that cannot be incorporated the national accounts without adjusting all other items in the accounts. Without energy recovery forest products industries would pay for alternative energy, reducing their value added but enlarging the value added of other energy sectors. There would be a net loss in GDP across forestry and energy supply sectors, but as this is an avoided loss it is already included in the forest industries' value added, and cannot be added to other values without double counting.

Carbon sequestration value

Carbon sequestration value is estimated for two assessments of carbon storage from the Kyoto Protocol recording purposes and those for the UNFCCC. It also uses two prices of carbon to reflect the range of recent prices. The outcome from the range of values and volumes used is shown Table 10.

Table 10 Value of sequestered carbon in *Pinus radiata*

$ M 2012 values, assuming 94% of sequestration is in *Pinus radiata*

Price NZ$/tCO2-e	Kyoto volume 15 Mt CO2-e	UNFCCC volume 26.6 Mt CO2-e
$8.06	$112.1m	$199.6m
$0.29	$ 4.1m	$ 7.2m

Source: NZIER using data from MfE on sequestered volumes and carbon prices

As prices currently lie at the lower end of this range, the value of carbon sequestration is negligible in the scheme of values reported here.

Effect on net present value of long term production

The value of wood into the future is difficult to predict, but an indication is given by New Zealand Wood Availability Forecasts 2010-2040. Assuming that it would earn in real terms no less than the current Value Added of $173 per cubic metre of timber earned across the forestry industries, and combining the volume and value information in a discounted cash flow indicates the following valuations.

Table 11 Value of standing stock of *Pinus radiata* forests[16]

Net present value of Value Added (contribution to GDP) 2013-2040

Discount rate	Forecast years	Scenario 1 Mean cut tonnes/year	Scenario 1 27 year NPV $m	Scenario 3 Mean cut tonnes/year	Scenario 3 27 year NPV $m
8%	27	25,320	58,791	25,024	55,856
6%	27	25,320	71,420	25,024	68,173
3%	27	25,320	99,274	25,024	96,020

Source: NZIER using data from MAF Wood Availability Forecasts 2010-2040

This can be interpreted as a maximum present value at risk should *Pinus radiata* be rendered unusable by some threat. More likely a threat will reduce the productive value by some proportion, which can be inferred from these estimates.

[16] The value of the expected stream of future timber from harvesting trees that are currently planted, valued on the assumption that the current Value Added per hectare will continue into the future. It is thus a value that growing trees will have when they reach harvest age at some time in future, discounted back to present value terms.

C.3 Douglas fir (*Pseudotsuga menziesii*)

Douglas fir (*Pseudotsuga menziesii*) is the second most commonly planted exotic forestry species in New Zealand, producing wood with a reputation for structural timber and some feature beams. It is mostly grown in the South Island. Its rotation is commonly longer (at 45 years) than that for *Pinus radiata* and its end uses are similar but complementary to those of *Pinus radiata*.

Applying the same attribution of industry output value and value added as for *Pinus radiata* results in the following break-down of value across the forestry sectors.

Table 12 Douglas fir summary

Year ending December 2012, $ M

Stage of production	Outputs used by other industry	Outputs to domestic final consumption	Outputs to export	Gross output $m	GDP share of Gross Output (source: SNZ: Input-Output tables, Tab 4)	GDP value
Forestry & logging	182	47	66	**295**	0.35	**104**
Wood product manufacture	135	7	66	**208**	0.29	**59**
Pulp & paper manufacture	78	5	52	**135**	0.27	**37**[2]
Total Douglas fir	**395**	**59**	**183**	**637**	**0.31**	**200**[1]

Note (1) numbers rounded. (2) This is the Value Added (GDP) contribution of each of the three sectors attributable to Douglas Fir. The total ($200M) appears in Table 3. Table 21 at the end of this section is the linking table, which shows for each species the GDP values per sector per species and the distribution of their output across other industries (e.g. processing), domestic consumption and exports). Those output distribution figures from Table 18 also appear in Table 3, albeit in a different scale format.

Source: NZIER, using Statistics New Zealand's Input-Output tables, FOA Facts and Figures, Exports by product

This table implies that the annual value at risk from biosecurity threat to Douglas fir is $200 million in value added (0.1% of national GDP) and $183 million of export value (0.3% of total New Zealand exports).[17]

C.3.1 Value outside the annual national accounts

The value added and output estimates do not cover all the potential value at risk should Douglas fir be subject to biosecurity threat. Two quantifiable sources of commercial value potentially at risk are recovered energy and carbon sequestration.

[17] GDP and total export comparisons are based on Statistics New Zealand's estimate of annual GDP expenditure, Table 19, at http://www.stats.govt.nz/browse_for_stats/economic_indicators/GDP/GrossDomesticProduct_HOTPDec12qtr/Tables.aspx

Recovered energy value

Applying the methodology for value to energy generation, we estimate the contribution of Douglas fir to equate to around $57 million in reduced energy costs that would have created $15 million in value added for the electricity sector (other things held constant). The net value gain is therefore $42 million.

Carbon sequestration value

Carbon sequestration value is estimated for carbon storage estimates under the Kyoto Protocol and UNFCCC recording processes. The outcome from the range of values and volumes used is shown in Table 13.

Table 13 Value of sequestered carbon in Douglas fir

$ M 2012 values, assuming 94% of sequestration is in *Pinus radiata*

Price NZ$/tCO2-e	Kyoto volume 15 Mt CO2-e	UNFCCC volume 26.6 Mt CO2-e
$8.06	$5.06m	$8.97m
$0.29	$0.18m	$0.32m

Source: NZIER using data from MfE on sequestered volumes and carbon prices

As prices currently lie at the lower end of this range, the value of carbon sequestration is negligible in the scheme of values reported here.

Effect on net present value of long term production

The value of wood into the future is difficult to predict, but an indication is given by New Zealand Wood Availability Forecasts 2010-2040. Starting with the assumption that it would earn in real terms no less than the current Value Added of $173 per cubic metre of timber earned across the forestry industries, and combining the volume and value information in a discounted cash flow indicates the following valuations.

Table 14 Value of standing stock of Douglas fir forests

Net present value of Value Added (contribution to GDP) 2013-2040

Discount rate	Forecast years	Scenario 1 Mean cut tonnes/year	Scenario 1 27 year NPV $m
8%	27	1,019	1,827
6%	27	1,019	2,343
3%	27	1,019	3,583

Source: NZIER using data from MAF Wood Availability Forecasts 2010-2040

C.4 *Cupressus* species

Cupressus species include a range of species like cypress and macrocarpa (*Cupressus macrocarpa*) that are commonly used in farm woodlots and shelterbelts. It produces a

durable heartwood and clear timber with some decorative uses, and it matures in approximately 35 years given suitable sites and management.

Applying the same attribution of industry output value and value added as for *Pinus radiata* results in the following break-down of value across the forestry sectors.

Table 15 Cupressus summary

Year ending December 2012, $ M

Stage of production	Outputs used by other industry	Outputs to domestic final consumption	Outputs to export	Gross Output $m	GDP share of Gross Output (source: SNZ: Input-Output tables, Tab 4)	GDP value
Forestry & logging	17[2]	4	6	**28**	0.35	**10**
Wood product manufacture	13	1	6	**20**	0.29	**6**
Pulp & paper manufacture	7	1	5	**13**	0.27	**4**
Total *Cupressus*[1]	**38**	**6**	**17**	**61**	**0.31**	**19[3]**

Note (1) numbers rounded. (2) These figures are shares of outputs for total forestry, attributed to each species in proportion to volume harvested. The figures are from the IO tables, uprated in line with changes in export stats. (3) This figure can be reconciled with Table 3 with reference to Table 21.

Source: NZIER, using Statistics New Zealand's Input-Output tables, NZFOA Facts and Figures, Exports by product

This table implies that the annual value at risk from biosecurity threat to *Cupressus* species is $19 million in value added (0.01% of national GDP) and $17 million of export value (0.03% of total New Zealand exports).

C.4.1 Value outside the annual national accounts

The value added and output estimates do not cover all the potential value at risk should *Cupressus* species be subject to biosecurity threat. Two quantifiable sources of commercial value potentially at risk are recovered energy and carbon sequestration.

Recovered energy value

Applying the methodology for value to energy generation, we estimate the contribution of *Cypress* species to equate to around $5.4 million in reduced energy costs that would have created $1.4 million in value added for the electricity sector (other things held constant). The net value gain is therefore $4.0 million.

Carbon sequestration value

Carbon sequestration value is estimated for carbon storage estimates under the Kyoto Protocol and UNFCCC recording processes. The range of values using these volumes two prices of carbon to reflecting the range is shown in Table 16.

Table 16 Value of sequestered carbon in *Cupressus* species

$ M 2012 values, assuming 94% of sequestration is in *Pinus radiata*

Price NZ$/tCO2-e	Kyoto volume 15 Mt CO2-e	UNFCCC volume 26.6 Mt CO2-e
$8.06	$0.48 m	$0.55m
$0.29	$0.02m	$0.03

Source: NZIER using data from MfE on sequestered volumes and carbon prices

As prices currently lie at the lower end of this range, the value of carbon sequestration is negligible in the scheme of values reported here.

Effect on net present value of long term production

The value of wood into the future is difficult to predict, given the low volume and scattered nature of the plantings. There are no published forecasts of future *Cupressus* wood availability, but the NEFD Table 9.10 gives areas planted for 5-year age groupings. We have assumed these age classes are evenly distributed though the five year periods (i.e. each year 1/5th of the area was planted, that they will be felled at age 35 years, and that the average yield will be 570 m^3 per hectare).[18] Starting with the assumption that the resulting volume yield would earn in real terms no less than the current Value Added of $173 per cubic metre of timber earned across the forestry industries, a discounted cash flow indicates the following valuations.

Table 17 Value of standing stock of *Cupressus* forests

Net present value of Value Added (contribution to GDP) 2013-2040

Discount rate	Forecast years	Scenario 1 Mean cut tonnes/year	Scenario 1 27 year NPV $m
8%	27	105	157
6%	27	105	212
3%	27	105	347

Source: NZIER using data from NEDF

Note that the NPV is calculated over a 27-year period, to be consistent with that of pinus radiata and Douglas fir, which were set at 27 years in line with the 2040 forecasts.

[18] Special Purpose Timber Species, http://maxa.maf.govt.nz/forestry/publications/SpecialPurposefinal.pdf

C.5 Eucalyptus

The *Eucalyptus* genus includes over 450 species and more than 200 hybrids, over 100 of which are found in New Zealand. Only a small proportion have commercial value in New Zealand, and recent planting has focused on species *E. regnans, E. fastigata* and *E. nitens*, which produce long fibres for use in pulp for high quality papers.

While *Eucalyptus* timber has grain features, patterns and colour that makes it suited for furniture, veneers and high value uses, it also has properties that require careful cutting. Growing eucalypts over 35 year rotations has weak returns, so some recent papers suggest shorter rotations of 18-19 years could be optimal. Eucalypts respond well to coppicing and regenerate quickly from stumps and have attracted attention as potential feedstock for biofuel manufacture with shorter rotations of 10 to 15 years. It tends to spit when burned, so as fuelwood is best used in enclosed stoves.

Applying the same attribution of industry output value and value added as for *Pinus radiata* results in the following break-down of value across the forestry sectors.

Table 18 *Eucalyptus* summary

Year ending December 2012, $ M

Stage of production	Outputs used by other industry	Outputs to domestic final consumption	Outputs to export	Gross Output $m	GDP share of Gross Output (source: SNZ: Input-Output tables, Tab 4)	GDP value
Forestry & logging	38	10	14	**61**	0.35	**21**
Wood product manufacture	28	1	14	**43**	0.29	**12**
Pulp & paper manufacture	16	1	11	**28**	0.27	**8**
Total *Eucalypts*	**81**	**12**	**38**	**132**	**0.31**	**41**[1]
Note (1) numbers rounded.						

Source: NZIER, using Statistics New Zealand's Input-Output tables, NZFOA Facts and Figures, Exports by product

This table implies that the annual value at risk from biosecurity threat to *Eucalyptus* species is $41 million in value added (0.02% of national GDP) and $38 million of export value (0.06% of total New Zealand exports).

C.5.1 Value outside the annual national accounts

The value added and output estimates do not cover all the potential value at risk should *Eucalyptus* species be subject to biosecurity threat. Two quantifiable sources of commercial value potentially at risk are recovered energy and carbon sequestration.

Recovered energy value

Applying the methodology for value to energy generation, we estimate the annual contribution of *Eucalyptus* species to equate to around $11.7 million in reduced energy costs that would have created $3.1 million in value added for the electricity sector (other things held constant). The net value gain is therefore $8.7 million.

Carbon sequestration value

Carbon sequestration value is estimated for carbon storage estimates under the Kyoto Protocol and UNFCCC recording processes. The outcome from the range of values and volumes used is shown in Table 13.

Table 19 Value of sequestered carbon in *Eucalyptus* species

$ M 2012 values, assuming 94% of sequestration is in *Pinus radiata*

Price NZ$/tCO2-e	Kyoto volume 15 Mt CO2-e	UNFCCC volume 26.6 Mt CO2-e
$8.06	$1.05m	$1.85m
$0.29	$0.04m	$0.07m

Source: NZIER using data from MfE on sequestered volumes and carbon prices

The value of carbon sequestration is negligible in the values reported here.

Effect on net present value of long term production

There are no published forecasts of future *Eucalyptus* wood availability, but the NEFD Table 9.12 gives areas planted for 5 year age groupings. Assuming each year 1/5th of the area was planted, that trees are felled at age 35 years, that the average yield will be 400 m^3 per hectare,[19] and that the resulting volume yield would earn in real terms no less than the current Value Added of $173 per cubic metre of timber earned across the forestry industries, a discounted cash flow calculated over a 27-year period at 3%, 6% and 8% discount rates yields the following valuations.

Table 20 Value of standing stock of *Eucalyptus* forests

Net present value of Value Added (contribution to GDP) 2013-2040

Discount rate	Forecast years	Scenario 1 Mean cut tonnes/year	Scenario 1 27 year NPV $m
8%	27	193	281
6%	27	193	381
3%	27	193	631

Source: NZIER using data from NEDF

[19] *Eucalypts* New Zealand http://ieabioenergytask43.org/wp-content/uploads/2013/09/IEA_Bioenergy_Task43_PR2011-01.pdf

C.6 Value added component of the species

The foregoing sections have identified the gross value of species. Table 21 presents the value added for each species and sector, and the four species combined.

Table 21 Value added by species and sector

Species	Outputs used in other sectors	Outputs used in domestic consumption	Outputs sent for export	Total outputs
Pinus radiata	*$m*	*$m*	*$m*	*$m*
Forestry & logging	1,431	366	516	2,314
Wood products	856	45	420	1,321
Pulp & paper	473	33	314	820
Total	**2,760**	**444**	**1,250**	**4,454**
Douglas fir	*$m*	*$m*	*$m*	*$m*
Forestry & logging	64	16	23	104
Wood products	39	2	19	59
Pulp & paper	21	1	14	37
Total	**124**	**20**	**56**	**200**
Cupressus	*$m*	*$m*	*$m*	*$m*
Forestry & logging	6	2	2	10
Wood products	4	0	2	6
Pulp & paper	2	0	1	4
Total	**12**	**2**	**5**	**19**
Eucalyptus	*$m*	*$m*	*$m*	*$m*
Forestry & logging	13	3	5	21
Wood products	8	0	4	12
Pulp & paper	4	0	3	8
Total	**26**	**4**	**12**	**41**
Four species	*$m*	*$m*	*$m*	*$m*
Forestry & logging	1,514	388	547	**2,449**
Wood products	906	47	444	**1,398**
Pulp & paper	501	35	332	**868**
Total	**2,922**	**470**	**1,323**	**4,715**

Source: NZIER

Table 21 is calculated by applying the GDP: Output ratio to each sector's Gross Output distributed to other industries (for processing), to the domestic consumption and to

export. Hence the table shows how much value added each sector creates in distributing its output to the different uses, and the relative scale of value added created by forestry and logging, wood products and pulp and paper manufacture. The four species totals are the summation of the corresponding figures for each of the individual species, hence the four species forestry and logging figures are the sum of forestry and logging value added for each of the four species above. The Total rows for each species in this table are the figures that appear as Direct Impact columns in Table 5 above.

C.7 Limitations and potential refinements of forestry values

The method applied to forestry tree species is very high level, and as such may miss some of the distinctions between different species. It effectively attributes shares of industry value to species according to the volume harvested of each species. This has a number of limitations. If the tree species differ markedly in the average value per unit volume – for instance due to different qualities of wood fibre or different product mixes – some species may be over-valued and others under-valued. The estimation of future value streams at risk is itself at some risk of missing changes in future value or future cutting profiles reflecting varying market influences at the time.

Some of these issues (like uncertainty about future prices and harvest volumes) are common to all future-focused valuations, and manageable with sensitivity testing of input assumptions or predictions of ranges around a central forecast. Some are less problematic in the case of forestry species because of the characteristics of forestry in New Zealand. *Pinus radiata* is so dominant in New Zealand that average values and wood product mixes for *Pinus radiata* are likely to be close to those for all forestry.

There is more of an issue for species grown for special purpose timbers, which include some *Eucalyptus* and *Cupressus* species. But these are such a small part of the current forestry mix that the current method is unlikely to miss significant value.

That said, the method can obviously be improved by refining each of the smaller species so that the model reflects their average price per volume, or their mix of pulping, timber and biofuel uses. This would require more elaborate recording of harvesting activity and distribution of offtake to different uses. Both the cypress and eucalypt categories contain multiple species with distinct characteristics and uses. Obtaining reliable data specific to these species could be costly and possibly not justifiable for species with small scale value contribution.

The values described here are values associated with particular species, not the residual economic rent attributable to species after all other capital and labour inputs have covered their opportunity cost. Clearly value is created or added to a species by labour and capital inputs, but without detailed information on the assets and other inputs employed to determine an appropriate return to each factor, calculation of a residual rent attributable to a species will be problematic.

Appendix D Other plants

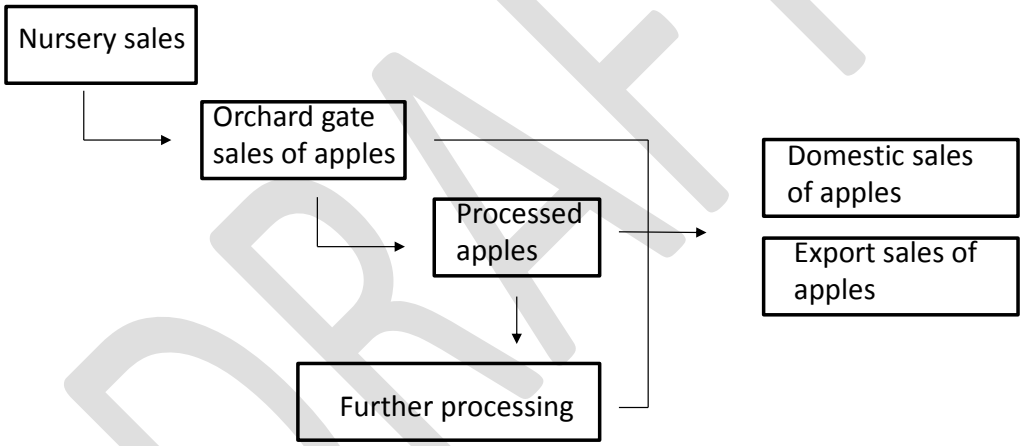
D.1 Apples (*Malus domestica*)

Apples (*Malus domestica*) arrived in New Zealand with the first European settlers. First exports occurred in 1888[20] and today while undergoing radical change with deregulation the industry is still a major contributor to the New Zealand economy.

Figure 2 sets out the apple value chain. Major points include:

- the best data is for exports. There is no other official data for other parts of the value chain. Therefore, we have worked backward through the marketing chain from the export value
- estimates are made for processed apples (i.e. the domestic market, further processing are based on industry views).

Figure 2 Apple value chain



Source: NZIER

D.1.1 Trees/root stock production

The following Table sets out the approximate value of apple nursery sales in 2012. While very approximate, we have used sales from a major nursery (personal communication, Kate Marshall, Waimea Nurseries, 16 May 2014) to identify domestic nursery sales. Total exports of live plants and root stock is relatively small.[21]

[20] http://www.teara.govt.nz/en/apples-and-pears/page-1

[21] No root stock was exported in 2012.

Table 22 Estimated apple nursery value

2012, June year, $ M

	Trees	Per unit sales	Nursery sales (per annum)
Apple nursery stock	600,000	$13	$7.8 million[1]
Notes (1) includes value per hectare, labour costs, and wholesale mark-up.			

Source: Waimea Nurseries and NZIER

D.1.2 Orchard gate

Total production is estimated to be 519,000 tonnes. This has been calculated by taking the total export tonnage (285,000 tonnes), adding estimates of domestic consumption (73,450 tonnes) and estimates of the amount removed at the processing stage (144,000).

Orchard date return estimates are calculated using the USDA's estimate of $300 per tonne (June year 2012) (USDA 2013) as follows: Estimated tonnes (519 tonnes) are multiplied by $300 per tonne equalling $155.7 million at the orchard gate).

D.1.3 Processing

Apple processing costs range between 20% and 50% of the domestic and export value depending on the variety (personal communication, David Lee-Jones, US Embassy, 16 October 2014).[22] Processing costs' values are estimated to be $172.5 million in 2012 (39% of domestic and export value) (Ministry for Primary Industries 2012).

D.1.4 Domestic sales

Domestic value is set out in Table 4. It comprises of orchard gate sales and estimated retail sales. The total value is approximately $56.2 million.

Table 23 Estimated apple domestic value

2012, June year, $m

	Sales	Comment
Orchard gate sales	$1.5 million[1]	Estimated at 1% of Orchard gate returns
Domestic sales	$8.8 million[2]	Estimated tonnes of 73,450 multiplied by $120[3] per tonne
Processing sales	$45.9 million[2]	USDA estimate
Total	$56.2 million	
Notes (1) NZIER estimate based on Industry rule of thumb. (2) USDA (2013) estimate (3) $120 per tonne value estimated at 10% of export values. See Lincoln Financial Budget Manual 2012/13, p A64.		

Source: USDA 2013 and Lincoln Financial Budget Manual 2012/2013

[22] It should be stressed that this is an approximate estimate.

D.1.5 Export sales

In 2012, 285,000 tonnes of apples were exported at a value of $385.6 million (Fresh Facts 2012 and Statistics New Zealand).

D.1.6 Summary

Table 24 sets out the GDP output share of apples to the New Zealand economy.

Table 24 Apple summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($7.8 million)	100%	0.39	$3.0 million
Farmgate ($155.7 million)	100%	0.39	$60.7 million
Processing ($172.5 million)	100%	0.32	$55.2 million
Domestic sales ($56.2 million)	100%	0.18	$10.1 million
Exports (385.6 million)	100%	0.45	$173.5 million
Total GDP output share			**$302.6 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts various years, Statistics New Zealand and USDA 2013

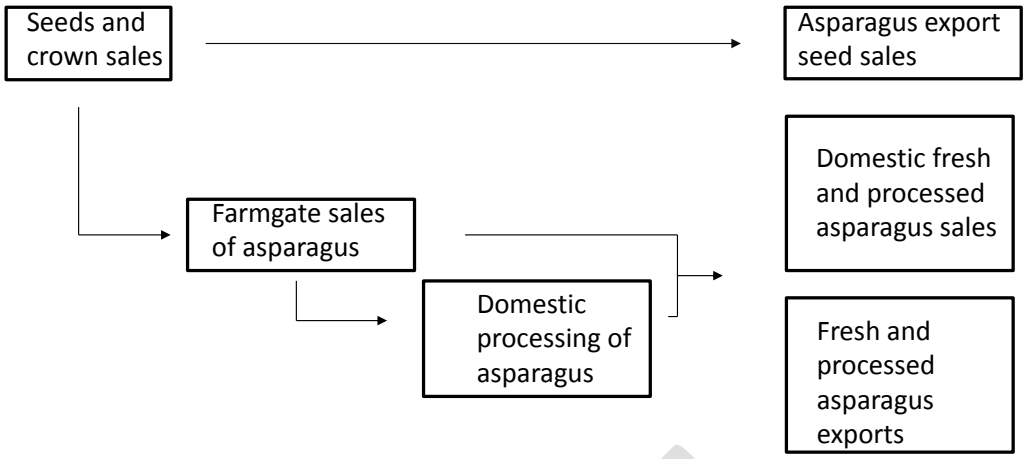
D.2 Asparagus (*Asparagus officinalis*)

Asparagus (*Asparagus officinalis*) is a small industry with approximately 60 asparagus growers. In 2012 production was in the vicinity of 1,800 tonnes.

Production is destined for fresh local supply, processing and export. About 70% of the asparagus grown is consumed by the local market; the rest is exported or processed. Japan is the major overseas market for the fresh product. Waikato, the south west North Island, and Hawke's Bay are the main producing areas.

The Figure below sets out the value chain for asparagus.

Figure 3 Asparagus value chain



Source: NZIER

D.2.1 Asparagus seed/crowns

Asparagus seeds are both imported and grown domestically. In 2012, imports and exports were approximately even ($84,000 was imported and $85,000 was exported). Unlike other industries, the seed is not sold directly to growers. Typically, it is grown for about a year and the crowns are transplanted by a nursery to the grower. The value of this process is worth approximately $0.9 million (personal communication, Peter Falloon, Aspara Pacific Ltd, 10 March 2015).

D.2.2 Farmgate

Farmgate value has been estimated at $7.6 million. To estimate this figure we have used farmgate export and domestic prices quoted by the Lincoln Financial Budget Manual (pA73 2012/13). We are unsure of the volume split between exports and domestic, although we know the approximate total volumes produced (Fresh Facts 2012, p16).

To estimate volumes we have used value as a proxy i.e. 79% of the value is generated in the domestic market therefore we have assumed that the domestic market volume is 79% of the total crop.

Calculations are set out in the following table.

Table 25 Farmgate values for asparagus

2012

Farmgate returns	Price (per tonne)	Volume (estimated) tonnes	Total
Domestic	$2,850[2]	1,421.05	$3.6 million[3]
Export	$9,479[2]	378.95	$4.1 million[3]
Total			**$7.6 million**
Note (1) Numbers rounded. (2) Prices per tonne, Lincoln Financial Budget Manual (3) Values: Fresh Facts.			

Source: NZIER, Fresh Facts, and Lincoln Financial Budget Manual 2012/2013

D.2.3 Processing

We have used a rule of thumb processing estimate since the amount processed for the domestic is unknown i.e. we have assumed that the value of the processing market is 25% of the export and domestic market value (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

$15.2 million (Fresh Facts 2012) multiplied by 25% equals $3.8 million.

D.2.4 Domestic sales

Domestic sales are estimated by Fresh Facts to be approximately $12 million (Fresh Facts 2012, p16), although industry sources suggest $15.9 million. We have stuck with the Fresh Facts estimate since it is the only published estimate.

D.2.5 Export sales

Export sales are estimated by Fresh Facts to be approximately $3.2 million in 2012 (Fresh Facts 2012, p16).

D.2.6 Summary

Table 26 sets out the GDP output share of asparagus to the New Zealand economy.

Table 26 Asparagus summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed/crown sales ($0.9 million)	100%	0.39	$0.4
Farmgate ($7.6 million)	100%	0.39	$3.0 million
Processing ($3.8 million)	100%	0.32	$1.2 million
Domestic sales ($12.0 million)	100%	0.18	$2.2 million
Exports (3.2 million)	100%	0.45	$1.5 million
Total GDP output share			**$8.2 million[1]**
Note (1) Numbers rounded.			

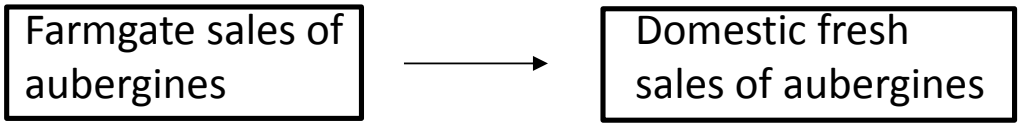
Source: Fresh Facts various years, Statistics New Zealand,

D.3 Aubergines/eggplant (*Solanum melongena*)

Aubergines (*Solanum melongena*) are produced year round in greenhouses. Greenhouse growing is a capital-intensive form of production (with high energy, fertiliser and labour inputs) with high yields. In good conditions, crops such as aubergines can yield 10 to 20 times more each year than a similar outdoor crop.

Aubergine growing in New Zealand is a small business with 4 growers servicing the domestic market.[23] The Figure below shows that the marketing chain is relatively straight forward.

Figure 4 Aubergine value chain



Source: NZIER

D.3.1 Aubergine seed production

Aubergine seeds are imported (personal communication, Warren Hobson, Lefroy Valley, March 12 2015).

D.3.2 Farmgate

We have used the rule of thumb provided by Horticulture New Zealand (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014) to provide an approximate estimate of farmgate returns. Domestic sales divided by 2 equals $3.5 million dollars.

D.3.3 Processing

There is little or no processing of aubergines.

D.3.4 Domestic sales

According to Market Access Solutionz[24] domestic sales of aubergines are approximately $7.0 million per annum.

D.3.5 Export sales

There are no export sales.

D.3.6 Summary

Table 27 sets out the GDP output share of aubergines to the New Zealand economy.

23 http://www.epa.govt.nz/search-databases/HSNO%20Application%20Register%20Documents/APP202097_SUBMISSION110662_Market_Access_Solutionz.pdf p33.

24 ibid p33.

Table 27 Aubergine summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales	100%	0.39	Imported
Farmgate ($3.5 million)	100%	0.39	$1.4 million
Processing		0.32	Little or no processing
Domestic sales ($7.0 million)	100%	0.18	$1.26 million
Exports	100%	0.45	No exports
Total GDP output share			**$2.6 million[1]**
Note (1) Numbers rounded.			

Source: Market Access Solutionz 2014, Horticulture New Zealand and NZIER

D.4 Avocados (*Persea Americana*)

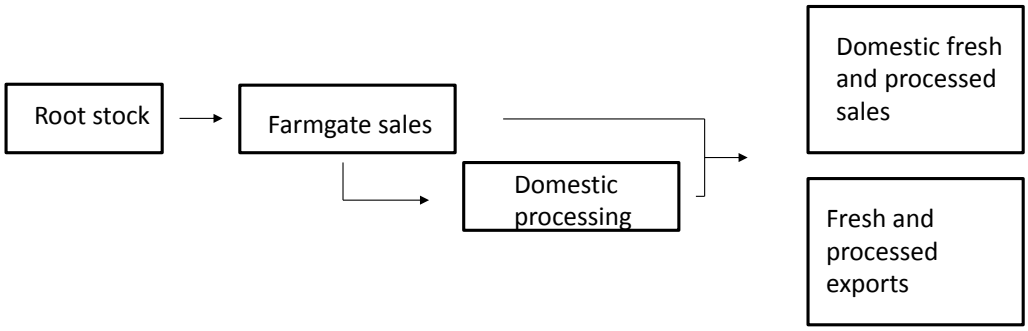
Avocado (*Persea Americana*) seeds were brought to New Zealand in the early 1900s and since that time the industry has developed to become a major fresh fruit business. The industry consists of 1,600 growers who collectively manage 5000+ hectares of mainly the Hass variety of avocados.

A number of packhouses, fruit marketing companies and exporters are involved in the industry to market and sell New Zealand avocados both domestically and overseas. Avocados are harvested for export from late August through to late March. About 80% of export grade fruit goes to the Australian market with the balance going to Japan, USA and South East Asian markets.[25]

[25] We should also note that the avocado industry has a major issue with alternate bearing. A large crop one year has a depressing impact on the next year's crop. This has the impact of producing uneven year-to-year growth. In 2012 the crop was large with domestic and export sales of $115.9 million while in 2013 the value was $62.4 million (Fresh Facts, 2012 and 2013).

The figure below sets out the value chain for avocados.

Figure 5 Avocado value chain



Source: NZIER

D.4.1 Trees/root stock production

Industry has estimated that 45,000 trees were sold to growers in the 2012 year. The costs range from $19 per tree to $39 per tree depending on whether the trees are under patent or not. Approximately half of all trees sold are patented.

Table 28 Cultivars sold to industry

2012 year

	Volume	Price	Value
Non patented	22,500	19	$0.4 million
Patented varieties	22,500	39	$0.9 million
Total			**$1.3 million**

Source: Personal communication, Colin Partridge, Southern Produce Ltd, 19 March 2015

D.4.2 Orchard gate

The orchard gate estimates are based on the crop volume 33,997 tonnes (Fresh Facts 2012, p14) multiplied by a grower price of $1.95 per kg (Lincoln Financial Budget Manual, pA65) equalling $66.3 million. The $1.95 included processing; therefore we reduced the price to growers by 10% to account for processing ($59.6 million).

D.4.3 Processing

Horticulture New Zealand estimates the processing as being 10% of the orchard gate sales i.e. 10% of $59.6 million equalling $6.0 million (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014). This provides an approximate estimate of total processing.

D.4.4 Domestic sales

Most of the domestic sales are for fresh avocado ($19.0 million, Fresh Facts 2012, p15) with some further processed avocado ($0.2 million, Fresh Facts 2012, p15).

D.4.5 Export sales

Export sales are estimated by Fresh Facts to be approximately $96.9 million in 2012 for fresh product and $1.8 million for further processed avocado (Fresh Facts 2012, p15).

D.4.6 Summary

Table 29 sets out the GDP output share of avocado to the New Zealand economy.

Table 29 Avocado summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Cultivar sales ($1.3 million	100%	0.39	$0.5 million
Farmgate ($59.6 million)	100%	0.39	$23.3 million
Processing ($6.0 million)	100%	0.32	$1.9 million
Domestic sales ($19.2 million)	100%	0.18	$3.5 million
Exports (98.7 million)	100%	0.45	$44.5 million
Total GDP output share			**$73.6 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts various years, Statistics New Zealand and USDA 2013

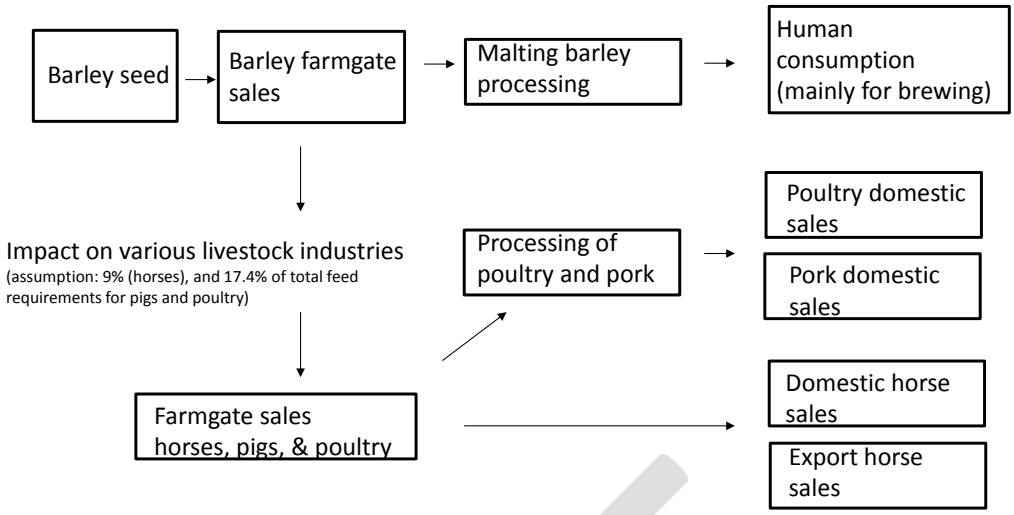
D.5 Barley (*Hordeum vulgare*)

Barley (*Hordeum vulgare*) is mostly grown in New Zealand for malting, other consumer consumption, or stock feed. Barley exports fluctuate, depending on international prices. Barley marketing has never been regulated in New Zealand, and growers sell directly to domestic and export seed, malting companies, and as feed.

Almost three-quarters of the barley-grain crop is grown in Canterbury. Barley grown in the North Island is grown predominately for malting barley (Millner and Roskruge 2013, p104).

The Figure below sets out the value chain for barley.

Figure 6 Barley value chain



Source: NZIER

D.5.1 Barley seed

Barley seed production was 4,800 tonnes in 2011 (Hampton et al, p131). This was divided between malt barley and feed barley seed. We have assumed that malt barley is 16% of the barley seed produced in line with barley malt production (based on volume of malt barley sold).

Prices have been estimated using the Lincoln Financial Budget Manual 2012/13 pA52 (malt barley $480 per tonne and feed barley $380 per tonne). A premium of $60 per tonne was assumed for seed production for both malt and feed barley (Lincoln Financial Budget Manual 2012/13 pA53). The calculations are set out in Table 30.

Table 30 Estimated barley seed production

Volume	Proportion	Price	Total
4,800 tonnes	16% malting barley	$542 per tonne	$0.4 million
	84% feed barley	$440 per tonne	$1.8 million
			$2.2 million

Source: Lincoln Financial Budget Manual, Hampton et al 2012

D.5.2 Farmgate

The farmgate value is calculated from:

- farmgate production at 69,826 tonnes produced for malting barley (AIMI 2013) multiplied by $482 per tonne (Lincoln Financial Budget Manual 2012/2013, pA52)
- the 368,974 tonnes produced for feed barley (AIMI 2013) multiplied by the $380 per tonne (Lincoln Financial Budget Manual 2012/2013, pA52).

This gives an estimate of $173.9 million at the farmgate.

D.5.3 Human consumption (malting barley)

We have little information on the processing costs associated with malting barley. Barley is used for a range of products from brewing to baking. We have estimated:

- a processing value 25% of retail value to give an order of magnitude estimate for the processing sector ($67.3 million x .25 = $16.8 million) (personal communication, John Seymour Horticulture New Zealand, December 12, 2014)
- using the Horticulture New Zealand rule thumb estimate of 2 times the farmgate value ($33.7 million) domestic sales was expected to be approximately ($67.3 million).

D.5.4 Animal consumption (feed barley)

Most feed barley is consumed by the horse, pig, and poultry industries. The New Zealand Feed Manufacturers Association estimated that for 2012 17.4% of all feeds were barley. In the absence of any industry information, we have assumed that barley represents 9% of horse feed requirements (NZIER estimate based on Gee 2012).

Farmgate value of the produce for the horse, pork and poultry industries are estimates taken from industry publications and communications with New Zealand Pork and the Poultry Industry Association of New Zealand.

Table 31 Contribution of barley to farmgate value of poultry, pork and horse industries

$ M, June year 2012

Sector	Estimated farmgate value (Gross output) ($m)	Impact of barley[1]
Layer-hen feed[2]	$148.0 million	17.4%
Poultry feed[2]	$1,000.0 million	17.4%
Pig feed[3]	$176.6 million	17.4%
Pig and poultry total	**$1,324.6 million**	
Horses	**$93.5 million**	**9.0%[4]**
Notes: (1) NZ Feed Manufacturers Association (2015). (2) pers comm, Mr Steven Kerr, Poultry Industry Association of New Zealand, 24 July 2014. (3) pers comm, Mr Ian Braugh, New Zealand Pork, 12 August 2014. (4) Gee E (2012).		

Source: Poultry Industry Association of New Zealand, NZ Feed Manufacturers Association, New Zealand Pork, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

Processing

Processing margins are based on assumptions from other livestock industries such as Beef + Lamb New Zealand and Horticulture New Zealand (personal communications, Mr Rob Davison, Beef + Lamb New Zealand, July 30 2014, and John Seymour, Horticulture New Zealand, December 12 2014) and are set out in the following table. The processing margin (33%) is an estimate for the value of the processing sector. The only exception is pork where we have been able to obtain accurate processing cost data (11.7%) from New Zealand Pork (personal communication, Mr Ian Braugh, 12 August 2014).

Table 32 Processing

$ M, June year 2012

Sector	Estimated processing value (Gross output) of each industry[2]	Impact of barley[1]
Layer-hen feed	$189.4m x 33% = $62.5m	17.4%
Poultry feed	$1,280m x 33% = $422.4m	17.4%
Pig feed[3]	$200m x 11.7% = $23.4m	17.4%
Estimated total value	**$508.3 million**	
Notes: (1) NZ Feed Manufacturers Association (2015). (2) Estimates are based on discussions with Mr Rob Davison, Beef + Lamb New Zealand, 30 July 2014 (Domestic sales multiplied by 33%). (3) Processing costs for pigs is estimated by New Zealand Pork at 11.7% (pers comm, Mr Ian Braugh, 12 August 2014).		

Source: Beef + Lamb New Zealand, Poultry Industry Association, New Zealand Pork

Domestic consumption of poultry and pork

The domestic retail margin is estimated at approximately 128% of farmgate value.[26] Therefore, the total domestic sales value is the sum of each subsector value (farmgate value multiplied by impact of barley), plus an additional 28%.

Table 33 Domestic sales value of poultry, horse, and pork products

$ M, June 2012

Sector	Estimated value (gross output) of retail sales[1]	Impact of barley
Hen-layer feed	$148m x 1.28 = $189 million	17.4%
Poultry growers	$1,000 million x 1.28 = $1,280 million	17.4%
Pigs	$176.6 million x 1.28 = 226.1 million	17.4%
Total livestock	**1,695.5 million**	**17.4%**
Horse sales	**$57.0 million**	**0.09[2]**
Note (1) New Zealand Retailers Association (2013, p16) suggests that meat retail margins are around 28%. (2) Numbers rounded.		

D.5.5 Exports

Sales of horses for export were $130.0 million in 2012 (Statistics New Zealand HS code 0101).

D.5.6 Summary of barley consumption

Table 34 sets out known values for barley production and value generated from industries that use barley as an input.

[26] Estimated from New Zealand Retailers Association (2013 p16).

Table 34 Barley summary

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Barley production			
Domestic seed production ($2.2 million)	100%	0.39	$0.9 million
Farmgate value ($173.9 million)	100%	0.39	$67.8 million
Barley Production for human consumption (malting barley)			
Processing ($16.8 million)	100%	0.32	$5.4 million
Domestic sales ($67.3 million)	100%	0.18	$12.1 million
Barley production as an input into various industries (feed barley)			
Farmgate sales (pig, and poultry, $1,324.6 million)	17.4%	0.24	$55.3 million
Farmgate sales horses ($93.5 million)	9.0%	0.24	$2.0 million
Processing (pig and poultry livestock, $508.3 million)	17.4%	0.68	$60.1 million
Domestic sales (pig and poultry $1,695.5 million)	17.4%	0.12	$35.4 million
Domestic sales horses ($57.0 million)	9.0%	0.20	$0.6 million
Exports			
Live horse exports ($130.0 million)	9.0%	0.20	$2.3 million
Total			**242.0 million**

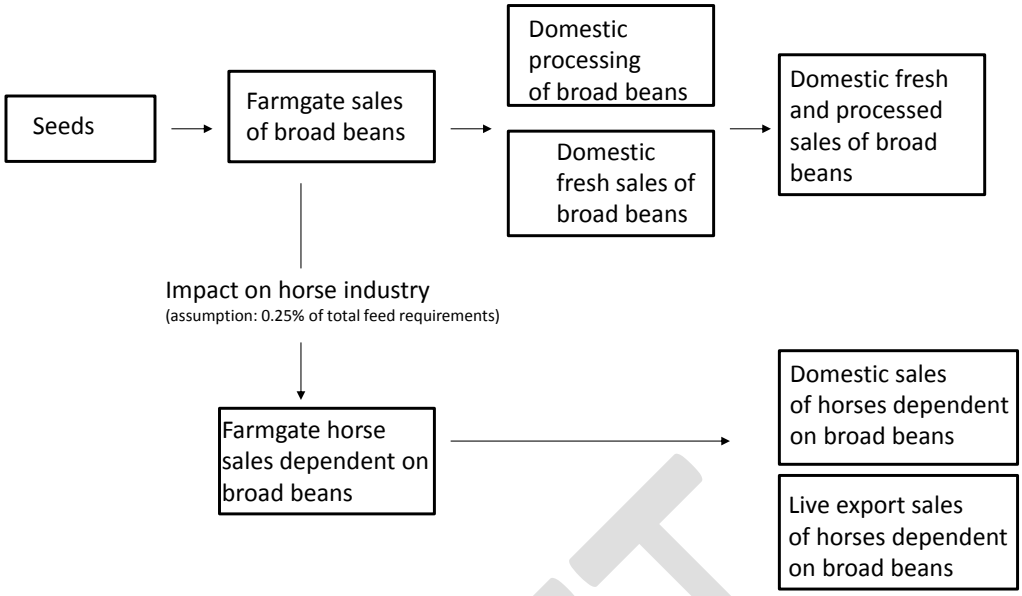
Source: Beef + Lamb New Zealand, DairyNZ, Poultry Industry Association of New Zealand, New Zealand Pork, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.6 Broad beans (*Vicia faba*)

Broad beans (*Vicia faba*) are one of the oldest vegetables grown in New Zealand. For over a hundred years, they have been grown commercially and by the New Zealand home gardener. Canterbury is the biggest growing area.

Figure 7 sets out the value chain for broad beans.

Figure 7 Broad bean value chain



Source: NZIER

D.6.1 Seeds

We have little information on broad bean seed sales. We have assumed (as in the case of green beans) that seed sales are approximately 1% of farmgate prices. This equates to $55,000 worth of sales.

D.6.2 Farmgate

Horticulture New Zealand has provided us with processed vegetable sales for the 2014 season (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014). In the case of broad beans, sales have been stable over time and since most broad beans are processed it provides a good approximation of farmgate sales ($0.6 million) in 2012.

D.6.3 Processing

Returns to processing are estimated to be 25% of the domestic sales (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Table 35 Broad bean processing value

	Domestic sales	Adjustment factor	Processing value estimate
Green bean processing	$1.1 million	0.25	$0.3 million

Source: NZIER and Horticulture New Zealand

D.6.4 Domestic sales

Domestic sales are estimated to be twice farmgate returns (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014). This is set out Table 36.

Table 36 Broad bean domestic value

	Farmgate	Adjustment factor	Broad bean domestic value estimate
Broad bean domestic value	$0.6 million	2	$1.1 million[1]
Note (1) Numbers rounded			

Source: NZIER and Horticulture New Zealand

D.6.5 Dependent industries

Broad beans are used as feed for horses to supplement their diet (see Gee, 2012). They are a good source of protein for horses and contain no starch. Small amounts are often combined with other feeds. We have assumed that broad beans make up 0.25% of a horses diet.

Horses contribute at the farmgate, domestic live sales of horses and live exports of horses. The contributions are set out in Table 37.

Table 37 Dependent industry contribution (horses)

Sector	Value of each sector	Dependence
Farmgate sales	$93.5 million	0.25%
Domestic sales	$57.0 million	0.25%
Exports	$130 million	0.25%

Source: IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.6.6 Summary

Table 38 below sets out known values for broad bean production.

Table 38 Broad bean summary

2012, June year $M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($ 0.06)	100%	0.39	$0.02 million
Farmgate ($0.6 million)	100%	0.39	$0.2 million
Processing ($0.3 million)	100%	0.32	$0.1 million
Domestic sales ($1.1 million)	100%	0.18	$0.2 million
Dependent industry (horses)			
Farmgate sales ($93.5 million)	0.25%	0.24	$0.1 million
Domestic sales of horses ($57.0 million)	0.25%	0.12	$0.02 million
Exports of live horses ($130 million)	0.25%	0.20	$0.07 million
Total GDP output share			**$0.7 million[1]**
Note (1) Numbers rounded.			

Source: Horticulture New Zealand, NZIER, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

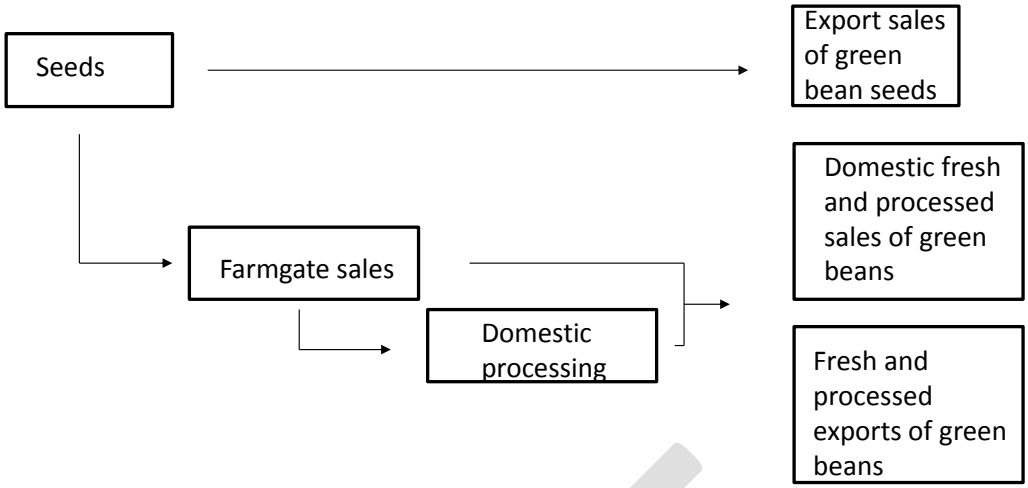
D.7 Green beans (*Phaseolus vulgaris*)

Green beans (*Phaseolus vulgaris*) have been grown in New Zealand for many years. The most important growing area is the Canterbury plains. Exports of green beans (like many other vegetables) have increased in recent years as Australian supermarkets begin to source more New Zealand product.

Good information is available on domestic, exports and seed production. However, a number of assumptions have been made about farmgate and processing.

Figure 8 sets out the value chain for green beans.

Figure 8 Value chain for green beans



Source: NZIER

D.7.1 Seeds

BERL (2012, p14) sets out the value of green bean seed production for New Zealand. For the 2011 year, sales are valued at $2.39 million.

D.7.2 Farmgate

Horticulture New Zealand estimates that for many vegetable industries' farmgate prices are approximately a half of the domestic and export sales. Fresh Facts (2012) estimate that domestic sales were $18 million and export sales were $47 million in 2012 (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Table 39 Green beans value at farmgate

	Domestic and export sales	Adjustment factor	Farmgate value estimate
Green bean farmgate sales	$65 million	0.5	$32.5 million

Source: NZIER and Horticulture New Zealand

D.7.3 Processing

In a similar fashion, the returns to processing are estimated to be 25% of the domestic sales (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Table 40 Green beans processing value

	Domestic and export sales	Adjustment factor	Processing value estimate
Green bean processing	$65 million	0.25	$16.25 million

Source: NZIER and Horticulture New Zealand

D.7.4 Domestic sales

Fresh Facts (2012, p16) estimate domestic sales at $18.0 million for 2012.

D.7.5 Export sales

Fresh Facts (2012, p16) estimate exports sales at $47.0 million for 2012.

D.7.6 Summary

The Table below sets out known values for green bean production.

Table 41 Green bean summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($2.39 million)	100%	0.39	$0.9
Farmgate ($32.5 million)	100%	0.39	$12.7 million
Processing ($16.25 million)	100%	0.32	$5.2 million
Domestic sales ($18.0 million)	100%	0.18	$3.2 million
Exports ($47.0 million)	100%	0.45	$21.2 million
Total GDP output share			**$43.2 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts, Horticulture New Zealand and NZIER

D.8 Beetroot (*Beta vulgaris*)

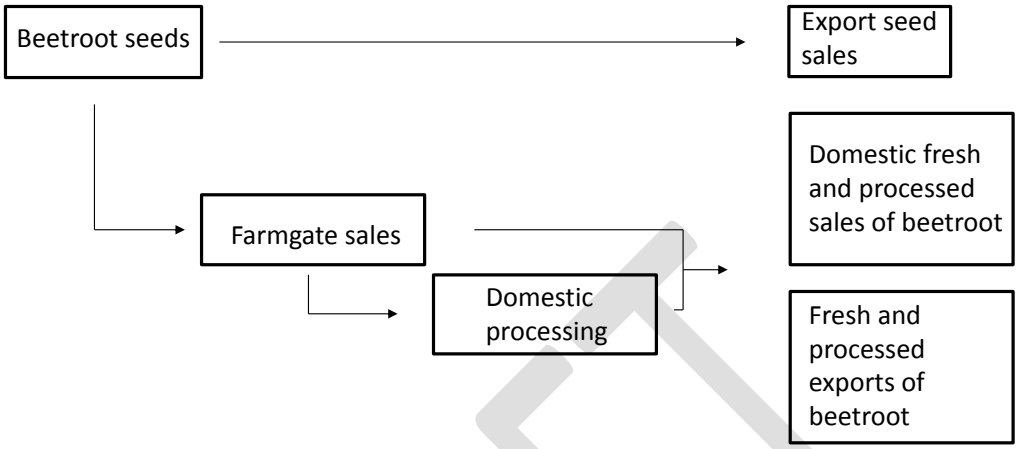
A native of Southern Europe, beetroot (*Beta vulgaris*) has a vibrant crimson colour which comes from pigments that no other vegetable has. In New Zealand, typically the roots are eaten; however, young beetroot leaves are sometimes available. Beetroot is frequently consumed pickled.

The crop is relatively small in value terms; however there is a thriving export seed trade because of the ideal growing conditions on the Canterbury plains.

Good estimates are available on export seeds, domestic and exports sales. Assumptions have been made about farmgate and processing returns based on domestic and export sales.

Figure 9 sets out the value chain for beetroot.

Figure 9 Beetroot value chain



Note: Fodder beet (a different variety of *Beta vulgaris*) is used as a winter feed for the livestock industry – particularly in the last few years dairy. We have not included fodder beet in this study because of the small size of the industry in 2012.

Source: NZIER

D.8.1 Seed production

Seed production is divided into export and domestic sales. Export sales were approximately $0.65 million in 2011 (BERL 2012, p14). Domestic seed sales are not well documented but are expected to be 1% of farmgate sales in line with other vegetable seed sales ($3.7 million multiplied by 1% equals $0.04 million). To obtain farmgate value we have used Horticultural New Zealand's rule of thumb of 50% of export plus 1% of farmgate sales.

Table 42 Beetroot seed value

	Export	Domestic	Total seed value farmgate estimate
Beetroot seed value	$0.65 million	$0.04 million	$0.4 million[1]
Note (1) Numbers rounded			

Source: NZIER and BERL 2012

D.8.2 Farmgate

Horticulture New Zealand estimates that for many vegetable industries farmgate prices are approximately half of the domestic sales. Fresh Facts (2012) estimate that consumption of beetroot in New Zealand is approximately $11.1 million (unpublished data and personal communication, Alastair Aitken, Martech, 13 February 2015).

Table 43 Beetroot value at farmgate

	Domestic sales	Adjustment factor	Farmgate value estimate
Beetroot farmgate value	$11.1 million	0.5	$5.6 million

Source: NZIER, Martech and Horticulture New Zealand

D.8.3 Processing

Returns to processing are estimated to be 25% of the domestic sales (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Table 44 Beetroot processing value

	Domestic sales	Adjustment factor	Processing value estimate
Beetroot processing	$11.1 million	0.25	$2.8 million

Source: NZIER and Horticulture New Zealand

D.8.4 Domestic sales

Domestic sales are approximately $11.1 million. This is based on unpublished data from Martech (sourced from Statistics New Zealand) on consumption of beetroot. There are few imports therefore consumption estimates give a reasonable proxy of the processed and fresh consumption (personal communication, Alastair Aitken, Martech, 13 February 2015).

D.8.5 Export sales

Export sales are mainly seeds. This is reported by BERL (2012, p14) at $0.65 million.

D.8.6 Summary

Table 45 sets out known values for beetroot production and sales.

Table 45 Beetroot summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($0.4 million	100%	0.39	$0.2 million
Farmgate ($5.6 million)	100%	0.39	$2.2 million
Processing ($2.8 million)	100%	0.32	$0.9 million
Domestic sales ($11.1 million)	100%	0.18	$2.0 million
Exports ($0.65 million)	100%	0.45	$0.3 million
Total GDP output share			**$5.5 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts, Horticulture New Zealand and NZIER

D.9 Blueberries (*Vaccinium* species)

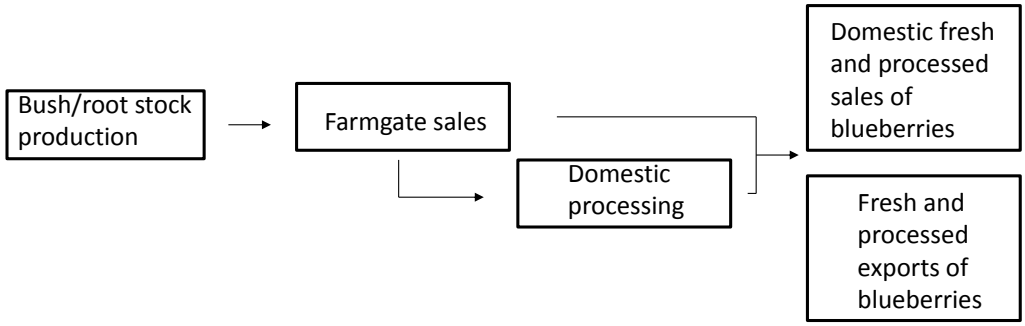
While blueberries (*Vaccinium* species) have been grown in New Zealand for some time, it was not until the 1980s that commercial growing began for export. According to Blueberries New Zealand (Blueberries New Zealand, 2015), there are three types of blueberry cultivated in New Zealand: Northern Highbush, Southern Highbush and Rabbiteye. The scientific names of these blueberry types are *Vaccinium corymbosum*, *Vaccinium formosum* (syn. *V. australe*) and *Vaccinium virgatum* (syn. *V. ashei*) respectively (GRIN 2015).

Blueberries are grown commercially mainly in Canterbury, Waikato, Kerikeri, and Bay of Plenty.

The best information we have is on domestic and export sales. Estimates have been for plant sales and approximations on farmgate and processing.

Below we set out the blueberry value chain.

Figure 10 Blueberry value chain



Source: NZIER

D.9.1 Blueberry plant sales

Domestic sales of plants are not well documented but are expected to be 0.5% of farmgate sales of berries (personal communication, Dan Peach, Oakberry Farm, 11 March 2015).

In addition, a further 300,000 plants are purchased for new plantings at $3.50 for a six-month old plant and $6 for an 18-month old plant. We have assumed that grower preference are split 50%/50% between buying six-month and 18-month old plants. Costs are therefore approximately $1.425 million (personal communication, Dan Peach, Oakberry Farm, 11 March 2015).

Table 46 Blueberry bush sales

	Replacement plants	New Plantings	Total plant value estimates
Blueberry plant sales	$0.083 million	$1.425 million	$1.5 million[1]
Note (1) Numbers rounded			

Source: NZIER

D.9.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately a half of export and domestic sales. Fresh Facts (2012, p14) estimate that sales of blueberries were $10.4 million (domestic) and $16.9 million (exports).

Table 47 Blueberries value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Blueberry farmgate value	$33.1 million	0.5	$16.6 million

Source: NZIER, Martech and Horticulture New Zealand

D.9.3 Processing

Returns to processing are estimated to be 25% of the domestic sales and export sales of processed product. Fresh Facts (2012) estimates that total processed sales are $5.8 million. We have assumed that the returns to the processor from those sales are 25% of total process sales (NZIER estimate).

Table 48 Blueberries processing value

	Domestic + export sales	Adjustment factor	Processing value estimate
Blueberry processing	$5.8 million	0.25	$1.5 million

Source: NZIER and Horticulture New Zealand

D.9.4 Domestic sales

Domestic sales are approximately $14.4 million (Fresh Facts 2012, p14).

D.9.5 Export sales

Export sales are estimated at $18.7 million (Fresh Facts 2012, p14).

D.9.6 Summary

Table 49 sets out known values for blueberry production and sales.

Table 49 Blueberry summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($1.5 million)	100%	0.39	$0.6 million
Farmgate ($16.6 million)	100%	0.39	$6.5 million
Processing ($1.5 million)	100%	0.32	$0.5 million
Domestic sales ($14.4 million)	100%	0.18	$2.3 million
Exports ($18.7 million)	100%	0.45	$9.0 million
Total GDP output share			**$18.5 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts, Horticulture New Zealand and NZIER

D.10 *Brassicas* (including brassicas for fodder)

Brassicas are divided into two: brassicas for human consumption and brassicas for fodder.

Brassicas for human consumption include cauliflower, broccoli, and cabbage (*Brassica olearacea* varieties).[27] While brassicas for fodder include oil seed rape & turnips (*Brassica rapa* varieties), kale (a variety of *Brassica oleraceae*), and swede (*Brassica napus*). Brassicas are traditional crops and have been grown in New Zealand since the 19th century.

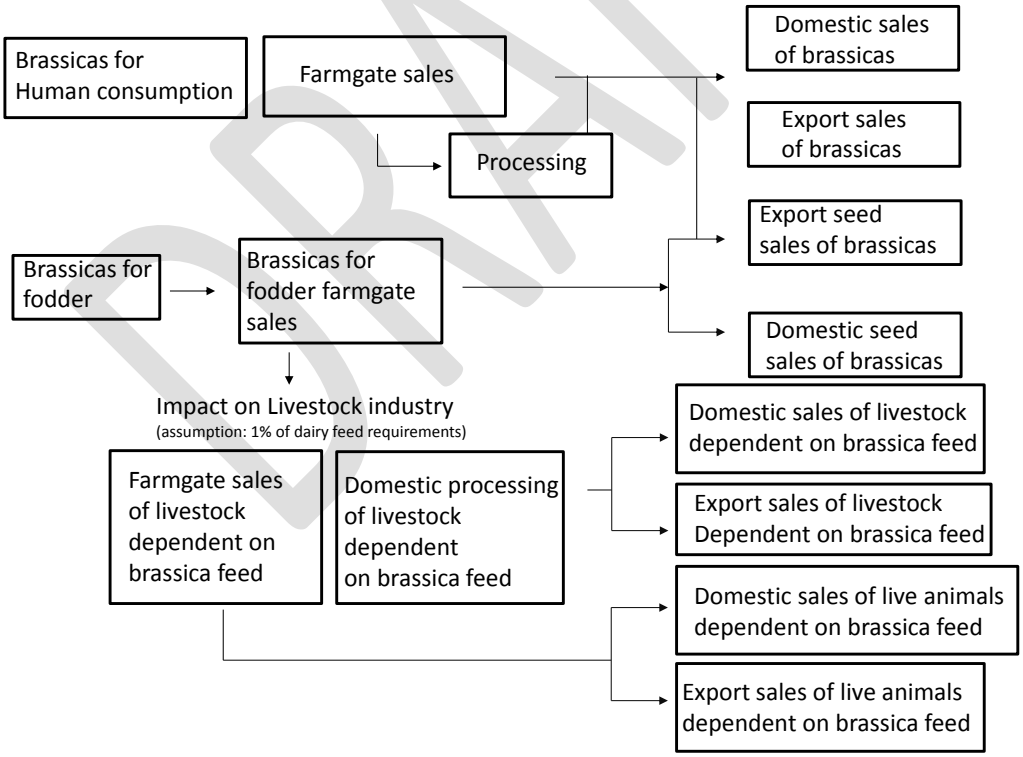
Good data is available for traditional brassicas for human consumption (seeds, processing, domestic sales and export sales). Farmgate sales are estimated using industry wide assumptions.

Information for brassicas for fodder relies upon total seed estimates from the industry and revenue per hectare estimates. Dependent industry information is well documented.

Below we set out the value chain for brassicas.

Figure 11 Value chain for brassicas

Note that we have assumed that brassicas are mainly consumed by the dairy industry.



Source: NZIER

A key assumption is the 1% impact on the livestock industry. This is an approximate figure provided by DairyNZ (personal communication, Matthew Newman, DairyNZ, 20 March 2015)

[27] Some brassicas are excluded because reliable estimate are unavailable e.g. Chinese vegetables such as bok choy.

D.10.1 Seed production (human consumption)

Brassica seed values are estimated at $4.7 million Fresh Facts (2012, p20).

D.10.2 Brassicas for human consumption:

Farmgate value

Horticulture New Zealand estimates that for many industries farmgate prices are approximately half of export and domestic sales. Fresh Facts (2012, p14) estimate that sales of brassicas were $85.0 million.

Table 50 Brassicas value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Brassicas for human consumption farmgate value	$85.0 million	0.5	$42.5 million

Source: Fresh Facts

Processing

Brassicas are mainly sold fresh. Horticulture New Zealand estimates that approximately 5% of domestic sales are processed. $85.0 million multiplied by 0.05 equals $4.0 million.

Domestic sales

Domestic sales are estimated by Fresh Facts (2012, p16) at $80.3 million.

Export sales

Export sales are estimated by Fresh Facts (2012, p16) at $4.7 million.

D.10.3 Brassicas for fodder

Seed production, domestic sales, and exports

Seed production is estimated at $10.1 million to the seed producers. We have used the Horticulture New Zealand rule of thumb to produce this estimate: Domestic sales ($10.8 million, BERL 2012, p14) and export sales ($9.44 million, Hampton et al 2012, p133) multiplied by 50%.

Farmgate value

Farmgate sales of brassicas for fodder are estimated from the tonnes (estimated by Statistics New Zealand) multiplied by prices per tonne (prices quoted in the Lincoln Financial Budget Manual (2012/2013, pA60) for oil seed rape): 245,528 tonnes multiplied by $400 per tonne equalling $98.6 million.

Dependent industries

We have assumed that most forage brassicas are being consumed by the dairy industry. We have further assumed that it contributes 1% of the protein for the whole dairy industry (personal communication, Matthew Newman, DairyNZ, 20 March 2015).

The value chain impacts for the dairy industry are set out below using Beef + Lamb New Zealand's estimates (personal communication, Mr Rob Davison, 5 June 2014) of farmgate value, processing, domestic and export sales of dairy product.

Table 51 sets out the summary of value for the dependent industry. In each case, the value at the stage of production is multiplied by the impact on the industry and the GDP output share to obtain a value for brassicas to the economy (also set out in Appendix B).

Table 51 Estimated dairy value at each stage of the marketing chain

2012, $ M

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Dairy values	$12,241.2 m	$585.4 m	$1,045.6 m	$12,477.8 m

Source: Beef + Lamb New Zealand estimates and Statistics New Zealand

D.10.4 Summary

Table 52 sets out the summary of brassica contribution to GDP.

Table 52 Brassica summary

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Brassicas for human consumption			
Domestic seed production ($4.7 million)	100%	0.39	$1.8 million
Farmgate value ($42.5 million)	100%	0.39	$17.0 million
Processing value ($4.1 million)	100%	0.32	$1.3 million
Domestic value ($80.3 million)	100%	0.18	$14.5 million
Export value ($4.7 million)	100%	0.45	$2.1 million
Sub total			*$36.3 million*
Brassicas for fodder			
Seed value ($10.1 million)	100%	0.39	$4.0 million
Farmgate value ($98.6 million)	100%	0.39	$38.5 million
Domestic seed sales ($10.8 million)	100%	0.18	$2.0 million
Export seed sales ($9.4 million)	100%	0.45	$4.3 million
Dependent industries for brassicas			
Dairy farmgate dependent on brassicas ($12,241 million)	1%	0.48	$58.8 million
Dairy processing dependent on brassicas ($585.4 million)	1%	0.39	$1.5 million
Dairy domestic sales dependent on brassicas ($1,045.6 million)	1%	0.18	$1.9 million
Dairy exports dependent on brassicas ($12,477.8 million)	1%	0.48	$59.9 million
Sub total			*$169.4 million*
Total brassica contribution			**$206.9 million**

Source: NZIER

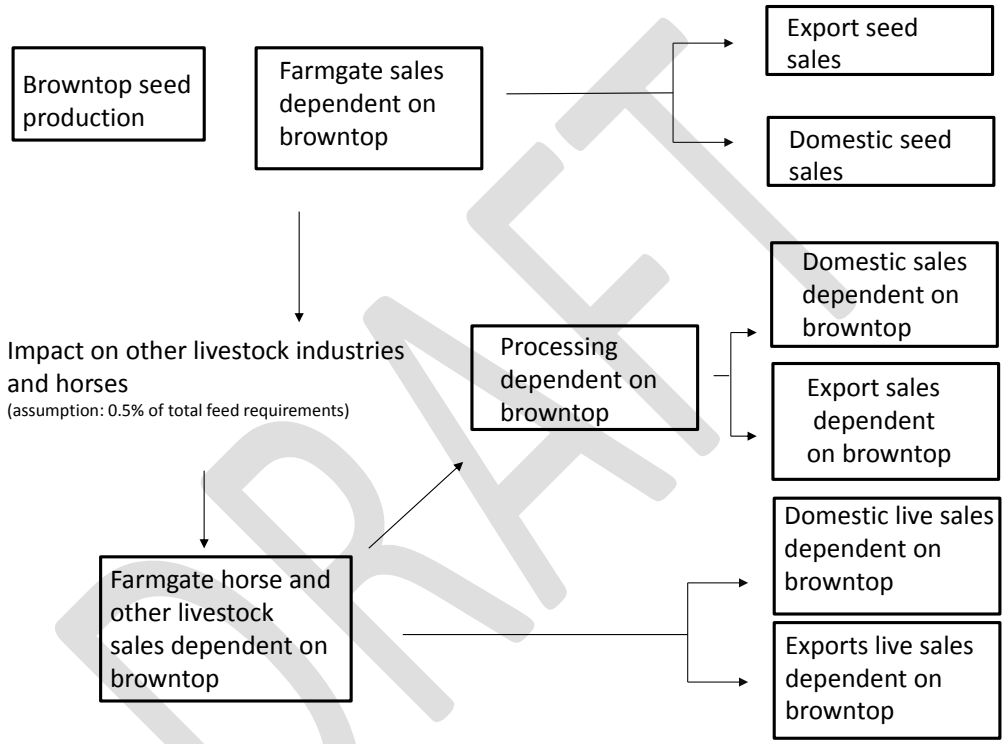
D.11 Browntop (*Agrostis capillaris*)

Browntop (*Agrostis capillaris*) is a widespread perennial grass found to some extent in nearly all older pastures in New Zealand. The main focus of browntop production has been as an off-season grass seed supplier to the Northern Hemisphere. We have limited information on most aspects of the small browntop market so we have relied on industry to provide us with an indication of the market size.

Figure 12 sets out the value chain for browntop production.

Figure 12 Browntop value chain

Note that livestock industries include live animals, wool, meat processing, velvet and other co-products sold. Horses are also included.



Source: NZIER

D.11.1 Browntop seed production

Seed production is valued at $1.0 million or 50% of the export plus domestic sales value (Horticulture New Zealand's rule of thumb for farmgate returns).

D.11.2 Domestic sales

Browntop production of seeds is geared to the off-season supply in the Northern Hemisphere. The main use is turf for amenity uses. A much smaller amount of browntop seed is sold into the domestic market for similar purposes. We have assumed that the domestic market is value at $0.3 million (or 20% of the export sales in line with other small exported species).

D.11.3 Export sales

Export sales for the 2011 year were $1.76 million (Hampton et al 2012).

D.11.4 Dependent industries

Most of the browntop production is focused on turf and amenity use. The browntop pastures have typically been old and lower producing pastures. These pastures are predominantly in hill country regions.

We have assumed that browntop contributes to the beef, sheep, deer, goat and horse industries. We have further assumed that it contributes 0.5% of the energy needs for those industries.

Values for dependent industries (other livestock and horses) gross output values are set out in Appendix B.

D.11.5 Summary

Table 53 below sets out known values for browntop production and sales.

Table 53 Browntop summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($1.0 million)	100%	0.39	$ 0.4million
Domestic sales ($0.3 million)	100%	0.18	$0.05
Exports ($1.76 million)	100%	0.48	$0.844 million
Dependent industries: sheep, goats, beef, deer (other traditional livestock) and horses			
Farmgate livestock (sheep, deer, goats and beef: $5,039.0 million)[2]	0.5%	0.39	$9.8 million
Processing livestock (sheep, deer, goats and beef: $6,701.9 million) [2]	0.5%	0.25	$8.4 million
Domestic sales livestock (sheep, deer, goats and beef: $1,432.8 million)[2]	0.5%	0.18	$1.3 million
Exports (sheep, deer, goats and beef: $6,882.1 million)[2]	0.5%	0.48	$16.5 million
Horse farmgate sales ($93.5 million)[2]	0.5%	0.24	$0.1 million
Horse domestic sales ($57 million)[2]	0.5%	0.12	$0.03 million
Horse exports ($130 million)[2]	0.5%	0.20	$0.1 million
Total GDP output share			**$ 37.6 million[1]**
Note (1) Numbers rounded. (2) Values set out in Appendix B.			

Source: Fresh Facts, Horticulture New Zealand and NZIER

D.12 Capsicums (*Capsicum annuum*)

Traditionally green capsicums were grown for the domestic market. However since 2000 capsicum exports from New Zealand have grown to $36 million in 2012. All export grade capsicums (*Capsicum annuum*) are produced in greenhouses.

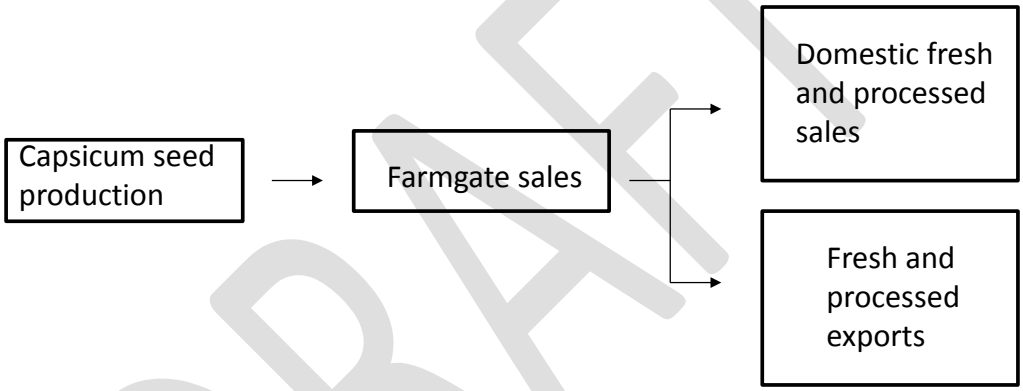
Production requires a high level of capital investment and while there are over 130 growers the industry is dominated by three key operators in the Auckland area.

The Japanese and Australian markets make up 97% of all capsicum exports, although the industry is seeking improved access to the USA and new access into Korea and China.

Good information is available on domestic and exports sales but little information on farmgate returns given the vertical integration of the business. Capsicum seeds are imported and there is very little processing.

Figure 13 sets out the value chain for capsicums.

Figure 13 Capsicum value chain



Source: NZIER

D.12.1 Capsicum seed production

Seeds for commercial growing are imported.

D.12.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately a half of export and domestic sales. Fresh Facts (2012, p14) estimate that sales of capsicums were $29.3 million (domestic) and $36.1 million (exports).

Table 54 Capsicum value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Capsicum farmgate value	$64.4 million	0.5	$32.7 million

Source: NZIER, and Horticulture New Zealand

D.12.3 Processing

Horticulture New Zealand suggests that the processing of capsicums is minimal.

D.12.4 Domestic sales

Fresh Facts (2012, p16) estimates the size of the domestic sales at $29.3 million.

D.12.5 Export sales

Fresh Facts (2012, p16) estimates the size of the domestic sales at $36.1 million.

D.12.6 Summary

Table 55 sets out known values for capsicum production and sales.

Table 55 Capsicum summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales			Imported
Farmgate ($32.7 million)	100%	0.39	$12.8 million
Processing			Na
Domestic sales ($29.3 million)	100%	0.18	$5.3 million
Exports ($36.1 million)	100%	0.45	$16.2 million
Total GDP output share			**$34.3 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts, Horticulture New Zealand and NZIER

D.13 Carrots (*Daucus carota*)

New Zealand has a long history of growing vegetables such as carrots (*Daucus carota*) for the domestic and export markets. Current production ranges from fresh carrots (for local and export markets) to juiced carrots (mainly for the Japanese export market).

Good information is available on the value of carrots through the marketing chain.

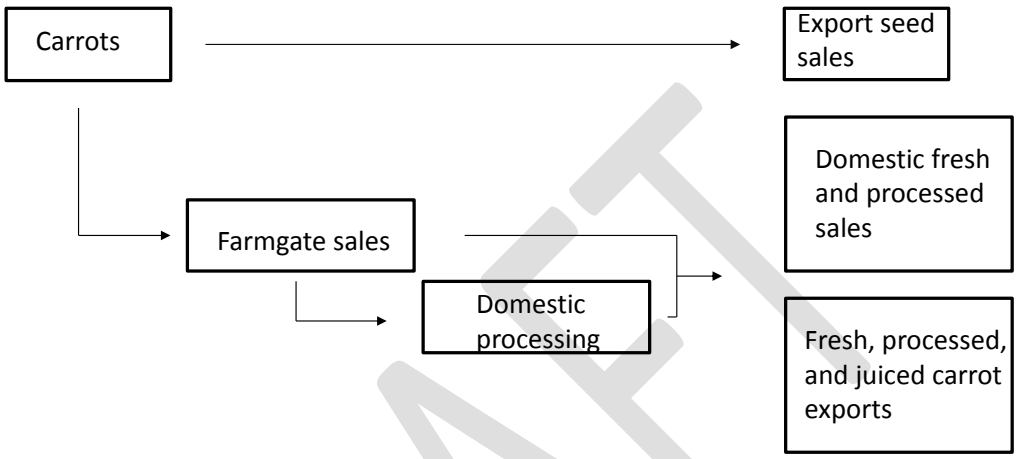
The extent of knowledge includes:

- the value of carrot seed exports. Most carrot seed exports are contract grown for large multinational agricultural entities. Seed is then imported by New Zealand growers from these multinationals
- production and value of carrots in New Zealand
- processed carrots production including:

- juiced carrot exports and domestic tonnage and values
- processed sales for domestic consumption and export values.

Figure 14 sets out the carrot value chain. Seed is grown for export. Imported seed (possibly re-imported) is then used to grow carrots. Fresh carrots are sold domestically and or exported. The majority of carrots are juiced (a proportion are also diced) and either sold domestically or exported.

Figure 14 Carrot value chain



Source: NZIER

Seed production

Seed used for carrot production in New Zealand is imported. However, New Zealand also exports seeds to the value of $17.8m (Fresh Facts, 2012, June years, p20).[28]

Farmgate value

In 2012, there was approximately 85,000 tonnes of carrots grown in New Zealand. Carrot prices were approximately between $400 and $650 (fob export price in March 2007) per tonne (quoted by the Lincoln Financial Budget Manual 2012/2013, pA74). While the prices are taken from different years it gives an approximate indication of the value, given that we have export and domestic sales values for 2012 (Fresh Facts 2012, p16). Dividing 400/650 multiplied by total sales value (export and domestic sales – approximately $68 million) suggest that the farmgate value is approximately $40m per annum (in June year 2012).

Domestic processing

The GDP output share of the carrot processing sector is confidential. It consists of cleaning fresh carrots, processing including production of frozen vegetables, and juiced and pureed carrots. We expect that its output share to be relatively small compared to the export value of carrots. In the absence of processing information we assume that the value of processing is 50% of the total sales (export and domestic sales) i.e. $30 million plus $38.2 million multiplied by 50%. This is much higher than other

[28] This shows the importance of globalised value chains. We have specialist seed producers contracted to agricultural multinational seed companies who grow seed on contract. This seed is exported, mainly to the USA. Carrot seed is then imported (possibly seed originated in New Zealand) for the new season's crop.

horticultural industries because of the large amount of carrot juicing that occurs for the export market.

Domestic sales

Domestic sales are approximately $30 million (Fresh Facts 2012, p16). The majority of sales domestically are fresh carrots although recent consumption figures are not available.

Export sales

Export sales are made up of fresh sales ($9 million, Fresh Facts 2012, p16), processed ($2.2 million, Fresh Facts 2012, p16) and juiced and pureed carrots ($27 million, personal communication, Mr Damian Honsis, RD2 International, 6 May 2014).[29]

Summary

Table 56 sets out the GDP output share of carrots to the New Zealand economy.

Table 56 Carrot summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Export seed sales ($17.8 million)	100%	0.39	$6.9 million
Farmgate sales ($40 million)	100%	0.39	$15.6 million
Domestic processing ($34.1 million)	100%	0.32	$10.9 million
Domestic fresh and processed sales ($30 million)	100%	0.18	$5.4 million
Fresh, processed, and juiced carrot exports ($38.2 million)	100%	0.45	$17.2 million
Total GDP output share			**$56.0 million[1]**
Note (1) numbers rounded.			

Source: Statistics New Zealand, Fresh Facts 2013, and RD2 International

D.14 Celery (*Apium graveolens*)

Celery (*Apium graveolens*) has been a staple vegetable grown in New Zealand for the domestic market. Many of the European varieties of celery are white. In the United

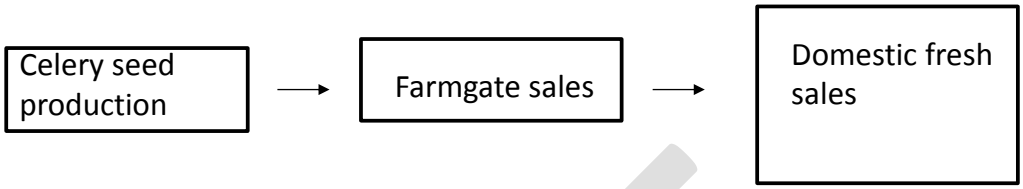
[29] Communication with the exporter RD2 International (RD2 has the sole South Canterbury factory juicing carrots).

States, a green-stemmed celery was developed and successfully introduced into New Zealand in the 1960s. New Zealanders prefer celery to be bright green.

Good information is available on domestic sales and seed production (mainly imported).

The celery value chain is set below.

Figure 15 Celery value chain



Source: NZIER

D.14.1 Seed production

The celery seed industry is very small, most seed is imported. (personal communication, Warren Hobson, Lefroy Valley, 4 March 2015).

D.14.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately a half of domestic sales. Domestic sales of celery were approximately $5.0 million (unpublished data supporting Fresh Facts (2012 p24), personal communication, Alastair Aitken, Martech, 13 February 2015).

Table 57 Celery value at farmgate

	Domestic sales	Adjustment factor	Farmgate value estimate
Celery farmgate value	$5.0 million	0.5	$2.5 million

Source: NZIER, and Horticulture New Zealand

D.14.3 Processing

Horticulture New Zealand advise that there was very little processing of celery in New Zealand. Possibly $0.1 million (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

D.14.4 Domestic sales

New Zealand consumers bought approximately $5.0 million worth of celery in 2012 (unpublished data supporting Fresh Facts (2012, p24), personal communication, Alastair Aitken, Martech, 13 February 2015).

D.14.5 Summary

The following table sets out the GDP output share of celery to the New Zealand economy.

Table 58 Celery summary

2012, June year, $M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Export seed sales ($million)	100%	0.39	Imported
Farmgate sales ($2.5 million)	100%	0.39	$1.0 million
Domestic processing ($0.1 million)	100%	0.32	$.032 million
Domestic sales ($5.0 million)	100%	0.45	$0.9 million
Total GDP output share			**$1.9 million[1]**
Note (1) numbers rounded.			

Source: Statistics New Zealand, Fresh Facts 2012

D.15 Chicory (*Cichorium intybus*)

Chicory (*Cichorium intybus*) is a herb with a deep tap root that produces high yields of quality forage. It is best suited as a re-growth special purpose summer crop sown with clover.

The increase in profitability in the dairy industry has driven increased demand for chicory. Therefore the growth of chicory is linked closely with the rises and falls in livestock industry fortunes.

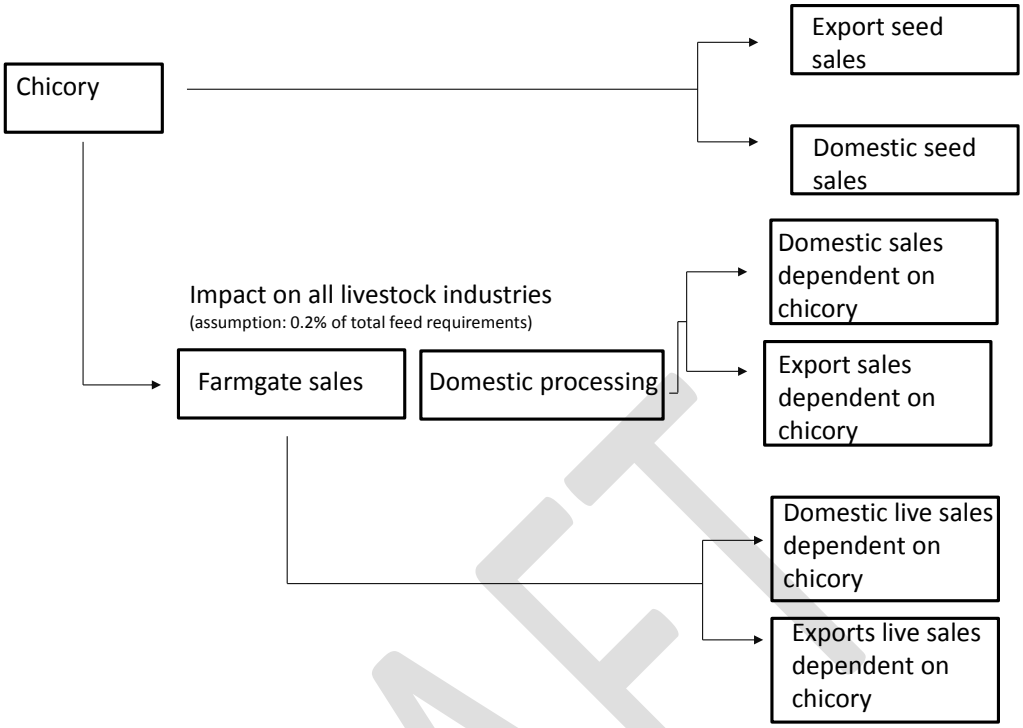
In addition to this chicory has good disease resistance and insect tolerance and with the right grazing management can provide viable stands for at least five years.

We have some information on seed sales and good information in dependent industry sales. Despite this chicory sales are relatively minor.

Figure 16 sets out the chicory value chain.

Figure 16 Chicory value sales

Note that all livestock industries include live animals (including horses), wool, dairy, meat processing, velvet and other co-products sold.



Source: NZIER

D.15.1 Seed stock production

Seed sales are approximately $9.0 million (300 tonnes multiplied by 30,000 per tonne), (personal communication, David Green, PGG Wrightson, 20 March 2015).

D.15.2 Domestic production

Domestic sales are estimated at twice seed production: $18.0 million in line with other horticultural industries.

D.15.3 Dependent industries

We have assumed that most chicory is being consumed by the dairy industry. We have further assumed that it contributes 0.02% of the protein for the whole dairy industry. This is an approximate figure based on discussions with DairyNZ (personal communication, Matthew Newman, 20 March 2015).

The value chain impacts for the dairy industry are set out in the Table below using Beef + Lamb New Zealand's estimates (personal communication, Mr Rob Davison, 5 June 2014) of farmgate value, processing, domestic and export sales.

Table 59 Estimated dairy value at each stage of the marketing chain

2012, $ M

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Dairy values	$12,241.2 million	$585.4 million	$1,045.6 million	$12,477 million
Other livestock values	$5,039.0 million	6,709.9 million	$1,432.8 million	$7,058.1 million
Horse values	$93.5 million		$57.0 million	$130.0 million
Note (1) How these values are determined is set out in Appendix B.				

Source: Beef + Lamb New Zealand estimates and Statistics New Zealand

Table 60 sets out the summary of value for the dependent industry. In each case, the value at the stage of production is multiplied by the impact on the industry and the GDP output share to obtain a value for chicory to the economy.

Table 60 Chicory for fodder summary for dependent industries

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed value ($9.0 million)	100%	0.39	$3.5 million
Domestic sales ($18.0 million)	100%	0.18	$3.2 million
Chicory for fodder production as an input into the dairy and other livestock industries			
Farmgate Dairy estimate ($12,241 million)[2]	0.2%	0.48	$ 11.8 million
Farmgate Other traditional livestock ($5,039.0) million) [2]	0.2%	0.39	$ 3.9 million
Farmgate horses ($93.5 million) [2]	0.2%	0.24	$0.5 million
All traditional livestock processing estimate ($7,287.3 million)[2]	0.2%	0.25	$ 3.6 million
All traditional livestock domestic sales estimate ($2,478.4 million)[2]	0.2%	0.18	$ 0.9 million
Domestic sales horses ($57.0 million)[2]	0.2%	0.12	$0.01 million
All traditional livestock export sales ($19,455.8 million)[2]	0.2%	0.48	$ 18.7 million
Export sales horses ($130.0 million)[2]	0.2%	0.20	$0.05 million
GDP output share (total)			**$ 45.8 million**
Notes: (1) Numbers rounded (2) Values set out in Appendix B.			

Source: Beef + Lamb New Zealand, DairyNZ, IER Pty Ltd (2010) and Statistics New Zealand HS Code 0101

D.16 Chillies (*Capsicum* species, excluding *C. annuum*)

Chillies are a comparatively new and niche crop in New Zealand, and include the species *Capsicum frutescens, C. chinense, C. pubescens*, and *C. baccatum*. Production is exclusively for the domestic market and used for processing and fresh markets. Chillies are mainly grown indoors sometimes in tandem with other crops.

Little information is available on chilli sales. Farmgate sales have been estimated with the help of seed merchants.

The value chain for chillies is set in Figure 17.

Figure 17 Value chain for chillies

Source: NZIER

D.16.1 Seed production

Seeds are mainly imported from other growing areas.

D.16.2 Farmgate

A very approximate estimate of farmgate returns nationally is $0.5 million in 2012 (personal communication, Warren Hobson, Lefroy Valley, 4 March 2015).

D.16.3 Processing

Processing is mainly for various chilli sauces produced for the domestic market and is approximately $0.4 million (personal communication, Warren Hobson, Lefroy Valley, 4 March 2015).

D.16.4 Domestic sales

To estimate the domestic sales we have used the Horticulture New Zealand suggested estimate of twice the farmgate value ($1.0 million). This includes processed and fresh for the domestic market in 2012 (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

D.16.5 Summary

Table 61 sets out the GDP output share of chillies to the New Zealand economy.

Table 61 Chillies summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Farmgate sales ($0.5 million)	100%	0.39	$0.2 million
Domestic processing ($0.4 million)	100%	0.32	$0.12 million
Domestic fresh and processed sales ($1.0 million)	100%	0.18	$0.18 million
Total GDP output share			**$0.5 million[1]**
Note (1) numbers rounded.			

Source: Statistics New Zealand, Fresh Facts 2013, and RD2 International

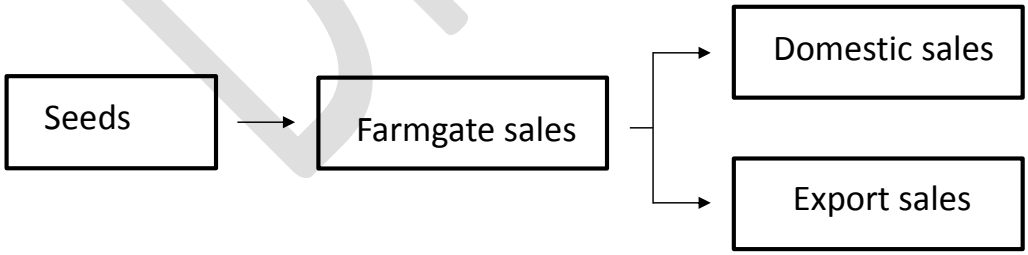
D.17 Chrysanthemums

Chrysanthemums originated in China and their cultivation dates back to at least 500 B.C. In New Zealand they are mainly grown for the domestic market but also some are exported.

Estimating the various parts of the value chain is very difficult. The large number of marketing channels means that only approximations can be made by industry experts.

The value chain for chrysanthemums is set out in Figure 18.

Figure 18 Chrysanthemum value chain



Source: NZIER

D.17.1 Seeds

The value of the chrysanthemum seed market is unknown. Some growers generate their own seeds while others buy them from seed growers. We have assumed a 1% value of seed production for the chrysanthemum seed market to approximate value based on observations of other industries. This is in line with seed providers in other vegetable industries (approximately $0.015 million).

D.17.2 Farmgate

Farmgate value approximations are problematic. Estimates are complicated by buyers buying directly from flower markets, florists buying from agents, and supermarkets buying direct from growers. Any estimate is likely to be an approximation only. FloraMax suggest the farmgate revenues for chrysanthemums are approximately $1.5 million (personal communication, Andre der Kwaak, GM FloraMax, 10 December 2014).

D.17.3 Domestic sales

Domestic sales estimates of chrysanthemums are subject to the same caveats. An approximate estimate is approximately $3.0 million in 2012 (personal communication, Andre der Kwaak, GM FloraMax, 10 December 2014).

D.17.4 Export sales

Export sales are estimated at $0.2 million (Fresh Facts 2012, p20).

D.17.5 Summary

Table 62 sets out the GDP output share of chrysanthemums to the New Zealand economy.

Table 62 Chrysanthemum summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Export seed sales ($0.015 million)	100%	0.39	$0.005 million
Farmgate sales ($1.5 million)	100%	0.39	$0.6 million
Domestic sales ($3.0 million)	100%	0.18	$0.54 million
Export sales ($0.2 million)	100%	0.45	$0.09 million
Total GDP output share			**$1.2 million[1]**
Note (1) numbers rounded.			

Source: Statistics New Zealand, Fresh Facts 2012

D.18 Citrus

Citrus arrived with European settlers and the first commercial orchards were planted in Northland, Auckland, and the Bay of Plenty. Most products are grown for the domestic market.

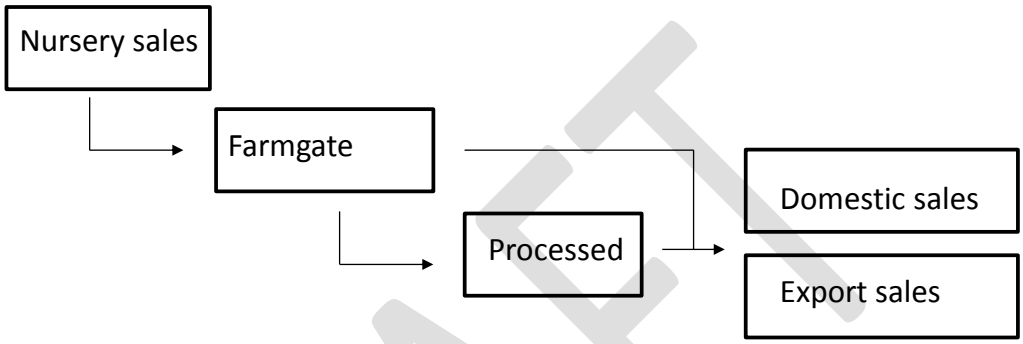
Citrus growers were protected from imports after the second world war when the Citrus Marketing Authority had the power to acquire all oranges and lemons that weren't sold directly to the consumer. These restrictions were eliminated in the 1980s.

Today the main citrus products are oranges, lemons, limes, tangelos, mandarins, and grapefruit.

We have good estimates of value for exports and for the domestic market. Also we have estimates for replacement trees and new plantings and farmgate values. Assumptions are made about the citrus market.

Figure 19 sets out the citrus marketing chain.

Figure 19 Citrus value chain



Source: NZIER

D.18.1 Citrus trees/root stock value

The value of citrus tree sales to growers is unclear. However, indications from the nurseries supplying the citrus industry (personal communication, Kate Marshall, Waimea Nurseries, 16 May 2014) suggest that sales to the industry are approximately 0.5% of farmgate values ($22.2 million multiplied by 0.5% equals $0.11 million).

D.18.2 Farmgate

Farmgate prices have been determined by tonnes estimated (Fresh Facts 2012, p14) and farmgate prices (Lincoln Financial Budget Manual 2012/2013, pA66).

Table 63 Estimated farmgate returns to citrus

	Tonnes[1]	Prices[2] per tonne	Value
Lemons	5137	$1050	$5.4 million
Oranges	11,762	$350	$4.1 million
Mandarin	10,358	$1150	$11.9 million
Grapefruit	300	$400	$0.12 million
Tangelo	800	$380	$0.34 million
Limes	300	$1,111[3]	$1.0 million
Total			**$22.2 million**
Notes (1) Fresh Facts 2012, p14. (2) Lincoln Financial Budget Manual 2012/2013p A66 and 67. Prices are for various years. (3) Estimate based on $1.0 million domestic sales (Fresh Facts 2012, p14) divided by tonnes per year divide by 2 (Horticulture New Zealand's rule of thumb farmgate returns – personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).			

Source: NZIER

D.18.3 Processing

Processing mainly involves juicing citrus and other human consumption items. We have little verifiable information on the citrus processing sector. Therefore, we have relied on the rule of thumb estimates suggested by Horticulture New Zealand (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014). That is 25% of domestic plus export sales.

Table 64 Citrus processing value

	Domestic + export sales	Adjustment factor	Processing value estimate
Citrus processing	$55.4 million	0.25	$11.7 million

Source: NZIER and Horticulture New Zealand

D.18.4 Domestic sales

Domestic sales are estimated in Fresh Facts (2012, p14) and are set out in Table 65.

Table 65 Estimated domestic citrus sales

	Tonnes	Estimated domestic sales value
Lemons	5137	$4.0 million
Oranges	11,762	$15.5 million
Mandarin	10,358	$25.3 million
Grapefruit	300	$0.3 million
Tangelo	800	$0.8 million
Limes	300	$1.0 million
Total		**$46.9 million**

Source: Fresh Facts 2012

D.18.5 Export sales

Export sales are estimated in Fresh Facts (2012, p14) and are set out in Table 66.

Table 66 Estimated export citrus sales

		Estimated export sales value
Lemons		$2.7 million
Oranges		$1.8 million
Mandarin		$4.0 million
Total		**$8.5 million**

Source: Fresh Facts 2012

D.18.6 Summary

The following table sets out the GDP output share of citrus to the New Zealand economy.

Table 67 Citrus summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Tree sales ($0.11 million)	100%	0.39	$0.043 million
Farmgate sales ($22.2 million)	100%	0.39	$8.7 million
Domestic sales ($46.9 million)	100%	0.18	$8.4 million
Processing ($11.7 million)	100%	0.32	$3.8 million
Export sales ($8.4 million)	100%	0.45	$3.8 million
Total GDP output share			**$24.7 million**[1]
Note (1) numbers rounded.			

Source: Statistics New Zealand and Fresh Facts 2012

D.19 Clover (red and white) (*Trifolium species*)

Red and white clover (*Trifolium pratense and T. repens* respectively) are major contributors to the livestock industry. It makes an important economic contribution to New Zealand by supporting the sheep, beef and dairy industries.

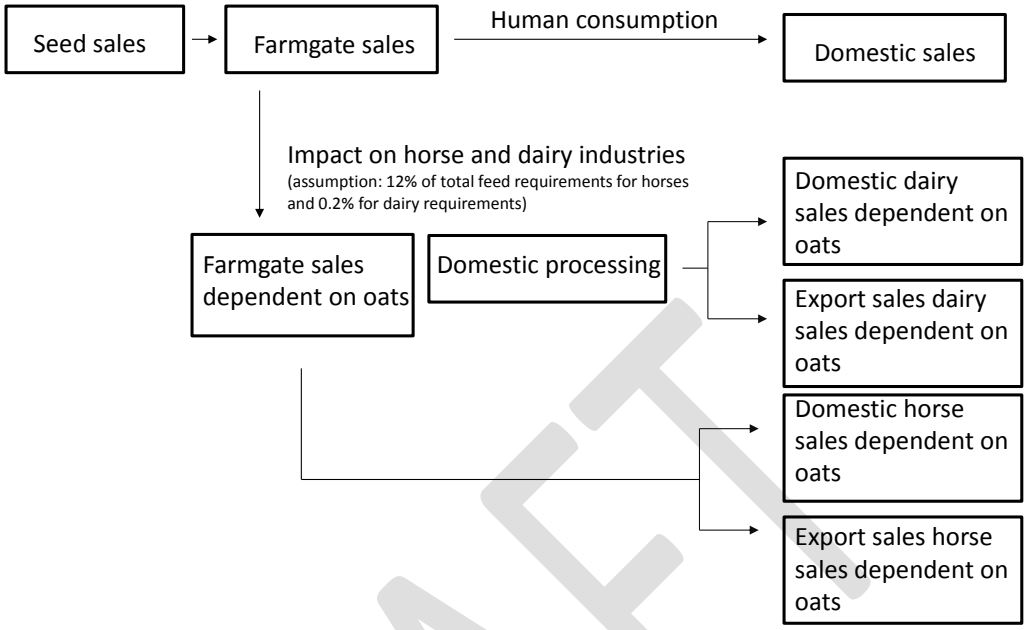
For industries that rely on clover Beef + Lamb New Zealand have credible estimates of livestock sales at the farmgate, processing and export values (personal communication, Mr Rob Davison, 5 June 2014). The main assumption made is that clover makes up approximately 12% of all livestock nutrient requirements (correspondence with Mr Matthew Newman (DairyNZ) and Mr Nick Pyke (FAR)).[30]

The clover value chain is set in Figure 20.

[30] Also see http://www.beeflambnz.com

Figure 20 Clover value chain[31]

Note that all livestock industries include live animals, wool, dairy, meat processing, velvet and other co-products sold.



Source: NZIER

D.19.1 Clover seed production value

Most seed production takes place in Canterbury. Total clover seed production in 2011 (December year)[32] was 3,745 tonnes (BERL 2011; Statistics New Zealand; Hampton et al 2012, p131).[33] The total sales of clover seed production is approximately $22.9 million (BERL 2012, p14). Most clover seed is sold into the export market ($14.15 million).

31 We have assumed that hay and other processed grass (e.g. silage) are incorporated into the value of farmgate production.

32 The latest year available where exports and domestic production is reported.

33 Note that we have used 2011 June year to get consistent export and domestic use figures.

Table 68 Seed value at farmgate, domestic sales and exports

2011 sales

Specific part of the value chain	Calculation	Value	Source/assumption
Farmgate	50% of export and domestic sales value	$11.5 million	Hort NZ assumption:
Domestic sales	Total sales minus export sales	$8.7 million	Derived from BERL 2012, p14 and Hampton et al 2012, p133
Export		$14. 2 million	Hampton et al 2012, p133

Source: BERL 2012, Hampton et al 2012 and Horticulture New Zealand

C.19.2 Value chain impact of dependent industries

Clover contributes 12% of all nutrition needs for livestock industries (personal communication, Mr Matthew Newman, DairyNZ, 24 February 2015). Horse nutritional needs are assumed to be 7.2% (based on Gee 2012). This makes clover one of New Zealand's preeminent economic plants in value terms.

Table 69 illustrates clover's importance by setting out the livestock and horse values for farmgate, processing, domestic sales and exports that depend upon clover. Export data comes from Statistics New Zealand through Beef + Lamb New Zealand (personal communication, Mr Rob Davison, 5 June 2014). Beef + Lamb New Zealand have also estimated processing margins and farmgate returns (personal communication, Mr Rob Davison, 30 July 2014) specifically for this project. Livestock (live) sales are a NZIER estimate based on historical data that suggests livestock sales are approximately 17% of the farmgate returns from livestock industries.[34]

Table 69 Livestock industries that depend on clover

2012, June year, $ M per annum

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Dairy values	$12,241.2 million	$585.4 million	$1,045.6 million	$12,573.7 million
Other traditional livestock values	$5,039.0 million	6,701.9 million	$1,432.8 million	$6,882.1 million
Horse values	$93.5 million		$57.0 million	$130.0 million
Note (1) See Appendix B for further detail				

Source: Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

[34] This is a tentative estimate but we are confident that it is of the right order of magnitude.

D.19.2 Clover summary

Table 70 sets out the summary of clover seed production and its dependent livestock and horse industries. Estimates of the size at each stage of production have been calculated from the Table below and multiplied by estimated industry impact, and GDP share of output[35] equalling the value of clover to each stage of production. These values are summed to get the total GDP share of output, which demonstrates the importance of clover to the economy.

Table 70 Clover summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Farmgate seed sales ($11.5 million)[1]	100%	0.39	$4.5 million
Domestic seed sales ($8.7 million	100%	0.18	$1.6 million
Export seed sales ($14.2 million	100%	0.45	$6.4 million
Dependent livestock industries			
Farmgate Dairy sales all livestock ($12,241million)	12%	0.48	$705.1 million
Farmgate Other livestock sales ($5,039 million)	12%	0.39	$235.8 million
Farmgate horses ($93.5 million)	7.2%	0.24	$1.6 million
Domestic processing all livestock ($7,287 million)	12%	0.25	$218.6 million
Domestic sales all livestock (processing and live) ($2,478.4 million)	12%	0.18	$53.5 million
Domestic sales horses ($57.0 million)	7.2%	0.12	$0.5 million
Exports all livestock ($19,445.8 million)	12%	0.48	$1,120.6 million
Export sales horses ($130.0 million)	7.2%	0.20	$1.9 million
Total GDP output share			**$2,350.1 million[2]**
Note (1) December year 2011. (2) Numbers rounded.			

Source: BERL 2012, Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.20 Cocksfoot (*Dactylis glomerata*)

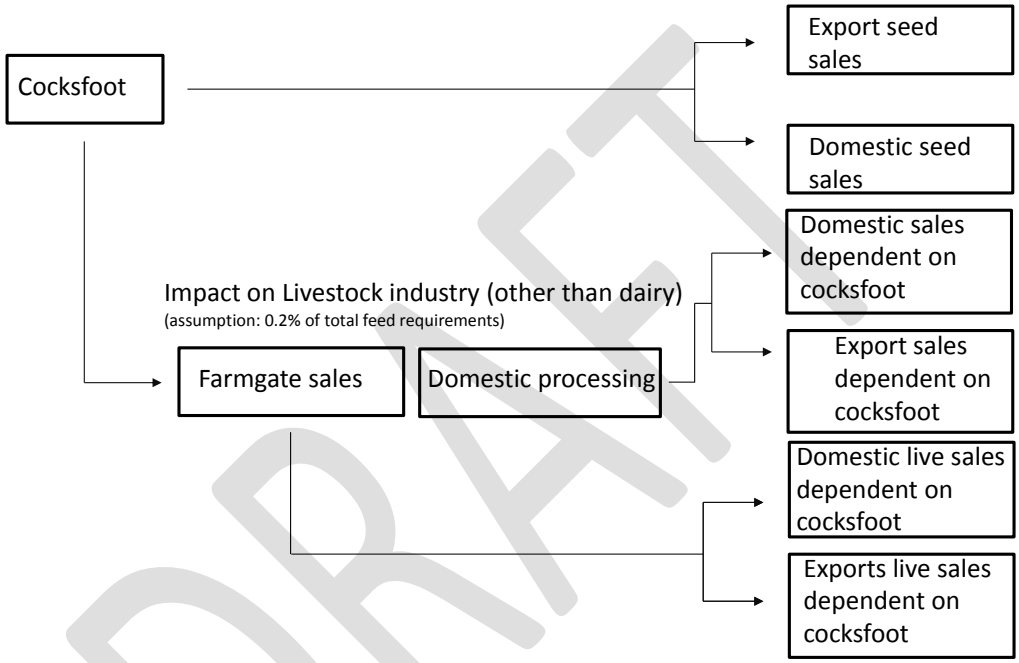
Cocksfoot (*Dactylis glomerata*) is a very persistent perennial grass that tolerates moisture stress, moderate soil fertility, insect attack and continual set stocking.

[35] The GDP share of output is calculated from estimates made in the Input-Output tables (see Table 1).

Cocksfoot is used to enhance the growth and persistence of permanent pasture in summer dry areas. It also adds variety to the stock diet. It is moderately slow to establish and has lower digestibility than most other grasses. Cocksfoot has limited winter growth but good summer growth. Cocksfoot is predominately used on sheep and beef farms and we have limited the dependent industries to sheep, beef and deer.[36]

Figure 21 Cocksfoot value chain

Note that livestock industries include live animals, wool, meat processing, velvet and other co-products sold. Horses are also included.



Source: NZIER

D.20.1 Cocksfoot seeds

Most seed production takes place in Canterbury. The farmgate value of cocksfoot seed production is approximately $0.9 million (approximately half of exports plus domestic sales).

[36] www.agricom.co.nz/products/cocksfoot

Table 71 Cocksfoot value at farmgate

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Cocksfoot farmgate value	$1.88 million	0.5	$0.9 million

Source: BERL 2012 and Hampton et al 2012

D.20.2 Domestic value

Domestic seed sales value is estimated at $0.33 million (BERL 2012, p14).

D.20.3 Export value

Export seed sales value is estimated at $1.55 million (Hampton et al, 2012).

D.20.4 Value chain impact of dependent industries

Cocksfoot contributes 0.2% of all nutrition needs for livestock industries (other than dairy). While much smaller in volume than other grasses it still makes a significant contribution in value terms. Cocksfoot is best suited for grazing sheep and dry stock because it persists well in dry, moderately fertile, and free draining soil.[37] Dairy is excluded from this value chain because cocksfoot is less suited to dairy production relative to other grasses (e.g. clover and ryegrass).

The Table below illustrates its importance by setting out the other livestock value of farmgate, processing, domestic sales and exports that depend upon cocksfoot. Export data comes from Statistics New Zealand through Beef + Lamb New Zealand (personal communication, Mr Rob Davison, 5 June 2014). Beef + Lamb New Zealand have also estimated processing margins and farmgate returns (personal communication, Mr Rob Davison, 30 July 2014) specifically for this project. Livestock (live) sales are a NZIER estimate based on historical data for other livestock industries.[38]

Table 72 Livestock industries that depend on cocksfoot

2012, June year, $ M per annum

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Other traditional livestock values	$5,039.0 million	6,701.9 million	$1,432.8 million	$6,822.1million
Horse values	$93.5 million		$57.0 million	$130.0 million
Note (1) Other traditional livestock values are set out in Appendix B				

Source: Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

[37] www.agricom.co.nz/products/cocksfoot and PGG Wrightsons cocksfoot advice, e.g.: http://www.pggwrightsonseeds.com/index.php?page=cocksfoot

[38] This is a tentative estimate but we are confident that it is of the right order of magnitude.

Cocksfoot summary

Table 73 sets out the summary of cocksfoot seed production and its dependent livestock industries (including horses). Estimates of the size at each stage of production have been calculated from above and multiplied by estimated industry impact, and GDP share of output[39] equalling the value of cocksfoot to each stage of production. These values are summed to get the total GDP share of output, which demonstrates the importance of cocksfoot to the economy.

Table 73 Cocksfoot summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales farmgate value ($0.9 million)[1]	100%	0.39	$0.37 million
Domestic sales ($0.33 million)	100%	0.18	$0.06 million
Export sales ($1.6 million)	100%	0.45	$0.7 million
Dependent livestock industries			
Farmgate Other livestock sales ($5,039 million)[3]	0.2%	0.39	$3.9 million
Farmgate horses ($93.5 million)[3]	0.2%	0.24	$0.04 million
Domestic processing ($6,701.9 million)[3]	0.2%	0.25	$3.4 million
Domestic sales (processing and live) ($1,432.8 million)[3]	0.2%	0.18	$0.6 million
Domestic sales horses ($57.0 million)[3]	0.2%	0.12	$0.01 million
Exports ($6,882.1 million)[3]	0.2%	0.48	$6.6 million
Export sales horses ($130.0 million)[3]	0.2%	0.20	$0.05 million
Total GDP output share			**$15.6 million[2]**
Note (1) December year 2011. (2) Numbers rounded. (3) Values set out in Appendix B.			

Source: BERL 2012, Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

[39] The GDP share of output is calculated from estimates made in the Input-Output tables (see Table 1).

D.21 *Cucurbita* species

Cucurbita species valued in this study include buttercup squash (*Cucurbita maxima*), butternut pumpkin (*Cucurbita moschata*), and zucchini and other pumpkins (*Cucurbita pepo*).

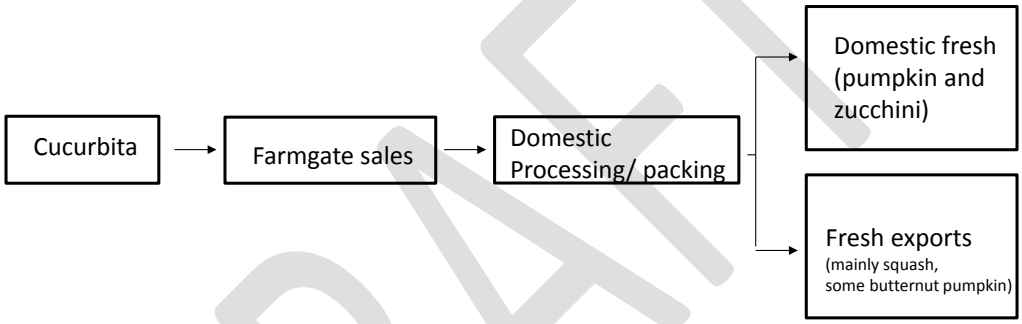
Butternut squash

Buttercup squash

The export focus is on buttercup squash. The main export markets are Japan and South Korea. A very small amount of other pumpkin (less than $100,000 FOB) was also exported in 2012. The main focus for butternut pumpkin and zucchini and other pumpkins is the domestic market.

These species are grown in variety of places including Gisborne, Hawke's Bay, South Auckland, Horowhenua and Canterbury. The value chain is set out below.

Figure 22 *Cucurbita* species value chain



Source: NZIER

D.21.1 Cucurbita seeds

Cucurbita seeds are a mixture of imported seeds (squash and zucchini) and domestically grown (pumpkin), (personal communication, Warren Hobson, Lefroy Valley, 13 March 2015).

An approximate estimate of pumpkin seed sales in 2012 is $0.6 million (personal communication, Warren Hobson, Lefroy Valley, 13 March 2015).

D.21.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries that farmgate prices are approximately half of export and domestic sales. Below we set out the estimated farmgate estimates.

Table 74 Cucurbita value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Squash farmgate value	$67.9 million[1]	0.5	$34.0 million
Zucchini farmgate value	$12.0 million[3]	0.5	$6.0 million
Pumpkin			$6.2 million[2]
Notes (1) Fresh Facts (2012, p17). (2) 31,000 tonnes multiplied $200 per tonne (pers comm John Seymour, Horticulture New Zealand, 12 December 2014. (3) Fresh Facts (2012, p27) based on consumption.			

Source: NZIER, and Horticulture New Zealand

Pumpkin farmgate value is calculated 31,000 tonnes multiplied by $200 per tonne (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014) which equals $6.2 million.

D.21.3 Processing

There is little or no processing of Cucurbita products in New Zealand. Most are exported and sold domestically on a fresh basis.

D.21.4 Domestic sales

Domestic sales are set out in Table 75.

Table 75 Cucurbita domestic sales value

	Squash	Pumpkin	Zucchini
Domestic sales	$2.9 million[1]	$12.4 million[2]	$12.0 million[3]
Notes (1) Fresh Facts (2012, p17). (2) Twice the farmgate value (pers comm, John Seymour, Horticulture New Zealand, 12 December 2014). (3) Fresh Facts (2012, p27) based on consumption.			

Source: NZIER and Horticulture New Zealand

D.21.5 Export sales

Squash is the major exported *Cucurbita* species. Exports were $65.0 million in 2012 (Fresh Facts 2012, p16). Some butternut pumpkin was also exported ($0.08 million).

D.21.6 Summary

Table 76 sets out the GDP output share of Cucurbita to the New Zealand economy.

Table 76 Cucurbita summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($0.6 million)	100%	0.39	$0.2 million
Farmgate sales ($46.2 million)	100%	0.39	$18.0 million
Processing			Little or no processing
Domestic sales ($27.3 million)	100%	0.18	$4.9 million
Export sales ($65.1 million)	100%	0.45	$29.3 million
Total GDP output share			**$52.4 million[1]**
Note (1) numbers rounded.			

Source: Statistics New Zealand and Fresh Facts 2012

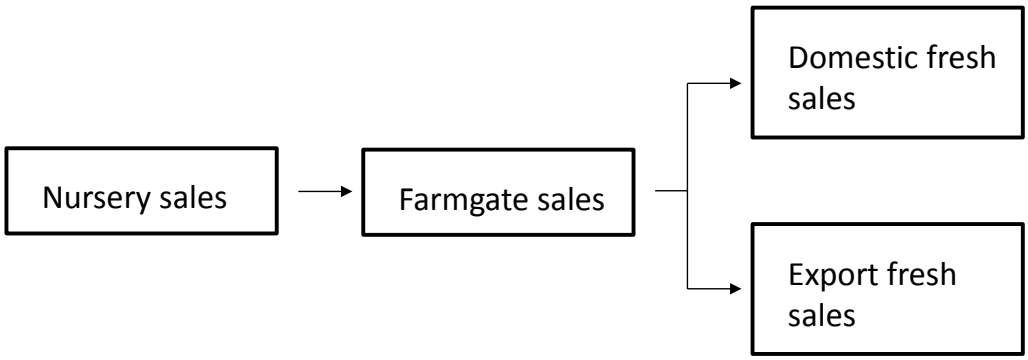
D.22 Feijoas (*Acca sellowiana*)

Feijoas (*Acca sellowiana*) have been grown in New Zealand since the beginning of the 20th century. The feijoa industry is a small industry with a stable domestic market and small export market.

While exports statistics are readily available, domestic information on the industry is reliant on nurseries and industry estimates.

The value chain for feijoas is set out below.

Figure 23 Feijoa value chain



Source: Sales

D.22.1 Trees/root stock production

The number of trees sold in New Zealand is approximately 6,000 multiplied by $10 per tree equalling $0.06 million (personal communication, Kate Marshall, Waimea Nurseries, 13 March 2015).

D.22.2 Farmgate

The farmgate value of feijoa is estimated at approximately $0.95 million based on the domestic and export sales approximation suggested by Horticulture New Zealand (see Table 77).

Table 77 Feijoa value at farmgate

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Feijoa farmgate value	$1.9 million	0.5	$0.95 million

Source: Fresh Facts and Horticulture New Zealand

D.22.3 Domestic sales

Domestic sales are estimated at $1.7 million (Fresh Facts 2012, p14).

D.22.4 Export sales

Export sales are estimated at $0.2 million (Fresh Facts 2012, p14).

D.22.5 Summary

Table 78 sets out the GDP output share of feijoa to the New Zealand economy.

Table 78 Feijoa summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($0.06 million)	100%	0.39	$0.02 million
Farmgate sales ($0.95 million)	100%	0.39	$0.4 million
Processing			Little or no processing
Domestic sales ($1.7 million)	100%	0.18	$0.3 million
Export sales ($0.2 million)	100%	0.48	$0.1 million
Total GDP output share			**$0.8 million**[1]
Note (1) numbers rounded.			

Source: Statistics New Zealand, Fresh Facts 2012 and Waimea Nurseries

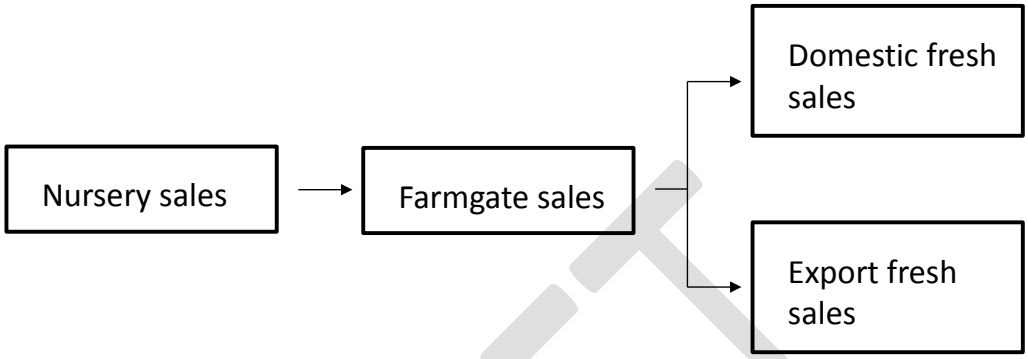
D.22.6 Garlic (*Allium sativum*)

Garlic (*Allium sativum*) growing in New Zealand is a small industry catering mainly for the domestic market.

Information on sales is scarce so we have relied on local experts and Fresh Facts.

The value chain for garlic is set out below.

Figure 24 Garlic value chain



Source: NZIER

D.22.7 Garlic corms

The amount of garlic corms grown is unknown however we expect the value to be approximately 1% of the farmgate value (based on other vegetable and horticultural production ($0.04 million).

D.22.8 Farmgate

The farmgate value of garlic is estimated at approximately $3.9 million based on the domestic and export sales approximation (see Table 79).

Table 79 Garlic value at farmgate

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Garlic farmgate value	$7.1 million	0.5	$3.6 million

Source: Fresh Facts and Horticulture New Zealand

D.22.9 Domestic sales

Domestic sales were estimated at $6.5 million in 2012(Fresh Facts 2012, p14).

D.22.10 Export sales

Export sales were estimated at $0.6 million in 2012 (Fresh Facts 2012, p14).

D.22.11 Summary

The following table sets out the GDP output share of garlic to the New Zealand economy.

Table 80 Garlic summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($0.04 million)	100%	0.39	$0.01 million
Farmgate sales ($3.9 million)	100%	0.39	$1.5 million
Processing[1]			Unknown but assume it is small
Domestic sales ($6.5 million)	100%	0.18	$1.2 million
Export sales ($0.6 million)	100%	0.48	$0.3 million
Total GDP output share			**$2.9 million[2]**
Notes (1) Assumed to be crushed garlic, added to sauces, hummus etc. (2) Numbers rounded.			

Source: Statistics New Zealand, Fresh Facts 2012

D.23 Grapes (*Vitis* species)

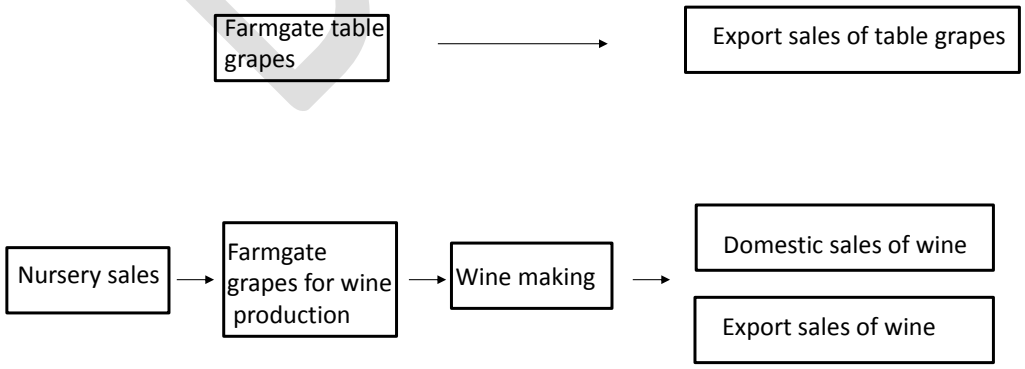
Grapes (*Vitis* species) consist of table grapes (servicing very small high value niche export markets) and the wine industry (very large). Table grapes are grown in greenhouses and air-freighted to Japan.

The wine industry grows grapes outdoors and ships product to a large number of industrialised and rapidly industrialising nations at premium prices. The key to success of the wine industry is the consistent high quality and distinct New Zealand varieties reinforced by the skill of the wine maker.

Good information is available on all aspects of the marketing chain.

Below the value chain is set out.

Figure 25 Table grape and vineyard value chain



Source: NZIER

D.23.1 Vines/root stock production

Nursery sales to growers are approximately $7.5 million per annum (personal communication, Ben Wickham, New Zealand Wine Growers, 19 August 2014). This includes new plantings and replacements.

D.23.2 Orchard gate

It is difficult to place an accurate figure on the orchard gate returns. However, a general understanding can be gained from the New Zealand Wine Growers, 2013 Annual Report. This is set out in Table 81 where area planted, average yield, and price per hectare are multiplied to give an orchard value.

Table 81 Wine orchard gate value

Area planted	Average yield	Average price per hectare	Orchard value
35,337 hectare	8 tonnes per hectare	$1,399	$375.8 million

Source: New Zealand Wine Growers 2013

A further $0.1 million was added to orchard gate returns for table grapes.

D.23.3 Processing

Processing values are calculated from the cost of bulk wine per litre multiplied by the volume of bulk wine produced: $1.84 per litre multiplied by 194 million litres equalling $357 million (Deloitte 2012).

D.23.4 Domestic sales

Domestic sales of wine were $604.6 million in 2012. The calculation comprises of: domestic volume (91.9 million litres) multiplied by the export value ($1,177.0 million) divided by the export volume (178.9 million litres) (New Zealand Wine Growers 2013).

D.23.5 Export sales

Export sales of wine comprise of $1,177.0 million (New Zealand Wine Growers 2013) plus $300,000 worth of table grape exports.

D.23.6 Summary

Table 82 sets out the summary of grape sales. Estimates of the size at each stage of production have been calculated in each part of the industry and the values set out. These values are summed to get the total GDP share of output, which demonstrates the importance of grapes to the economy.

Table 82 Grape summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Plant sales farmgate value ($7.5 million)[1]	100%	0.39	$2.9 million
Orchard gate sales ($375.8 million)	100%	0.18	$146.6 million
Processing sales ($357.0 million)	100%	0.25	$114.2 million
Domestic sales (wine) ($604.6 million)	100%	0.18	$108.8 million
Export sales ($1,177.3 million)	100%	0.45	$529.8 million
Total GDP output share			**$902.3 million[1]**
Note (1) Numbers rounded.			

Source: New Zealand Wine Growers 2013, Deloitte 2012, Statistics New Zealand and NZIER

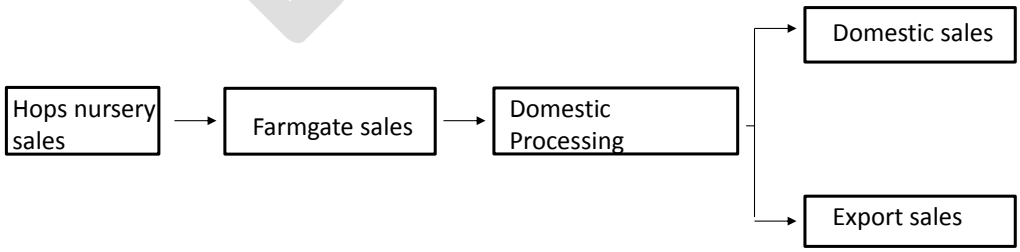
D.23.7 Hops (*Humulus lupulus*)

English and German settlers first planted hops (*Humulus lupulus*) in the Nelson region during the mid- 19th century. In the latter part of the 20th century New Zealand has developed high quality seedless varieties with bittering and aroma characteristics desired by beer brewers around the world.

Information is available on the nursery sector, farmgate, domestic sales and export sector. Assumptions have been made about the processing sector.

The value chain for hops is set out below.

Figure 26 Hops value chain



Source: NZIER

D.23.8 Hops plants

The number of hops plants supplied to growers was approximately $0.12 million in value (personal communication, Kate Marshall, Waimea Nurseries, 13 March 2015).

D.23.9 Farmgate

Farmgate value was estimated by Plant and Food Research Limited at approximately $2.0 million.[40]

D.23.10 Processing

Most processing occurs in Nelson area which is where hops are predominantly grown. The processing cost is approximately 25% of domestic and export sales ($3.1 million), (as per Horticulture New Zealand's rule of thumb).

D.23.11 Domestic sales

Domestic sales are estimated at $3.0 million by Fresh Facts (2012, p15).

D.23.12 Export sales

Export sales are estimated at $9.2 million by Fresh Facts (2012, p15).

D.23.13 Summary

Table 83 sets out the summary of hops sales. Estimates of the size at each stage of production have been calculated in each part of the industry.

Table 83 Hops summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Plant sales orchard ate ($0.12 million)	100%	0.39	$0.045 million
Orchard gate sales ($2.0 million)	100%	0.18	$0.8 million
Processing sales ($3.1 million)	100%	0.25	$1.0 million
Domestic sales ($3.0 million)	100%	0.18	$0.5 million
Export sales ($9.2 million)	100%	0.45	$4.4 million
Total GDP output share			**$6.8 million[1]**
Note (1) Numbers rounded.			

Source: Waimea Nurseries, Plant and Food Research, Horticulture New Zealand and NZIER

[40] http://www.plantandfood.co.nz/

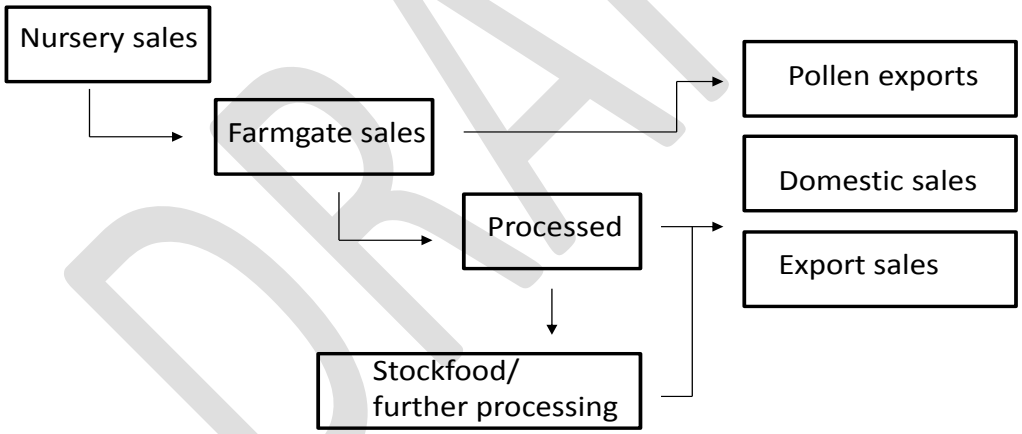
D.24 Kiwifruit (*Actinidia* species)[41]

The kiwifruit (*Actinidia* species) industry has its origins in seeds bought from China in the early part of the 20th Century. From these seeds, the Hayward variety was developed and kiwifruit began its growth from a small local market operation to a major export crop.

Valuing kiwifruit has been made more difficult with the PSA incursion. Given the expected "bounce" back of gold kiwifruit we have used 2012 figures.[42] These data show production prior to the major impact of PSA particularly on gold kiwifruit. Figure 27 below sets out the kiwifruit value chain. Major points include:

- the best data is for exports. There is no other official data for other parts of the value chain. Therefore, we have worked backward through the marketing chain from the export value
- estimates for processed kiwifruit (i.e. the domestic market, dumped into bins for stockfood or further processing are based on industry views).

Figure 27 Kiwifruit value chain



Source: NZIER

D.24.1 Nursery sales

Table 22 sets out the approximate value of kiwifruit nursery sales in 2012. We have used estimates from Fruition (personal communication, Ms Ruth Underwood, Fruition, 15 May 2014) to identify approximate domestic nursery sales. Total exports of live plants and root stock is relatively small.[43]

41 Includes *Actinidia chinensis* (gold), *Actinidia deliclosa* (green), and *Actinidia arguta* (berry).

42 The PSA (Pseudomonas syringae pv. actinidiae) disease has devastated particularly gold kiwifruit (Hort 16A variety). A new gold variety (G3) has shown good resistance to PSA and the industry are expecting gold volumes to return to pre PSA levels by 2015 (see for example http://www.nzherald.co.nz/bay-of-plenty-times/news/article.cfm?c_id=1503343& objected=11203065).

43 No root stock was exported in 2012. The average for the period 2000-2012 was $100,000 per annum. (HS code 0602900019 Plants, live, Kiwifruit stock, Statistics New Zealand http://www.stats.govt.nz /)

Table 84 Estimated kiwifruit nursery value

2012, June year, $ M

	Hectares	Estimated per hectare value (per annum)	Nursery sales (per annum)
Kiwifruit nursery stock	1,000	$10,000 per hectare	$10m[1]
Notes (1) Includes value per hectare, labour costs, and wholesale mark-up.			

Source: Personal communication with Fruition and MPI

D.24.2 Farmgate production value

Total production is estimated to be 390,000 tonnes. This has been calculated by taking the total export tonnage, adding estimates of domestic consumption and the estimates of the amount removed at the processing stage.

Farmgate return estimates are calculated in the following way:

- MPI's Bay of Plenty Orchard model results (March year 2012)[44] estimate the gross returns to green and gold are $35,335 and $92,080 per hectare, respectively
- gross returns are multiplied by the number of hectares of green (9,500 hectares), gold (3,070 hectares) and other kiwifruit (187 hectares)[45] (Statistics New Zealand final production estimates, supplied by Mr Rod Forbes, MPI, personal communication, 15 May 2014).

From this NZIER has estimated the farmgate value as being approximately $630 million.

D.24.3 Processing

Kiwifruit processing costs range between 25% and 50% of the domestic and export value depending on the variety. Processing costs were estimated to be $329.8 million in 2012 (30% of domestic and export value).[46]

D.24.4 Domestic value

Domestic value is set out in Table 85. This is made up of farmgate sales and estimated retail sales. The total value is approximately $53m.

[44] www.**mpi**.govt.nz

[45] Prices for other kiwifruit are not known. As a proxy, we used an average of green and gold returns ($63,708 per hectare).

[46] www.**mpi**.govt.nz/Portals/0/.../2012-**bop**-kiwifruit-data-release.xls

Table 85 Estimated kiwifruit farmgate value

2012, June year, $ M

	Further processing and stock food	Domestic sales	Export	Total crop
Tonnes	20,000[2]	23,500[1]	339,000	390,000[5]
Value	$0.2m[3]	$53m[4]	$1,045.7m	
Notes (1) includes 20,000 tonnes at retail level and 3,500 tonnes of gate sales (USDA 2013a). (2) Fruition estimate, pers comm, Ms Ruth Underwood, 15 May 2014. (3) $10 per tonne (pers comm, Ms Ruth Underwood, 15 May 2014). (4) Value estimated at 80% of class I fruit and farmgate sales were estimated at 50% of class I fruit (5) Includes losses at 2% or 7,500 tonnes (pers comm, Ms Ruth Underwood, 15 May 2014).				

Source: USDA 2013a, Fruition, and Statistics New Zealand

D.24.5 Kiwifruit exports

In 2012, 339,000 tonnes of kiwifruit was exported at a value of $1,045.7m (Fresh Facts 2013, p2 and Statistics New Zealand).

A further 878.49 kg[47] of kiwifruit pollen was exported at approximately $2,900 per kg.[48] For the 2012 December year, kiwifruit pollen exports were approximately $2.5 million.

D.24.6 Summary table

Table 86 sets out the GDP output share of kiwifruit to the New Zealand economy.

Table 86 Kiwifruit summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($10 million)	100%	0.39	$3.9 million
Farmgate ($630.3 million)	100%	0.39	$245.8 million
Processing ($329.8 million)	100%	0.32	$105.5 million
Further processing (0.2m)	100%	0.32	$0.06m
Domestic sales ($53.7 million)	100%	0.18	$9.7 million
Exports (1,048.3m)[1]	100%	0.45	$471.7 million
Total GDP output share			**$836.6 million[2]**
Note (1) Includes pollen exports. (2) Numbers rounded.			

Source: Fresh Facts various years, Statistics New Zealand, Fruition and USDA 2013a

D.25 Kumara (*Ipomoea batatas*)

Approximately 90% of kumara (*Ipomoea batatas*) is grown and processed on the alluvial plains of the Northern Wairoa River, Northland. Kumara is a tropical plant

47 Ms Paula Loader, MPI, 2014, pers comm, 24 July 2014. Data from MPI Exports Group June 2014.

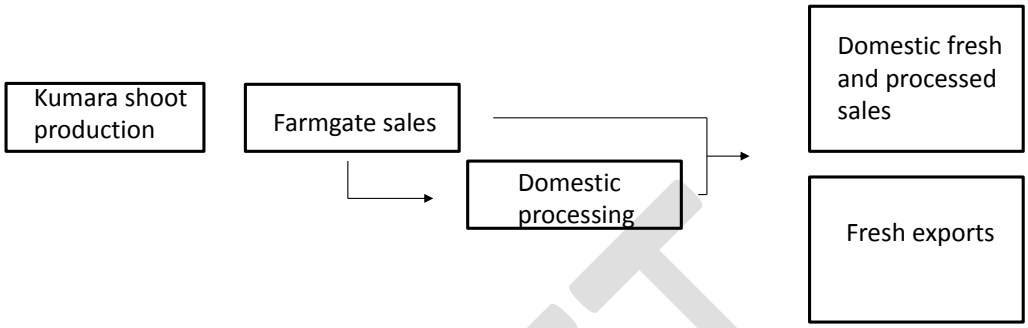
48 Mr Steven Saunders, Pollen Plus, 2014, pers comm, 14 August 2014.

requiring a frost free hot dry summer for best results. Kumara is harvested in February, March and April and stored for supply throughout the year.

Good information is available from the industry on 2012 production and sales.

The value chain is set out in the following diagram.

Figure 28 Kumara value chain



Source: NZIER

D.25.1 Kumara shoots

Kumara shoots sold to growers was approximately $0.7 million in 2012 (personal communication, Anthony Blundell, Kaipara Kumara, 3 March 2015).

D.25.2 Farmgate

Growers returns at the farmgate were approximately $9.0 million (personal communication, Anthony Blundell, Kaipara Kumara, 3 March 2015).

D.25.3 Processing

Processing returns are estimated at $1.0 million (personal communication, Anthony Blundell, Kaipara Kumara, 3 March 2015).

D.25.4 Domestic sales

Domestic sales are approximately $28 million for the 2012 period (personal communication, Anthony Blundell, Kaipara Kumara, 3 March 2015).

D.25.5 Export sales

Export sales for 2012 were $5.1 million (Market Access Solutionz 2014a, p83).

D.25.6 Summary

Table 87 sets out the GDP output share of kumara to the New Zealand economy.

Table 87 Kumara summary

2012, June year, $ M per annum

Gross Output (price multiplied by	Impact of plant species on industry	Share of output value (attributable to stage	Impact of the plant species on GDP

quantity at stage of production)	or stage in value chain	in value chain) that contributes to GDP	
Nursery sales ($0.7 million)	100%	0.39	$0.26 million
Farmgate ($9.0 million)	100%	0.39	$3.5 million
Processing ($1.0 million)	100%	0.32	$0.32m
Domestic sales ($28.0 million)	100%	0.18	$5.04 million
Exports (5.1 million)	100%	0.45	$2.2 million
Total GDP output share			**$11.4 million**[1]
Note (1) Numbers rounded.			

Source: Anthony Blundell, Kaipara Kumara, Fresh Facts, and Horticulture New Zealand 2014

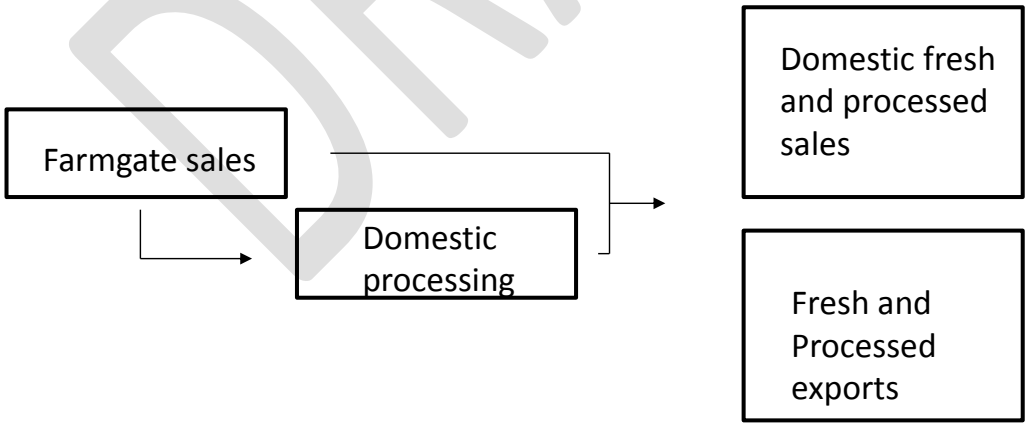
D.26 Lettuce (*Lactuca sativa*)

Lettuce (*Lactuca sativa*) has always been popular as a salad green in New Zealand. The range of varieties has risen dramatically over the past twenty years with the availability changing often.

Information is available on domestic and export sales. Assumptions are made on the processing and farmgate returns. Seeds are mainly imported.

The value chain for lettuce is set out below.

Figure 29 The lettuce value chain



Source: NZIER

D.26.1 Seed production

Very small amounts are grown in New Zealand; however, the vast bulk of lettuce seeds are grown in warm climates such as Australia.

D.26.2 Farmgate

Farmgate value estimates are approximately half of domestic and export sales (general rule of thumb for vegetable/horticulture industries). Below we set out the estimated farmgate estimates.

Table 88 Lettuce value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Lettuce farmgate value	$43.4 million[1]	0.5[2]	$21.7 million
Notes (1) Fresh Facts (2012, p16). (2) Adjustment factor suggested by John Seymour, Horticulture New Zealand.			

Source: NZIER and Horticulture New Zealand

D.26.3 Processing

Processing of lettuce consists of packaging lettuce and is approximately 10% of the export and domestic sales value ($4.3 million) (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

D.26.4 Domestic sales

Domestic sales for 2012 were estimated at $41.8 million (Fresh Facts 2012, p16).

D.26.5 Export sales

Export sales for 2012 were estimated at $1.6 million (Fresh Facts 2012, p16).

D.26.6 Summary

Table 89 sets out the GDP output share of lettuce to the New Zealand economy.

Table 89 Lettuce summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales	100%	0.39	Mostly imported
Farmgate ($21.7 million)	100%	0.39	$8.5 million
Processing ($4.3 million)	100%	0.32	$1.4 million
Domestic sales ($41.8 million)	100%	0.18	$7.5 million
Exports (1.6 million)	100%	0.45	$0.8 million
Total GDP output share			**$18.1 million**[1]
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and Horticulture New Zealand

D.27 Lilies (*Lilium* species)

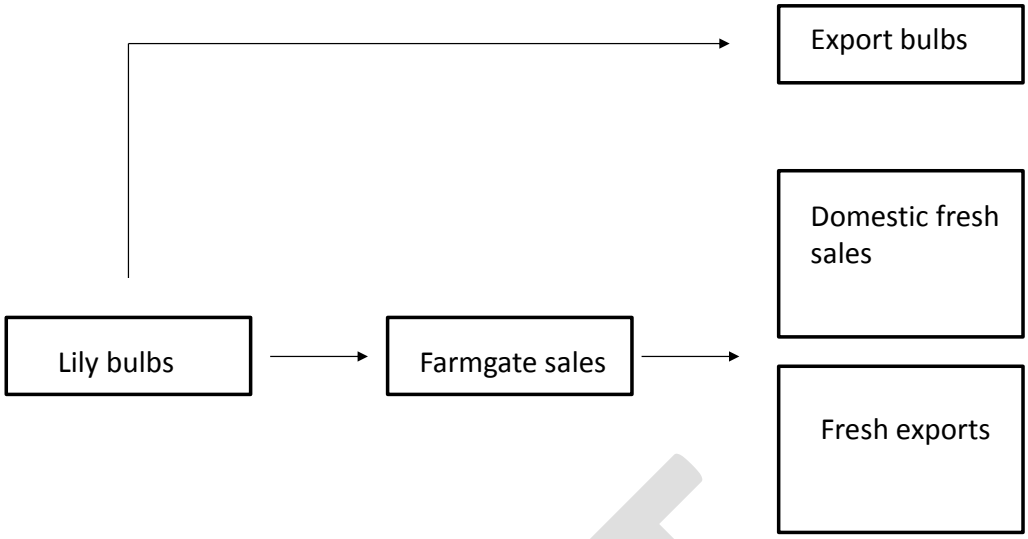
Lilies (*Lilium* species) are big business in New Zealand. The bulbs are exported by a number of companies to fulfil off-season demand in Japan, China, Taiwan and Europe. There is also strong demand in India, Vietnam, Australia, Columbia and Mexico.

Typically companies lease land off local farmers (mainly in South Canterbury). Land owners plough and roll the paddock and providing irrigation, while contractors plant, fertilise, spray, debud and harvest the bulbs.

Information is difficult to come by on all of the flower businesses. Good information exists on export sales but we have to rely on industry approximations for other parts of the value chain.

The value chain is set out below.

Figure 30 Lily value chain



Source: NZIER

D.27.1 Bulb production

In most cases separating the bulb production from growing bulbs is not possible since it part of the same vertically integrated production process. Bulbs for the next season are produced at the same time scaled and multiplied up.

The approximate cost or 'best guess' of the value of this process is approximately $0.2 million (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014 and NZIER estimate).

D.27.2 Farmgate

Farmgate estimates are also hard to estimate for the same reason. The best guess by the industry is approximately $17.7 million (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014). Further the sales channels are numerous with each channel having a different pricing strategy e.g. supermarkets, agents, buyers buying direct etc. This complicates estimating the farmgate returns.

D.27.3 Domestic sales

Domestic sales are estimated at $12.0 million. This is a highly approximate figure based on 60 million flowers sold at 0.20 cents per flower equalling $12.0 million. (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014).

D.27.4 Export sales

Fresh Facts (2012, p20) estimates the export sales of lilies as $23.4 million.

D.27.5 Summary

Table 90 sets out the GDP output share of lilies to the New Zealand economy.

Table 90 Lily summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.2 million)	100%	0.39	$0.08
Farmgate ($17.7 million)	100%	0.39	$6.9 million
Domestic sales ($12.0 million)	100%	0.18	$2.2 million
Exports (23.4 million)	100%	0.45	$11.2 million
Total GDP output share			**$20.3 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and FloraMax

D.28 Lucerne (*Medicago sativa*)

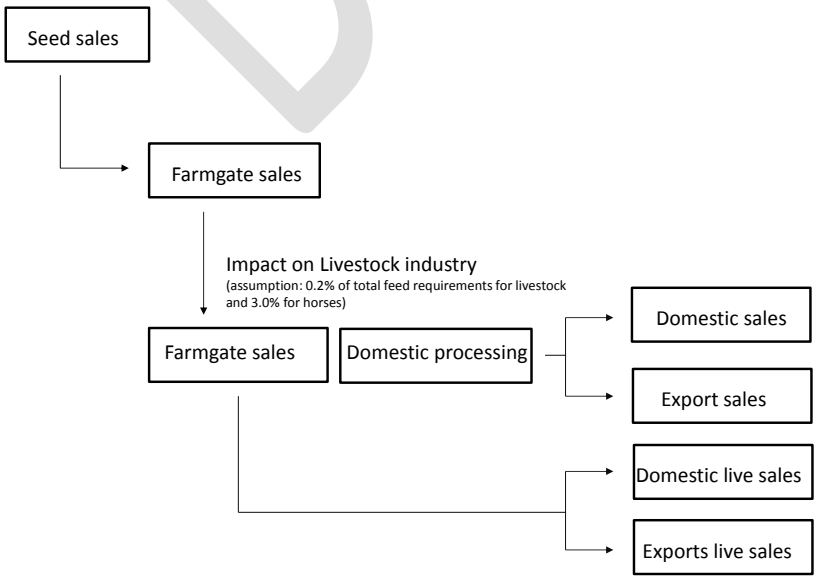
Lucerne (*Medicago sativa*) is grown for livestock industries in New Zealand. With the growth of the dairy industry the demand has increased since it provides forage which allows farmers to extend milk production.

We have little information on the Lucerne production with most information coming from seed merchants and industry experts.

The value chain is set out below.

Figure 31 Lucerne value chain

Note that all livestock industries include live animals (including horses), wool, dairy, meat processing, velvet and other co-products sold.



Source: NZIER

D.28.1 Lucerne seeds

Lucerne seed value is estimated at approximately $1.1 million (personal communication, Stephen Finch, Spec Seed, 5 March 2015).

D.28.2 Farmgate

The crop revenue estimate approximation was $11.9 million in 2012. Number of hectares (4,583) multiplied by the revenue per hectare ($2,600).[49]

D.28.3 Dependent industries

Lucerne is grown by farmers as a forage crop either for their own use or sold on the open market. DairyNZ suggest that lucerne is a minor but valuable addition to livestock feed requirements particularly in the South Island – approximately 0.2% of total livestock requirements (personal communication, Mr Matt Newman, DairyNZ, 18 May 2014).

More lucerne is used in the horse breeding industry, however relative to other forage (e.g. ryegrass and clover) the amount used is relatively small and restricted to the South Island. In the absence of verifiable information on horse intake we have assumed it to be approximately 3% (NZIER estimate).

Table 91 sets out the size of the dependent industries involved.

Table 91 Livestock industries that depend on lucerne

2012, June year, $M per annum

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Dairy values	$12,241.2 million	$585.4 million	$1,045.6 million	$12,573.7 million
Other livestock values	$5,039.0 million	6,701.9 million	$1.432.8 million	$4,607.4 million
Horse values	$93.5 million		$57.0 million	$130.0 million

Source: Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

[49] http://www.landcareresearch.co.nz/__data/assets/pdf_file/0005/77036/1_8_Millner.pdf

D.28.4 Summary

Table 92 sets out the GDP output share of lucerne to the New Zealand economy.

Table 92 Lucerne summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($1.1 million)	100%	0.39	$0.4 million
Farmgate sales ($11.9 million	100%	0.39	$4.7 million
Dependent livestock industries (refer to the Table above for livestock industry sales figures for each step in value chain)			
Farmgate Dairy sales ($12,241million)	0.2%	0.48	$11.8 million
Farmgate Other livestock sales ($5,039million)	0.2%	0.39	$3.9 million
Farmgate horses value ($93.5 million)	3.0%	0.24	$0.7 million
Domestic processing ($7,287million)	0.2%	0.25	$3.6 million
Domestic sales (processing and live) ($2,478.4 million)	0.2%	0.18	$0.9 million
Domestic sales horses ($57.0 million	3.0%	0.12	$0.2 million
Exports livestock ($19,455.8 million)	0.2%	0.48	$18.8 million
Exports horses ($130 million)	3.0%	0.2	0.8 million
Total GDP output share			**$45.6 million**[1]
Note (1) Numbers rounded.			

Source: BERL 2012, Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.29 Maize and corn (*Zea mays* varieties)

This analysis looks at both maize and corn (*Zea mays* varieties). In New Zealand, maize is used mainly for stock feed while corn is consumed domestically and exported. For maize we have followed Booker (2009, p10) and categorised maize into two subsectors: maize grain and maize silage. Maize grain uses only the grain content of the plant while maize silage uses the whole crop: stem, leaf and cob (including the grain). Figure 32 sets out the structure of the maize industry.

Corn has been a staple vegetable in New Zealand for many years. Corn production is centred on the east coast of the North and South Island. Information on the domestic values (seeds, farmgate value and processing) is scarce with much information tightly held.

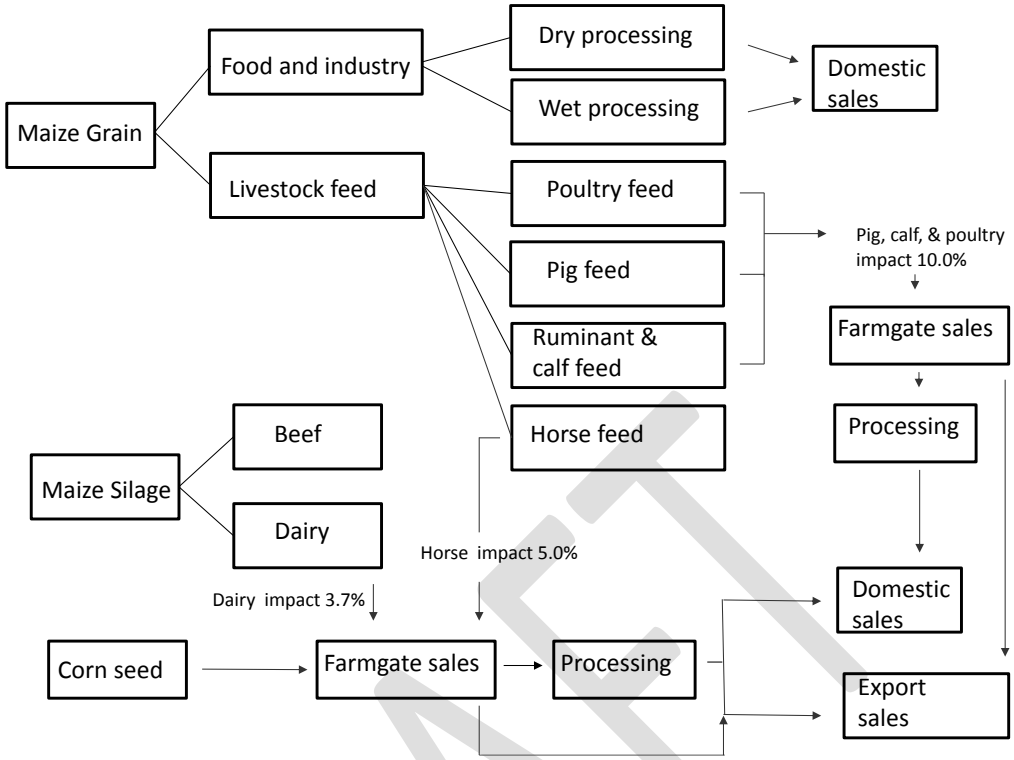
The maize silage industry is primarily focused on providing food energy for the dairy industry. Extra feed allows for higher stocking rates and production per hectare. Maize silage is harvested in early autumn when yields are maximised and can be fed as dry matter or a greenfield crop. Many dairy farmers grow their own maize silage.

Maize grain is a major feed component for layer birds (eggs), poultry and pig industries. The information for these domestic industries is hard to find. Therefore, estimates for the size of these industries have been taken from various reports and industry associations. While we are unable to verify the exact size of these industries we are confident that the magnitudes are right given that industry associations monitor the industries closely.

Maize grain typically undergoes wet or dry processing. Dry processed maize grain is used in the livestock, poultry, pig and ruminant feed sectors. Also a small amount goes into human consumption and is used as a basis for products such as flaking grits, fine grits, semolina, polenta and maize flour.

Wet processed maize grain is used in products such as starch. Other uses include stock feed, particularly in the dairy industry.

Figure 32 Structure of the maize industry



Source: Booker 2009, p10, Fresh Facts 2012 and Lefroy Valley Nurseries

D.29.1 Maize silage

Maize silage is an input into the livestock industry: mainly dairy (95%) and some beef (5%).[50]

Maize silage growth has occurred off the back of the expansion in the dairy industry. It provides supplementary feed so that farmers can maximise milk production at certain times of the year. According to Booker (2009, p35) maize silage is either grown by dairy farmers themselves or bought from other farmers. There are a number of benefits from purchasing or growing maize:

- it can extend lactation through autumn feeding improving profitability
- it can be stored easily reducing the risk of unfavourable weather i.e. a risk management tool to keep stock in good condition
- by growing maize in dairy effluent paddocks it can decrease the nutrient build-up on farms.[51]

Seed sector

Little information is available on seed production. Information on seed production is confidential.

[50] We have not included beef in this analysis since it is very difficult to approximate its value and impact to the whole beef sector.

[51] For more explanation, see for example http://www.farmlands.co.nz

Farmgate production

Table 93 sets out the estimated farmgate gross value of maize silage. The dairy industry uses approximately 922,000 tonnes of maize silage (AIMI 2012). It provides approximately 3.7% (in 2012) of the fodder requirements for the dairy industry (personal communication, Mr Matt Newman, DairyNZ, 18 May 2014). Therefore, the impact of maize on the dairy industry is deemed 3.7%.

For the horse industry, the impact has been estimated at 5% (NZIER estimate based on a qualitative description of horse intake needs in Gee (2012).

At $300 per tonne (Lincoln Financial Budget Manual 2012/2013, pA58; Booker 2009, p68) the approximate size of the industry is $277 million.

Table 93 Production of maize silage

2012, $ M

Production	Farmgate prices	Estimated value
922,000 tonnes	$300 per tonne	$277m

Source: Lincoln Financial Budget Manual, FAR and Statistics New Zealand

The value chain impacts for the dairy and horse industries are set out in the Table below using Beef + Lamb New Zealand's estimates (personal communication, Mr Rob Davison, 5 June 2014) of farmgate value, processing, domestic and export sales.

Table 94 Estimated dairy and horse value at each stage of the marketing chain

2012, $ M

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Dairy values[1]	$12,241.2 m	$585.4 m	$1,045.6 m	$12,573.7 m
Horse values	$93.5 m		$57.0 m	$130.0 m
Note (1) Dairy values set out in Appendix B.				

Source: Beef + Lamb New Zealand estimates and Statistics New Zealand, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

Table 95 sets out the summary of value for maize silage. In each case the value at the stage of production is multiplied by the impact on the industry and the GDP output share to obtain a value for maize silage to the economy.

Table 95 Maize silage summary

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Maize silage production			
Domestic seed production			Confidential
Farmgate value ($277 million)	100%	0.39	$107.9 million
Maize silage production as an input into the dairy industry			
Farmgate Dairy estimate ($12,241 million)	3.7%	0.48	$217.4 million
Dairy processing estimate ($585.4 million)	3.7%	0.25	$5.4 million
Dairy domestic sales estimate ($1,045.6 million)	3.7%	0.18	$7.0 million
Dairy export estimate ($12,573.7 million)	3.7%	0.48	$223.3m
GDP output share (total)			**$561.0m**
Notes (1) Values set out in Appendix B.			

Source: Booker 2009, Beef + Lamb New Zealand, DairyNZ, and Statistics New Zealand

D.29.2 Maize

Maize production services a domestic industry that produces animal feed and consumer products.

Seed sector

Little information is available on seed production. Information on seed production is confidential.

Farmgate production

According to FAR,[52] 226,840 tonnes (@ $400 per tonne)[53] was produced in the 2012 June year (see Table 96).

[52] http://www.far.org.nz/mm_uploads/AIMI_Maize_May_1_2012.pdf

[53] Lincoln Financial Budget Manual 2012/2013, pA58.

Table 96 Production of maize

2012, $ M

Production	Farmgate prices	Estimated value
226, 840 tonnes	$400 per tonne	$90.7m

Source: Lincoln Financial Budget Manual 2012/2013 and Statistics New Zealand

Wet and dry processes

Table 97 sets out what is known about the wet and dry processes used to process maize. A full description of these processes is set out in Booker (2009, p22-34).

Dry processes are focused on feed production for the egg, poultry and ruminant markets. There is also some human consumption of maize in food products. Wet processes remove the starch, fibre and gluten for various food types of human food products.

Table 97 Wet and dry process sector information

2012

Subsector	Maize consumed estimates (tonnes)[1]	Estimated impact on subsector[1]	Farmgate value of sector
Dry process			
Layer-hen feed[2]	30,000/35,000	10%	$148 million[3]
Poultry feed	15,000/20,000	10%	$1,000 million[3]
Pig feed	12,000	10%	$176 million[4]
Ruminant feed	80,000/ 85,000[6]	10%	$180 million[5]
Human consumption	20,000		Unknown
Horse feed	5,000/ 10,000	5%	$193.5 million
Wet process			
Human consumption & industrial uses	50,000		Unknown
Notes (1) All estimated tonnes and estimated impact on subsector are based on Booker (2009, p22-34) and adjusted for 2012. (2) Layer hens are focused on egg production. (3) pers comm, Mr Steven Kerr, Poultry Industry Association of New Zealand, 24 July 2014. (4) pers comm, Mr Ian Braugh, NZ Pork, 12 August 2014. (5) Double bobby calf export returns ($90m) per annum, Compendium of Farm Facts, 2013 Beef + Lamb New Zealand (6) pers comm, Mr Matt Newman, DairyNZ, 4 August 2014.			

Source: Lincoln Financial Budget Manual 2012/2013, Statistics New Zealand, Communications with New Zealand Pork and the Poultry industry Association of New Zealand, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

Farmgate

Farmgate value for the pork and poultry industries are estimates taken from industry publications and communications with New Zealand Pork, the Poultry Industry Association of New Zealand and Beef + Lamb New Zealand.

Table 98 Farmgate value

$ M, June year 2012

Sector	Estimated farmgate value ($m)	Impact of maize[1]	Value ($m)
Layer-hen feed[2]	$148.0 million	0.1	$37.0 million
Poultry feed[2]	$1,000.0 million	0.1	$60.0 million
Pig feed[3]	$176.6 million	0.1	$35.3 million
Ruminant feed[4]	$120.6 million	0.1	$12.1 million
Total livestock			**$144.4 million**
Horse feed	$93.5 million	0.05	$4.7 million
Notes: (1) Booker 2009, p22-34. (2) pers comm, Mr Steven Kerr, Poultry Industry Association of New Zealand, 24 July 2014 . (3) pers comm, Mr Ian Braugh, New Zealand Pork, 12 August 2014. (4) Double bobby calf export returns per annum less processing costs of $180m x33%. Compendium of Farm Facts, 2013 Beef + Lamb New Zealand and pers comm with Mr Rob Davison, 30 June 2014.			

Source: Beef + Lamb New Zealand, Poultry Industry Association of New Zealand, Booker 2009, New Zealand Pork, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

Processing

Processing margins are based on assumptions from other livestock such as beef and lamb (approximately 33%, personal communication, Mr Rob Davison, Beef + Lamb New Zealand, 30 July 2014) and are set out in the following table. The processing margin is an estimate for the value of the processing sector. The only exception is pork where we have been able to obtain accurate processing cost data (11.7%) from New Zealand Pork (personal communication, Mr Ian Braugh, 12 August 2014).

Table 99 Processing

$ M, June year 2012

Sector	Estimated processing value of each industry[2]	Impact of maize[1]	Industry values
Layer-hen feed	$189.4m x 33% = $62.5m	0.10	$6.3 million
Poultry feed	$1,280m x 33% = $422.4m	0.10	$42.2 million
Ruminant processing	$90.6m x 33% = $29.9m	0.10	$3.0 million
Pig feed[3]	$200m x 11.7% = $23.4m	0.10	$2.3 million
Estimated total value	**$508.3 million**		**$53.8 million**
Notes: (1) Booker (2009, p22-34) estimates. (2) Estimates are based on discussions with Mr Rob Davison Beef + Lamb New Zealand, 30 July 2014. (3) Processing costs for pigs is estimated by New Zealand Pork at 11.7% (pers comm, Mr Ian Braugh, 12 August 2014).			

Source: Beef + Lamb New Zealand, Poultry Industry Association of New Zealand, New Zealand Pork and Booker 2009

Domestic consumption

The domestic retail margin is estimated at approximately 28% of farmgate value (New Zealand Retail Association 2013, p16). Therefore, the total domestic sales value is the sum of each subsector value (farmgate value multiplied by impact of maize), plus an additional 28%. The calculations in are set out in the Table below.

Table 100 Domestic and export sales value

$ M, June 2012

Sector	Estimated value of retail sales[1]	Impact of maize	Value
Hen-layer feed	$148 million x 1.28 = $189 million	0.1	$18.9 million
Poultry growers	$1,000 million x 1.28 = $1,280 million	0.1	$128.0 million
Pigs	$176.6 million x 1.28 = $226.1 million	0.1	$22.6 million
Domestic livestock sales total	**$1,695.5 million**		**$169.6 million**
Domestic sales horses	$57.0 million	0.05	$2.9 million
Bobby calf sales[2]	$90.6 million	0.1	$9.1 million
Horse exports[3]	$130.0 million	0.05	$6.5 million
Note (1) New Zealand Retailers Association (2013, p16) suggests that retail margins are around 28%. (2) Bobby calf sales are international so don't attract a domestic retail mark-up. (3) IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101.			

Source: Beef + Lamb New Zealand, Poultry Industry Association of New Zealand, New Zealand Pork and Booker 2009

Maize grain summary

Table 101 sets out known values for maize production and value generated from industries that use maize grain as an input.

Table 101 Maize summary

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Maize production			
Domestic seed production			Confidential
Farmgate value ($90.7 m)	100%	0.39	$35.4 million
Maize dry production as an input into various industries			
Farmgate (pig and poultry) (($1,324.6 million)	10%	0.24	$31.8 million
Farmgate (calves) ($120.6 million)	10%	0.39	$4.7 million
Farmgate (horses) ($93.5 million)	5%	0.24	$1.1 million
Processing (pigs, poultry, and bobby calves) ($508.3 million)[1]	10%	0.68	$34.6 million
Processing (bobby calves) ($29.9m)	10%	0.25	$0.7 million
Domestic sales pig and poultry ($1,695.5m)[2]	10%	0.12	$20.3million
Domestic sales horses ($57 million)	5%	0.12	$0.3 million
International sales (calves) ($90.6 million)	10%	0.48	$4.4 million
International sales horses ($130 million)	5%	0.2	$1.3 million
Maize wet production as an input into various industries[3]			
Dry processes	Tonnes		
Human consumption	20,000		Unknown, small inputs into various industries. Value will be less than $3m[2]
Wet processes			
Human & industrial consumption	50,000		Unknown, small inputs into various industries. Value will be less than $7m[2]
Total including wet and dry processing impact estimates			**$144.7 million**
Notes (1) The $508.3 is the sum of the poultry layer, poultry and pig industries. (2) The $169.4m is the sum of the poultry layer, poultry and pig industries. (3) The markets for these products are many and varied. A quick calculation illustrates the likely magnitude of the value: 70,000 tonnes (consumed in these markets) divided by total farmgate crop 226,000 tonnes = 31%. 31% of the farmgate figure of $84.5m = $26.1m. Processing is unlikely to cost more than 33% of the farmgate value $26.1m x 0.33 = $8.6m. The output share is likely to be $8.6m x 25% (the processing GDP output share estimated from the Input-output tables) = $2m. A similar calculation could also be made for domestic sales. This will produce a higher number but be unlikely to be more than $8m.			

Source: Booker 2009, Beef + Lamb New Zealand, DairyNZ, Poultry Industry Association of New Zealand, New Zealand Pork, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.29.3 Corn

We had difficulty in obtaining data on the domestic value chain associated with corn. Therefore we have relied on industry experts and a rule of thumb approach suggested by Horticulture New Zealand. These give approximate values.

Seeds

Most seeds are imported. A very small amount of seed is grown in New Zealand (approximately 5%). Approximately $0.01 worth of corn seed is grown locally (personal communication, Warren Hobson, Lefroy Valley, 13 March 2015).

Farmgate vales

The estimated farmgate value is based on tonnes produced (82,000 tonnes, Fresh Facts 2012 p16) multiplied by a per tonne price ($225 for 2009, Lincoln Financial Budget Manual 2012/13, pA77) equalling $18.5 million.

Processing values

Processing values are tightly held by companies. Also they find it difficult to separate out corn processing from the processing of other crops since many of the processing facilities are processing multiple crops.

Table 102 Corn processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated corn processing value	$62.0 million	0.25	$15.5 million

Source: Fresh Facts and Horticulture New Zealand

Domestic values

Fresh Facts (2012, p16) estimate domestic production at $20.0 million in 2012.

Export values

Fresh Facts (2012, p16) estimates that export values were $42.0 million in 2012.

Summary of corn values

Table 103 sets out the GDP output share of corn to the New Zealand economy.

Table 103 Corn summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.01 million)	100%	0.39	$0.003 million
Farmgate ($18.5 million)	100%	0.39	$7.2 million
Processing ($15.5 million)	100%	0.32	$5.0 million
Domestic sales ($20.0 million)	100%	0.18	$3.6 million
Exports ($42.0 million)	100%	0.45	$18.9 million
Total GDP output share			**$34.7 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012, Lincoln Financial Budget Manual 2012/13, Horticulture New Zealand and Lefroy Valley nurseries

D.29.4 Summary of maize silage and maize grain

Table 104 sets out the GDP output share for the maize silage and maize grain industries. As the project progresses we will also add corn to the estimated value.

Table 104 Summary of corn, maize silage and maize grain

Industries	Estimated value
Corn	34.7 million
Maize silage	$561.0 million
Maize grain	$144.7 million
Total	**$740.4 million[1]**
Note (1) Numbers rounded.	

Source: NZIER

D.30 Nuts (diverse species)

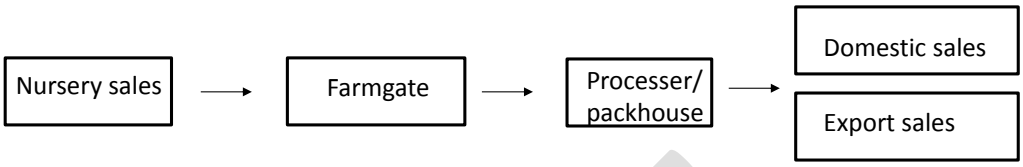
The New Zealand nut industry comprises chestnuts (*Castanea* spp.; Fagaceae family), cashews (*Anacardium occidentale*; Anacardiaceae family), macadamias (*Macadamia* spp.; Protaceae family), walnuts (*Juglans* spp.; Juglandaceae family) and hazelnuts (*Corylus avellana;* Corylaceae family). The domestic nature of the industry means that we have only industry opinion on the size and value of the industry.

Most of the industry is based around hobby farmers in the Waikato and Bay of Plenty. New plantings have been established in Northland, Wairarapa, Horowhenua, and Canterbury.

Information on industry size is scarce with the only reliable information on export data. To estimate farmgate values we have taken the hectares planted and applied conservative yields and dollars per tonne to arrive at an approximation of farmgate values. Other values are generated from these estimates.

The nut industry value chain is set out below.

Figure 33 Nut value chain



Source: NZIER

D.30.1 Trees/root stock production

It can take up to 8 years before a tree goes into full production. The numbers of trees being sold to growers is relatively small under $0.1 million per annum.

D.30.2 Farmgate

Fresh Facts (2012, p25) estimate that the planted area for nuts is 1,484 hectares in 2012. While yields vary between various nut varieties, volumes are expected to be approximately 2,400 tonnes. Multiplying the tonnes by a conservative $3,000 per tonne farmgate returns are likely to be $7.2 million.

D.30.3 Processing

Most nuts are sold to processes. If we assume that processing is 25% of the domestic and export sales then the value is approximately $3.6 million (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

D.30.4 Domestic sales

With farmgate revenues expected to be close to $7.2 million, domestic sales value is estimated to be twice the farmgate values less export sales equalling $7.3 million.[54]

D.30.5 Export sales

Fresh Facts (2012, p14-15) estimates nut exports at $1.3 million plus a further $5.8 million in processed exports.

D.30.6 Summary

Table 105 sets out the GDP output share of nuts to the New Zealand economy.

[54] Typically we expect farmgate sales to be a half of export plus domestic sales. Therefore, domestic sales are twice farmgate values less export sales (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Table 105 Nuts summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.1 million)	100%	0.39	$0.04 million
Farmgate ($7.2 million)	100%	0.39	$2.8 million
Processing value ($3.6 million)	100%	0.32	$1.2 million
Domestic sales ($7.3 million)	100%	0.18	$1.3 million
Exports (7.1 million)	100%	0.45	$3.2 million
Total GDP output share			**$8.5 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and NZIER estimates

D.31 Oats (*Avena sativa*)

The market for oats (*Avena sativa*) divides into oats for human consumption and forage oats.

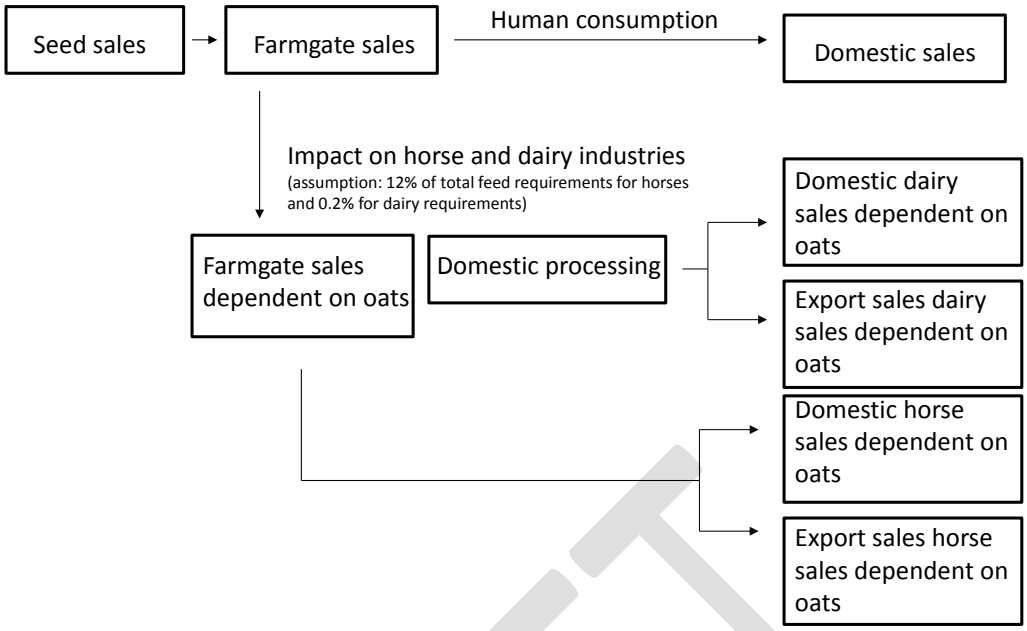
Milled oats are consumed as breakfast cereals and used as cooking ingredients.

Forage oats provide a large amount of feed for a single grazing during winter. They can be planted in February for early-winter grazing, through to April/May in mild climates for late-winter grazing.

Relatively good information is available on oat production and prices therefore good approximations are available on seed and farmgate returns. We have assumed that horse racing is the most important dependent industry.

The value chain is set out below.

Figure 34 Oats value chain



Source: NZIER

D.31.1 Oat seed production

Oat seed production is estimated at $0.8 million in 2012. This is based on total production of 1,600 tonnes (Hampton et al 2012, p131) multiplied by $460 per tonne (Lincoln Financial Budget Manual 2012/2013, pA55) plus a premium for seed of $30 per tonne (NZIER estimate).

D.31.2 Farmgate

Farmgate values are based on FAR estimates (AIMI 2013) of 15,834 tonnes for milling wheat and 2,466 tonnes of forage oats in 2012 both at a price per tonne of $460 per tonne ($8.4 million at the farmgate in 2012).

D.31.3 Dependent industries

a) Human consumption

Little is known about the value of oat processing for human consumption. There are a variety of channels and processes undertaken with the information on costs being closely guarded by the manufactures. It is likely that the processing value is at least 25% of the domestic sales: $14.6 million multiplied by 0.25 equalling $3.6 million (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Domestic sales are estimated at twice the farmgate values ($7.3 million multiplied by 2 equalling $14.6 million).

We have little information on the contribution of oats to the processes. However, the products produced from oats are an integral part of products. We have assumed a 100% contribution.

b) Forage oats

Forage oats value stems from their use in the horse and horse racing industries, although in recent years some (an indeterminate amount) has entered the dairy industry. Approximately 15% of the protein consumed in the horse racing industry is in the form of forage oats.[55] Oats contribution to the racing industry is calculated in the following way:

- the farmgate value of racing in New Zealand is valued at $93.5 million (IER Pty Ltd 2010, p9)
- domestic sales of race horses was $57 million in 2010 (IER Pty Ltd 2010, p9)
- the exports of race horses sales was estimated at $167 million (IER Pty Ltd 2010, p9).

Oats are also used in the dairy industry, although the amount is very small: approximately 0.2% (personal communication, Matthew Newman, DairyNZ, 24 February 2015).

The livestock industries dependent on oats are set out in Table 106.

Table 106 Livestock industries that depend on oats

2012, June year, $ M per annum

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Dairy values	$12,241.2 million	$585.4 million	$1,045.6 million	$12,573.7 million
Horse values	$93.5 million		$57.0 million	$130.0 million
Note (1) See Appendix B for value estimates.				

Source: Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

[55] See the following article for a discussion on feeding race horses. http://www.thehorse.com/articles/10331/feeding-racehorses

D.31.4 Summary

Table 107 sets out the GDP output share of oats to the New Zealand economy.

Table 107 Oats summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.784 million)	100%	0.39	$0.3 million
Farmgate ($8.4 million)	100%	0.39	$3.3 million
Dependent industry (human consumption)			
Processing ($3.6 million)	100%	0.25	$0.9 million
Domestic sales ($14.6 million)	100%	0.18	$ 2.6 million
Dependent industry (horse racing)			
Farmgate sales ($93.5 million)	12%	0.24	$2.7 million
Domestic sales ($57.0 million)	12%	0.18	$0.8 million
Exports (130.0 million)	12%	0.45	$3.1 million
Dependent industry (dairy)[2]			
Farmgate ($12,241.2 million)	0.2%	0.48	$11.8 million
Processing ($585.4 million)	0.2%	0.25	$0.3 million
Domestic sales ($1,045.6 million)	0.2%	0.18	$0.4 million
Export sales (12,573.7 million)	0.2%	0.48	$12.0 million
Total GDP output share			**$38.3 million[1]**
Note (1) Numbers rounded. (2) See Appendix B for value estimates			

Source: Fresh Facts 2012 and NZIER estimates

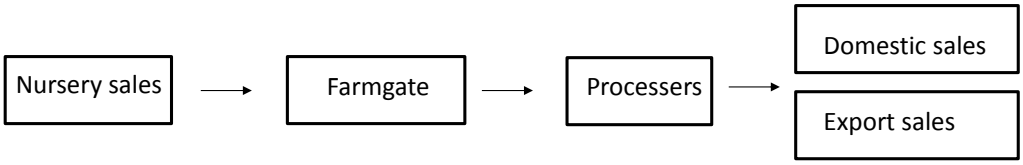
D.32 Olives (*Olea europaea*)

Olive (*Olea europaea*) production in New Zealand began in the 1990s with strong interest particularly in the Marlborough area. While other areas joined in prices received did not meet the expectations of growers and production declined in recent years.

There is little concrete data on domestic production but most olives are pressed into olive oil for the domestic market and a small amount for export.

The value chain is set out below.

Figure 35 Olive value chain



Source: NZIER

D.32.1 Nursery production

Nursery production is estimated at $0.03 million in 2012: 3,000 trees multiplied by $10 per tree (personal communication, Kate Marshall, Waimea Nurseries, 13 March 2015).

D.32.2 Farmgate

We have no estimates available on farmgate values. Therefore, to proxy a farmgate estimate we follow Horticulture New Zealand's rule of thumb estimate of dividing domestic sales plus export sales by two.

Table 108 Olive farmgate value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated olive farmgate value	$2.8 million	0.5	$1.4 million

Source: Fresh Facts and Horticulture New Zealand

D.32.3 Processing

The companies in the industry tightly hold processing value information. We have used domestic and export sales multiplied by 25% to estimate the size of the processing industry.

Table 109 Estimated olive processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated olive processing value	$2.8 million	0.25	$0.7 million

Source: Fresh Facts and Horticulture New Zealand

D.32.4 Domestic sales

Domestic sales are estimated at $2.3 million (Fresh Facts 2012, p15).

D.32.5 Export sales

Export sales are estimated at $0.5 million (Fresh Facts 2012, p15).

D.32.6 Summary

Table 24 sets out the GDP output share of olives to the New Zealand economy.

Table 110 Olives summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.03 million)	100%	0.39	$0.01 million
Farmgate ($1.4 million)	100%	0.39	$0.6 million
Processing value ($0.7 million)	100%	0.32	$0.2 million
Domestic sales ($2.3 million)	100%	0.18	$0.4 million
Exports (0.5 million)	100%	0.45	$0.2 million
Total GDP output share			**$1.4 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and NZIER estimates

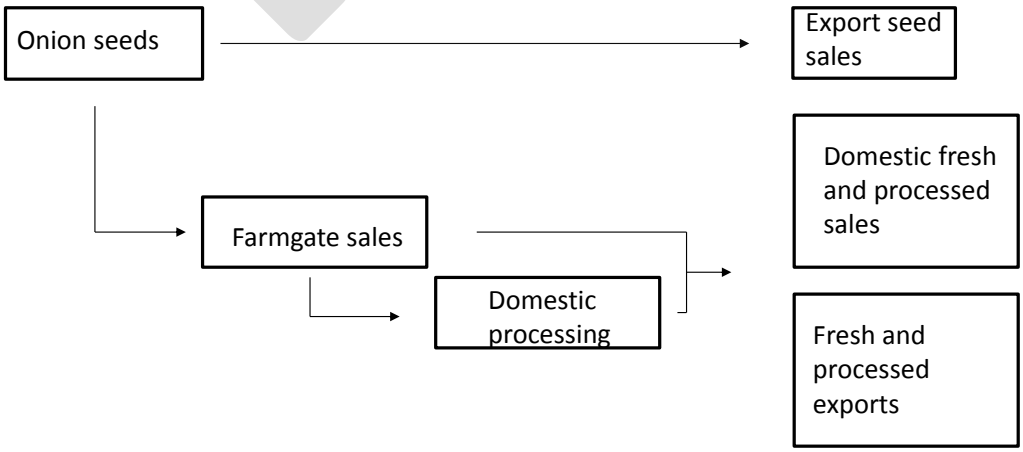
D.33 Onions (*Allium cepa*)

Onions (*Allium cepa*) are mainly grown in the South Auckland region, Hawke's Bay, Manawatu-Horwhenua, and Canterbury. Unlike most horticultural products onions store well; therefore cheaper sea-freight options are available for the export crop. Therefore European markets are within easy reach of onion growers.

Good information is available on domestic sales, exports and seeds. Also good information is available about the small processing sector. Farmgate value has been approximated since we have no official figures.

Below we set out the value chain for onions.

Figure 36 Onion value chain



Source: NZIER

D.33.1 Seed production

Total seed production is reported by Hampton et al (2012, p131) to be $2.6 million.

D.33.2 Farmgate

Farmgate sales are estimated at $29.0 million. We have no official estimates available on farmgate values, therefore to proxy a farmgate estimate we follow Horticulture New Zealand's rule of thumb estimate of dividing domestic sales plus export sales by two.

Table 111 Onion farmgate value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated olive farmgate value	$87.1 million	0.5	$43.6 million

Source: Fresh Facts and Horticulture New Zealand

D.33.3 Processing

Processing of onions is relatively small. The estimates are based on the area planted for processing: domestic plus export sales multiplied by 1.3% equals $1.1 million (data provided Matthew Spence, Horticulture New Zealand, 18 December 2015).

D.33.4 Domestic sales

Domestic sales are estimated at $25.0 million (Fresh Facts 2012, p16).

D.33.5 Export sales

Export sales are estimated at $62.2 million (Fresh Facts 2012, p16).

D.33.6 Summary

Table 112 sets out the GDP output share of onions to the New Zealand economy.

Table 112 Onions summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($2.6 million)	100%	0.39	$1.0 million
Farmgate ($43.6 million)	100%	0.39	$17.0 million
Processing value ($1.1 million)	100%	0.32	$0.4 million
Domestic sales ($25.0 million)	100%	0.18	$4.5 million
Exports (62.1 million)	100%	0.45	$27.9 million
Total GDP output share			**$50.8 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and NZIER estimates

D.34 Orchids (*Orchidaceae*)

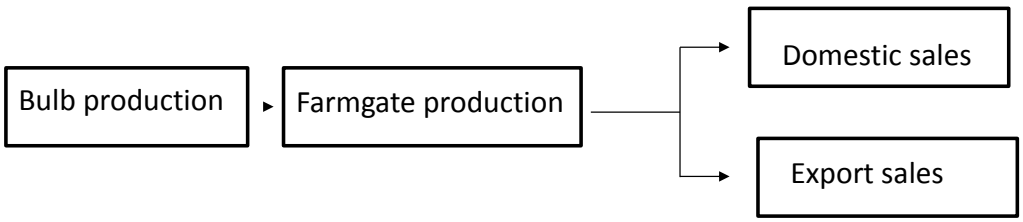
There are a range of different orchids grown commercially in New Zealand; they are species from the family *Orchidaceae*. Orchids) are a highly capital intensive glasshouse business with most operations vertically integrated.

The domestic market while important is not the main target market. The aim is to take advantage of the European off-season sending cut flowers and bulbs into Asian and European markets.

Apart from the value of exports, we do not have very good information on other parts of the value chain and rely on industry experts to provide information on the magnitude of these markets.

The value chain is set out below.

Figure 37 Orchid value chain



Source: NZIER

D.34.1 Bulb production

We have no official information on orchid bulb production. As with other flower production, businesses are vertically integrated. Bulbs for the next season are produced at the same time as this year's production and scaled and multiplied up.

The approximate cost or "best guess" of the value of this process is approximately $0.1 million (personal communication, Andre der Kwaak, GM FloraMax, 2014, 28 November 2014 and NZIER estimates).

D.34.2 Farmgate

Farmgate estimates are also hard to estimate for the same reason. The best guess by the industry is approximately $10.8 million (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014). Further the sales channels are numerous with each channel having a different pricing strategy e.g. supermarkets, agents, buyers buying direct etc. This complicates estimating the farmgate returns.

D.34.3 Domestic sales

Domestic sales are estimated at $3.0 million. This is a highly approximate figure based on 60 million flowers sold at 0.05 cents per flower (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014).

D.34.4 Export sales

Fresh Facts (2012, p20) estimates the export sales of orchids as $18.5 million.

D.34.5 Summary

Table 113 sets out the GDP output share of orchids to the New Zealand economy.

Table 113 Orchids summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.1 million)	100%	0.39	$0.04
Farmgate ($10.8 million)	100%	0.39	$4.2 million
Domestic sales ($3.0 million)	100%	0.18	$0.5 million
Exports (18.5 million)	100%	0.45	$8.9 million
Total GDP output share			**$13.6 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012, FloraMax

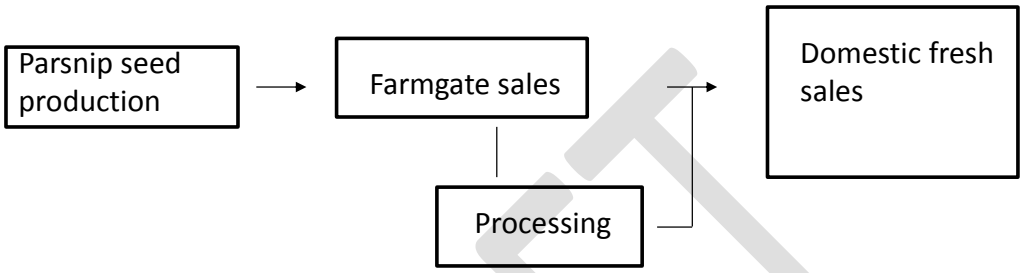
D.35 Parsnips (*Pastinaca sativa*)

Parsnips (*Pastinaca sativa*) are a small domestic industry mainly grown in Pukekohe and Ohakune.

The domestic nature of the business means that information is scarce with consumption data used to calculate the size of the domestic market and other parts of the value chain approximated from domestic market data.

Below we set out the value chain for parsnips.

Figure 38 Parsnip value chain



Source: NZIER

D.35.1 Seed production

The parsnip seed industry is very small, most seed is imported. However there are some lines of parsnip grown in New Zealand but no more than 0.02 million (personal communication, Warren Hobson, Lefroy Valley, 4 March 2015).

D.35.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries that farmgate prices are approximately a half of domestic sales. Domestic sales of parsnips were approximately $4.5 million (unpublished data supporting Fresh Facts 2012, p24 and personal communication, Alastair Aitken, Martech, 13 February 2015).

Table 114 Parsnips value at farmgate

	Domestic sales	Adjustment factor	Farmgate value estimate
Parsnips farmgate value	$4.5 million	0.5	$2.3 million

Source: NZIER, and Horticulture New Zealand

D.35.3 Processing

Horticulture New Zealand advise that there was very little processing of parsnips in New Zealand. Possibly $0.1 million (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

D.35.4 Domestic sales

New Zealand consumers bought approximately $4.5 million worth of parsnips in 2012 (unpublished data supporting Fresh Facts 2012, p24 and personal communication, Alastair Aitken, Martech, 13 February 2015).

D.35.5 Summary

Table 115 sets out the GDP output share of parsnips to the New Zealand economy.

Table 115 Parsnips summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($0.02 million)	100%	0.39	$0.009 million
Farmgate sales ($2.3 million)	100%	0.39	$0.9 million
Domestic processing ($0.1 million)	100%	0.32	$.032 million
Domestic sales ($4.5 million)	100%	0.45	$0.8 million
Total GDP output share			**$1.7 million**[1]
Note (1) numbers rounded.			

Source: Statistics New Zealand and Fresh Facts 2012

D.36 Passionfruit (*Passiflora edulis*)

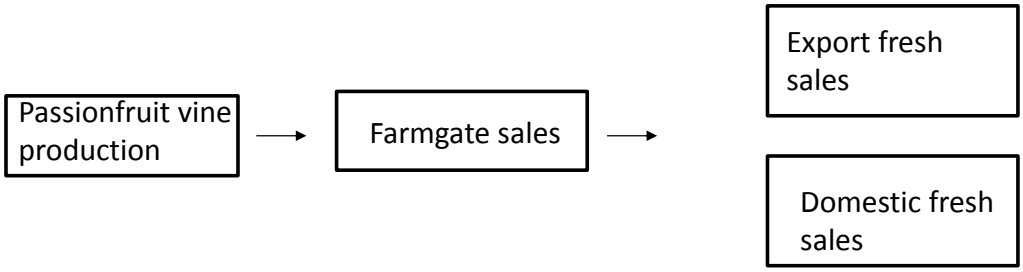
Passionfruit (*Passiflora edulis*) was first grown in Kerikeri in 1927. Only 17 hectares of passionfruit are grown in New Zealand with 65 growers, down from 66 hectares a few years ago. The main reason for this is crown rot which has devastated up to 80% of the crop each year.

Most product is sold into the domestic market, with 25% exported.

Being a small industry we have good data on domestic and export sales but other parts of the value chain have been estimated by industry experts.

The value chain is set out below.

Figure 39 Passionfruit value chain



Source: NZIER

D.36.1 Vines sold

It is difficult to estimate the number of vines sold to growers because of the impact of the crown rot disease. The New Zealand Passionfruit Growers Association advise that the number of vines sold to growers are unknown. Their preliminary estimate is that 8,000 vines have been lost due to the crown rot disease. If those vines were replaced (at a cost of $2.70 per vine), this would equate to a value of approximately $0.03 million.

D.36.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries that farmgate prices are approximately half of domestic plus export sales. Domestic sales of passionfruit were approximately $1.3 million and export sales were $0.3 million (Fresh Facts 2012, p14).

Table 116 Passionfruit value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Passionfruit farmgate value	$1.6 million	0.5	$0.8 million

Source: NZIER and Horticulture New Zealand

D.36.3 Processing

Horticulture New Zealand advise that there was very little processing of passionfruit (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

D.36.4 Domestic sales

New Zealand consumers bought approximately $1.3 million worth of passionfruit in 2012 (Fresh Facts 2012, p14).

D.36.5 Export sales

Exports of passionfruit were $0.3 million in 2012.

D.36.6 Summary

The following table sets out the GDP output share of passionfruit to the New Zealand economy.

Table 117 Passionfruit summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($0.03 million)	100%	0.39	$0.01
Farmgate sales ($0.8 million)	100%	0.39	$0.3 million
Domestic sales ($1.3 million)	100%	0.18	$0.2 million
Export sales ($0.3 million)	100%	0.45	$0.1 million
Total GDP output share			**$0.7 million**[1]
Note (1) numbers rounded.			

Source: Statistics New Zealand and Fresh Facts 2012

D.37 Pears (*Pyrus* species)

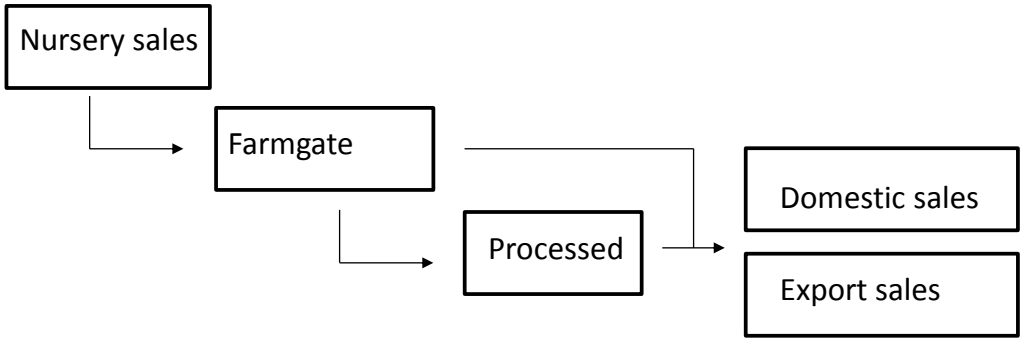
This analysis includes both the common pear (*Pyrus communis*) and Nashi pear (*Pyrus pyrifolia*). The first common pear tree was planted in New Zealand in 1819 by Samuel Marsden. Since that time pear production has been a small but constant orchard industry in New Zealand.

The traditional areas for growing pears have been Hawke's Bay and Nelson.

Approximately 400 hectares are planted in pears. In the mid-1980s, Nashi pears were introduced into New Zealand and there has been steady growth in volumes.

The value chain for pears is set out below.

Figure 40 Pear value chain



Source: NZIER

D.37.1 Trees/root stock production

Pear trees supplied to growers are approximately $0.4 million (personal communication, Kate Marshall, Waimea Nurseries, 12 December 2014).

D.37.2 Farmgate

Farmgate value is based on 14,700 tonnes (USDA 2013) multiplied by 210 per tonne (in line with farmgate tray equivalent prices of $5.40, Lincoln Financial Budget Manual 2012/2013, pA72) equals $3.8 million (personal communication, David Lee-Jones, US Embassy, 16 October 2014).

D.37.3 Processing

Processing value is based on the number of apples grown for processing (3,000 tonnes (USD 2013)) multiplied by the price per tonne ($210, (in line with farmgate tray equivalent prices of $5.40), Lincoln Financial Budget Manual 2012/2013, pA72) equalling $0.6 million.

D.37.4 Domestic sales

Domestic sales were approximately 7,000 tonnes (personal communication, David Lee-Jones, US Embassy, 16 October 2014) multiplied by a per tonne price of $245 per tonne (approximately 20% of the export price in line with apples) equals $3.2 million.

D.37.5 Export sales

Pear exports, including nashi pears (*Pyrus pyrifolia*)] and processed pears is valued at $5.5 million (Fresh Facts 2012, p14-15).

D.37.6 Summary

Below we set out the contribution of pears to the New Zealand economy.

Table 118 Pear summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.4 million)	100%	0.39	$0.2 million
Farmgate ($3.8 million)	100%	0.39	$1.5 million
Processing value ($0.6 million	100%	0.32	$0.2 million
Domestic sales ($3.2 million)	100%	0.18	$0.6 million
Exports (5.5 million)	100%	0.45	$2.5 million
Total GDP output share			**$4.9 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012, USDA 2013 and Lincoln Financial Budget Manual 2012/2013

D.38 Peas (*Pisum sativum*)

Pea (*Pisum sativum*) production in New Zealand began in the 19th century with European settlement.

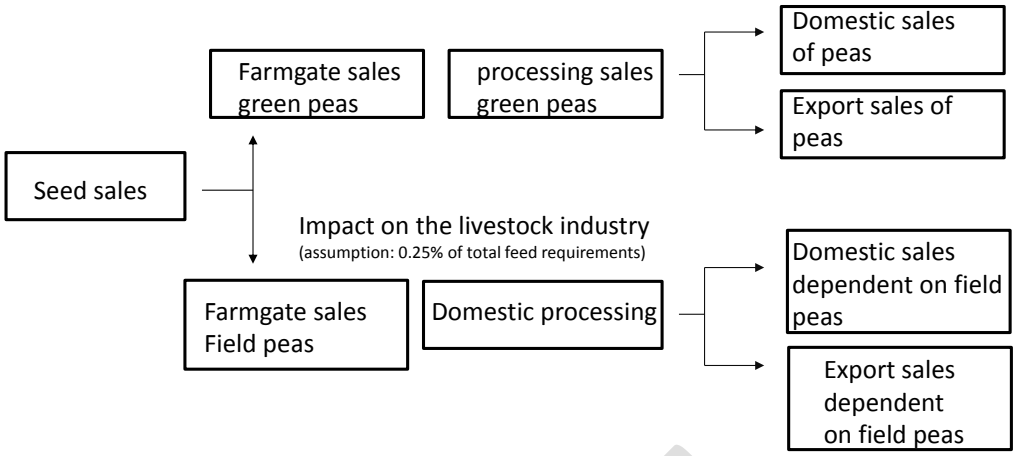
Garden peas are annual cool weather vegetable plants cultivated for their edible green seed or pods. They are harvested at an immature stage to be eaten fresh, canned, and frozen or for processing. Field peas are use as protein supplements in the pig and poultry industries.

Peas play an important role in horticulture because they have a high protein content, atmospheric N fixation, control grassy weeds and disrupt cereal disease life cycles.

Relatively good information exists on seed sales, farmgate volumes and prices, domestic sales and export sales. Processing values have been estimated.

Below we set out the pea value chain.

Figure 41 Pea value chain



Source: NZIER

D.38.1 Pea seeds

Pea seed sales are estimated at $23.9 million (BERL 2012, p14).

Field pea seed sales are unknown however an approximate estimate at 1% of farmgate value is $0.12 million.

Total seed sales are approximately $24.0 million.

D.38.2 Farmgate

Farmgate values are calculated in Table 119, based on Fresh Facts volume estimates and Lincoln Financial Budget Manual prices.

Table 119 Pea value at farmgate

	Volumes	Prices[3]	Farmgate value estimate
Pea farmgate value	63,000 tonnes[1]	$1,000 per tonne	$63.0 million
Field pea farmgate value	20,148 tonnes[2]	$600	$12.1 million
Notes (1) Fresh Facts 2012, p16. (2) AIMI 2013. (3) Lincoln Financial Budget Manual 2012/2013, pA56 and pA75.			

Source: NZIER and Horticulture New Zealand

D.38.3 Processing

Processing values are tightly held by processing companies.

To give an approximation we have used domestic and export sales multiplied by 25% to estimate the size of the processing industry.

Table 120 Estimated pea processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated pea processing value	$155.3 million	0.25	$38.8 million

Source: Fresh Facts and Horticulture New Zealand

D.38.4 Domestic sales

Domestic sales are made up of domestic pea sales ($50.0 million, Fresh Facts 2012, p16) plus estimates of field pea sales ($21.8 million, twice the farmgate value of field peas).

D.38.5 Export sales

Export sales of $83.5 million (Fresh Facts 2012, p16).

D.38.6 Dependent industries

Field peas contribute to the poultry, horse, and pig industries.

Pigs and poultry

For pigs and poultry, we have estimated that 2,400 tonnes out a total of 991,027 tonnes consumed by these industries or 0.24% of total protein (New Zealand Feed Manufacturers Association 2015).

Farmgate value for the pork and poultry industries are estimates taken from industry publications and communications with the New Zealand Pork, and the Poultry Industry Association of New Zealand.

Table 121 Farmgate value

$ M, June year 2012

Sector	Est. farmgate value ($m)	Impact of field peas[1]	Value ($m)
Layer-hen feed[2]	$148.0 million	0.24%	$0.4 million
Poultry feed[2]	$1,000.0 million	0.24%	$2.4 million
Pig feed[3]	$176.6 million	0.24%	$0.4 million
Total	**$1,324.6 million**		**$3.2 million**
Notes: (1) NZ Feed Manufacturers Association 2015. (2) pers comm, Mr Steven Kerr, Poultry Industry Association of New Zealand, 24 July 2014. (3) pers comm, Mr Ian Braugh, New Zealand Pork, 12 August 2014.			

Source: Poultry Industry Association of New Zealand, NZ Feed Manufacturers Association and New Zealand Pork

Processing

Processing margins (33%) are based on assumptions from other livestock industries such as Beef + Lamb New Zealand and Horticulture New Zealand (personal communications, Mr Rob Davison, Beef + Lamb New Zealand, 30 July 2014 and John Seymour, Horticulture New Zealand, 12 December 2014) and are set out in Table 122.

The processing margin is an estimate for the value of the processing sector. The only exception is pork where we have been able to obtain accurate processing cost data (11.7%) from New Zealand Pork (personal communication, Mr Ian Braugh, 12 August 2014).

Table 122 Pea processing

$ M, June year 2012

Sector	Estimated processing value of each industry[2]	Impact of field peas[1]	Industry values
Layer-hen feed	$189.4m x 33% = $62.5m	0.24%	$0.2 million
Poultry feed	$1,280m x 33% = $422.4m	0.24%	$1.0 million
Pig feed[3]	$200m x 11.7% = $23.4m	0.24%	$0.06 million
Estimated total value	**$508. 3 million**		**$1.2 million**
Notes: (1) NZ Feed Manufacturers Association (2015). (2) Estimates are based on discussions with Mr Rob Davison, Beef + Lamb New Zealand, 30 July 2014. (3) Processing costs for pigs is estimated by New Zealand Pork at 11.7% (pers comm, Mr Ian Braugh, 12 August 2014).			

Source: Beef + Lamb New Zealand, Poultry Industry Association of New Zealand and New Zealand Pork

Domestic consumption

The domestic retail margin is estimated at approximately 128% of farmgate value (New Zealand Retailers Association 2013). Therefore, the total domestic sales value is the sum of each subsector value (farmgate value multiplied by impact of barley), plus an additional 28%.

Table 123 Domestic sales value

$ M, June 2012

Sector	Estimated value of retail sales[1]	Impact of field peas	Value
Hen-layer feed	$148m x 1.28 = $189m	0.24%	$0.5 million
Poultry growers	$1,000m x 1.28 = $1,280m	0.24%	$3.1 million
Pigs	$226.6m x 1.28 =	0.24%	$0.6 million
Total	**$1,695.5 million**		**$4.1 million[2]**
Note (1) New Zealand Retailers Association (2013, p16) suggests that meat retail margins are around 28%. (2) Numbers rounded.			

Horses

Field peas are used as feed for horses to supplement their diet. They are a good source of protein for horses. Small amounts are often combined with other feeds. We have assumed that field peas make up 0.25% of a horses diet (based on Gee 2012).

Horses contribute at the farmgate, domestic live sales of horses and live exports of horses. The contributions are set out in Table 37.

Table 124 Dependent industry contribution (horses)

Sector	Value of each sector	Dependence
Farmgate sales	$93.5 million	0.25%
Domestic sales	$57.0 million	0.25%
Exports	$130 million	0.25%

Source: IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.38.7 Summary of pea consumption

Table 125 sets out known values for pea production and value generated from industries that use field peas as an input.

Table 125 Pea summary

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Pea production			
Domestic seed production ($24.0 million)	100%	0.39	$9.4 million
Farmgate value ($75.1 million)	100%	0.39	$29.3 million
Processing value ($38.8 million)	100%	0.32	$12.4 million
Domestic sales ($82.6 million)	100%	0.18	$14.9 million
Exports sales ($83.5 million)	100%	0.45	$37.6 million
Field Pea production as an input into various dependent industries			
Farmgate (pig and poultry livestock, $1,324.6 million)	0.24%	0.24	$0.8 million
Processing (pig and poultry livestock, $508.3 million)	0.24%	0.68	$0.8 million
Domestic sales (pig and poultry livestock, $1,695.5 million)	0.24%	0.12	$0.5 million
Farmgate (horses, $93.5 million)	0.25%	0.24	$0.06 million
Domestic sales (horses, $57 million)	0.25%	0.12	$0.02 million
Export sales (horses, $130.1 million)	0.25%	0.20	$0.07 million
Total			**103.8 million**

Source: Beef + Lamb, DairyNZ, Poultry Industry Association of New Zealand and New Zealand Pork

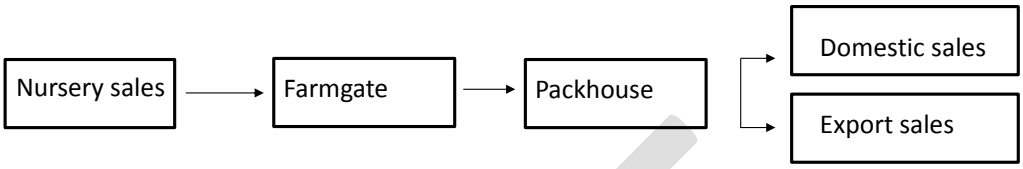
D.39 Persimmons (*Diospyros kaki*)

Persimmons (*Diospyros kaki*) were introduced into New Zealand as a commercial crop in the 1980s. The main growing regions are Northland, Auckland, Waikato and Gisborne.

Good information exists on domestic, export, farmgate and tree sales to orchards. There is little or no processing.

The value chain for persimmons is set out below.

Figure 42 Persimmon value chain



Source: NZIER

D.39.1 Trees/root stock production

The number of persimmon trees sold to growers is approximately $0.8 million (personal communications, Kate Marshall, Waimea Nurseries, 16 May 2014 and Athol Campbell, Riversun Nurseries, 16 May 2014).

D.39.2 Farmgate

The farmgate estimates are $7.8 million (personal communication, Ian Turk, New Zealand Persimmon Industry Council, 16 May 2014) and the New Zealand Persimmon Industry Council.

D.39.3 Domestic sales

Domestic value is estimated at $4.0 million (Fresh Facts 2012, p14).

D.39.4 Export sales

Export sales in 2012 were $7.1 million (Fresh Facts 2012, p14).

D.39.5 Summary

Table 126 sets out persimmon's contribution to the economy.

Table 126 Persimmon summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.8 million)	100%	0.39	$0.3 million
Farmgate ($7.8 million)	100%	0.39	$2.5 million
Domestic sales ($4.0 million)	100%	0.18	$0.7 million
Exports (7.1 million)	100%	0.45	$3.2 million
Total GDP output share			**$6.7 million**[1]
Note (1) Numbers rounded.			

Source: Fresh Facts 2012, New Zealand Persimmon Industry Council

D.40 Potatoes (*Solanum tuberosum*)

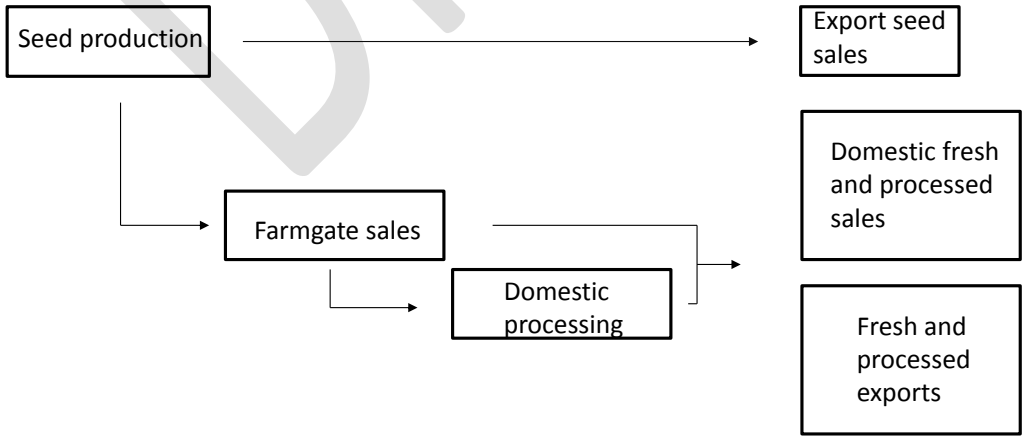
Potato (*Solanum tuberosum*) production has grown over the last ten years benefiting from increased export sales to Australia. However, most production is focused on the domestic market.

South Auckland and Canterbury are the main growing areas.

Good information is available on most aspects of the value chain, although processing data is tightly held by companies.

Below we set out the value chain for potatoes.

Figure 43 Potato value chain



Source: NZIER

D.40.1 Seed potatoes

The value of seed potatoes is approximately $11.5 million (based on tonnes grown or 8% of total value).[56]

D.40.2 Farmgate

Total farmgate value is estimated at $142 million.[57]

D.40.3 Processing

Processing values are tightly held by processing companies.

To give an approximation we have used domestic and export sales multiplied by 25% to estimate the size of the processing industry.

Table 127 Estimated potatoes processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated potatoes processing value	$568.4 million	0.25	$117.5 million

Source: Fresh Facts and Horticulture New Zealand

D.40.4 Domestic sales

Domestic sales are estimated at $451.0 million (Fresh Facts 2012, p16).

D.40.5 Export sales

Export sales are estimated at $117.5 million (Fresh Facts 2012, p16).

D.40.6 Summary

Table 128 sets out the contribution of potatoes to the New Zealand economy.

56 http://www.potatoesnz.co.nz/Overview/Our-Industry/Industry-profile.htm

57 ibid.

Table 128 Potato summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed potato sales ($11.3 million)	100%	0.39	$4.4 million
Farmgate ($142 million)	100%	0.39	$55.4 million
Processing value ($117.5 million)	100%	0.32	$37.6 million
Domestic sales ($451.0 million)	100%	0.18	$81.2 million
Exports (117.4 million)	100%	0.45	$52.8 million
Total GDP output share			**$231.4 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and Potatoes New Zealand

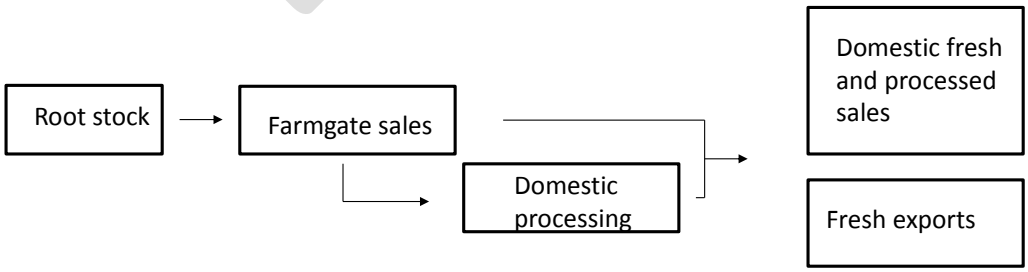
D.41 *Prunus* species

The *Prunus* species valued in this analysis are peaches, nectarines, apricots and cherries. Production of *Prunus* varieties is based in Central Otago and the Hawke's Bay. The industry has a strong export growth focus with approximately just under half of all *Prunus* exported (in value terms). Central Otago grows the main export crop.

Good information exists on exports, domestic sales, farmgate sales and trees supplied to growers. Processing of summerfruit has substantially reduced over the past 10 years.

Below we set out the value chain for summerfruit (Prunus).

Figure 44 Prunus value chain



Source: NZIER

D.41.1 Trees/root stock production

Trees supplied to growers are approximately 70,000 multiplied by $10 per tree equalling $0.7 million (personal communication, Julie Green and John Morton, Graham Greene Ltd, 13 March 2015).

D.41.2 Farmgate

Farmgate value is based on estimated tonnes presented by Fresh Facts and prices from various years collected in the Lincoln Financial Budget Manual.

These calculations are set out in Table 129.

Table 129 Prunus value at farmgate

	Volumes[1]	Prices[2]	Farmgate value estimate
Cherries	2,141 tonnes	$8,390 per tonne	$18.0 million
Apricots	3,470 tonnes	$2,880 per tonne	$10.0 million
Peaches	2,692 tonnes	$1,823 per tonne	$4.9 million
Nectarines	3,684 tonnes	$1,718	$6.3 million
Plums	2,496 tonnes	$2,496	$4.8 million
Total			**$44.0 million[3]**
Notes (1) Fresh Facts 2012, p16. (2) Lincoln Financial Budget Manual 2012/2013 for apricots and cherries, pA72. Peaches, nectarines and plums are NZIER estimates based on domestic sales. (3) Numbers rounded.			

Source: NZIER and Horticulture New Zealand

D.41.3 Processing

There is now little stone fruit grown for processing, once an important part of the industry. Golden Queen peaches from Hawke's Bay are canned by Wattie's, as are small quantities of Black Doris plums. With the closure of the Roxdale cannery, in Roxburgh, Central Otago, in the early 2000s, apricots are no longer canned in New Zealand. Apricots are dried in Central Otago, with volumes fluctuating yearly.

D.41.4 Domestic and export sales

Domestic and export sales are estimated by Fresh Facts 2012, p14.

Table 130 Prunus domestic sales

	Domestic consumption	Exports
Cherries	$7.0 million	$21.1 million
Apricots	$6.1 million	$10.2 million
Peaches	$7.4 million	$0.4 million
Nectarines	$10.1 million	Not available
Plums	$7.5 million	$0.2 million
Totals	**$38.1 million**	**$31.9 million**

Source: Fresh Facts 2012, p16

D.41.5 Summary

Table 131 sets out the contribution of Prunus to the New Zealand economy.

Table 131 Prunus summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.7 million)	100%	0.39	$0.3 million
Farmgate ($44.0 million)	100%	0.39	$17.2 million
Processing value	100%	0.32	Very little
Domestic sales ($38.1 million)	100%	0.18	$6.9 million
Exports 31.9 million)	100%	0.45	$14.4 million
Total GDP output share			**$38.7 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and Lincoln Financial Budget Manual 2012/2013

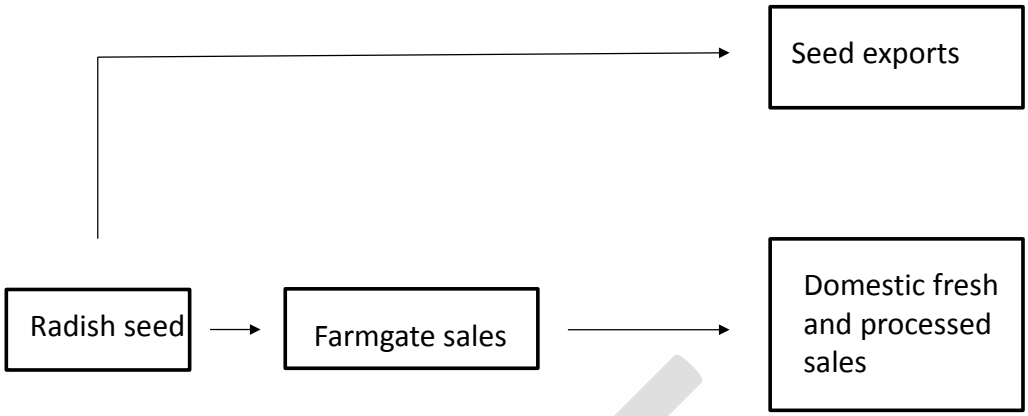
D.42 Radish (*Raphanus sativus*)

Radish (*Raphanus sativus*) seed trade is one of the standout successes in a flourishing international seed trade. Being in the European off season and having ideal growing conditions the radish seed business is multimillion dollar industry.

We have good information on export seed sales; however, radish consumption data has been used to estimate the small New Zealand market.

Below we set out the value chain for radish.

Figure 45 Radish value chain



Source: NZIER

D.42.1 Seed production and farmgate values

Large amounts of radish seeds are exported from New Zealand. We have assumed that farmgate values are half of the total export value: $7.5 million (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Farmgate values are estimated $0.4 million.

Table 132 Radish value at farmgate

	Domestic sales	Adjustment factor	Farmgate value estimate
Radish farmgate value	$1.4 million	0.5	$0.7 million

Source: NZIER and Horticulture New Zealand

D.42.2 Domestic sales

Domestic sales are estimated at $1.4 million (consumption data is unpublished data supporting Fresh Facts 2012, p24 and personal communication, Alastair Aitken, Martech, 13th February 2015).

D.42.3 Export sales

Radish seed exports are estimated at $22 million (Fresh Facts 2012, p20).

D.42.4 Summary

Table 133 sets out the contribution of radishes to the New Zealand economy.

Table 133 Radish summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed s sales ($7.5 million)	100%	0.39	$2.9 million
Farmgate ($0.7 million)	100%	0.39	$0.3 million
Domestic sales ($1.4 million)	100%	0.18	$0.3 million
Exports (22.0 million)	100%	0.45	$9.9 million
Total GDP output share			**$13.4 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012

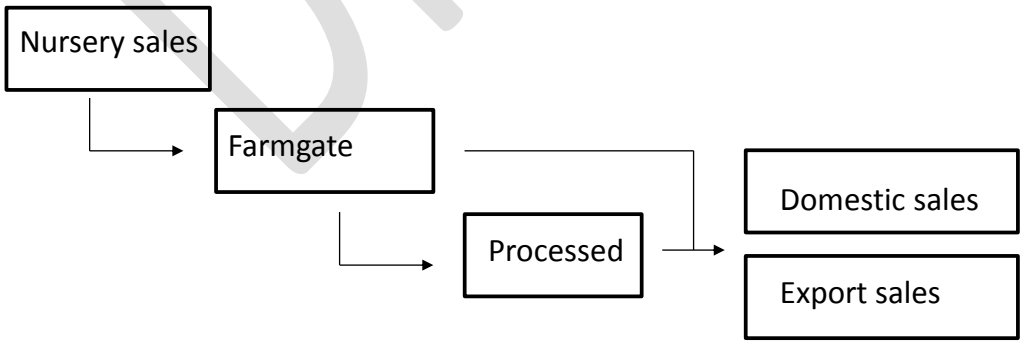
D.43 *Ribes* species

The *Ribes* species valued in this analysis are blackcurrants (*Ribes nigrum*), redcurrants (*Ribes rubrum*) and gooseberries (*Ribes uva-crispa*). Most value (99%) comes from the domestic and exports sales of blackcurrants. Redcurrants and gooseberries are very small crops (5 to 10 hectares each depending on the year).

Good information is available on plant sales, domestic sales and exports. Industry assumptions have been made for farmgate production and processing.

Below we set out the value chain for Ribes.

Figure 46 Ribes value chain



Source: NZIER

D.43.1 Plant production

The number of blackcurrant bushes supplied to growers is small. On a per annum basis, it is less than $0.1 million dollars (personal communication, Mike Kearney, Blackcurrants New Zealand Inc, 12 October 2014).

D.43.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately half of domestic sales. Domestic sales of Ribes fruit were approximately $22.6 million (Fresh Facts 2012, p14).

Table 134 Ribes value at farmgate

	Domestic sales	Adjustment factor	Farmgate value estimate
Ribes farmgate value	$22.6 million	0.5	$11.3 million

Source: NZIER and Horticulture New Zealand

D.43.3 Processing

Processing value is tightly held by the companies in the industry. We have used domestic and export sales multiplied by 25% to estimate the size of the processing industry.

Table 135 Estimated Ribes processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated olive processing value	$22.4 million	0.25	$5.6 million

Source: Fresh Facts and Horticulture New Zealand

D.43.4 Domestic sales

Domestic sales are approximately $3.7 million. This comprises of $3.6 million (Fresh Facts 2012, p14) in blackcurrant sales with the remainder being redcurrants and gooseberries.

D.43.5 Export sales

Export sales in 2012 were $18.8 million.[58]

[58] http://blackcurrant.co.nz/blackcurrants/the-nz-industry/

D.43.6 Summary

Table 136 sets out the contribution of Ribes to the New Zealand economy.

Table 136 Ribes summary

2012, June year $M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.1 million)	100%	0.39	$0.04 million
Farmgate ($11.3 million)	100%	0.39	$4.4 million
Processing value ($5.6 million)	100%	0.32	$1.8 million
Domestic sales ($3.7 million)	100%	0.18	$0.7 million
Exports (18.8 million)	100%	0.45	$8.5 million
Total GDP output share			**$15.4 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and Blackcurrants New Zealand Inc

D.44 Ribwort plantain (*Plantago lanceolata*)

Narrow leafed plantain (*Plantago lanceolata*) is an upright perennial herb which tolerates many pests and diseases. It has become increasingly popular as a specialist crop or sown in a pasture mix. Approximately 5,000 hectares of plantain was sown in 2011 (New Zealand Forage Systems 2012, p1).

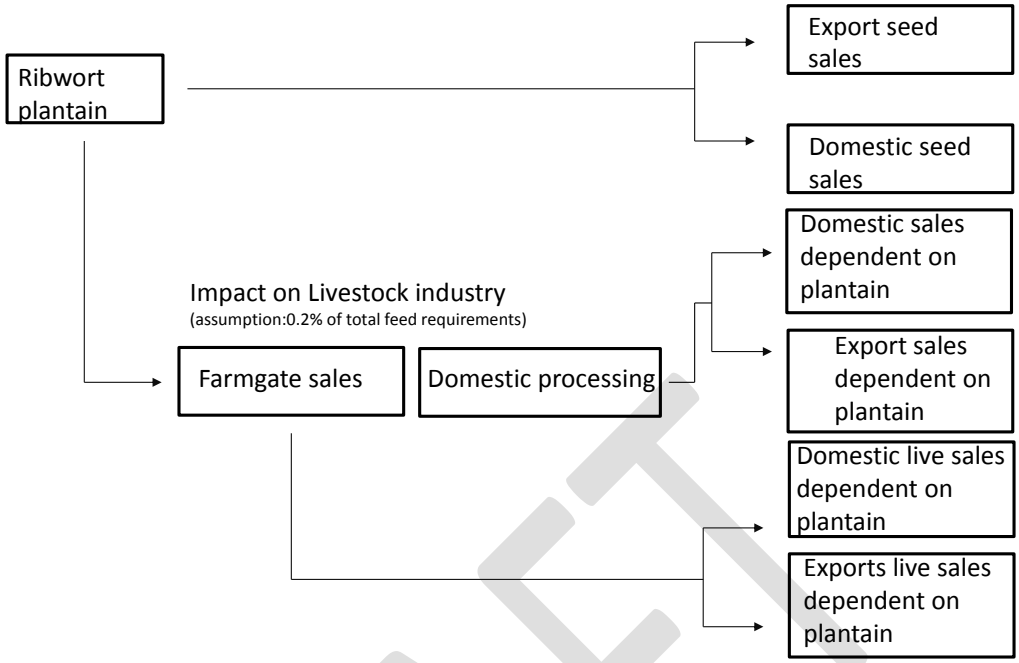
Its coarse root system consists of both a tap root and a fibrous root. The tap root grows to a shallower depth than other tap rooted plants and means that plantain is less tolerant of drought than chicory, red clover and lucerne, though the tap root does provide some degree of drought tolerance.

The small size of the crop means that we had to rely on industry sources for approximations of seed value and domestic sales. Exports sales are record by Statistics New Zealand.

Below we have set out the plantain value chain.

Figure 47 Ribwort plantain value chain

Note that all livestock industries include live animals, dairy, wool, dairy, meat processing, velvet and other co-products sold.



Source: NZIER

D.44.1 Seed sales

Seed sales are estimate at half the domestic sales or $1.1 million.

D.44.2 Farmgate

Farmgate sales of plantain have been calculated from the estimated 5,000 hectares (New Zealand Forage Systems 2012, p1) planted multiplied by $2,600 per hectare revenue (Millner and Roskruge 2013, Table 1 p103 and personal communication, Ivan Lawrie, FAR, 4 March 2015) equalling $13.0 million.

D.44.3 Domestic sales

Domestic seed sales are estimated at $2.25 million (BERL 2012, p14).

D.44.4 Dependent industries

Plantain is grown by farmers as a forage crop either for their own use or sold on the open market. DairyNZ suggest that plantain is a minor but valuable addition to livestock feed requirements particularly in the South Island – approximately 0.2% of total livestock requirements (personal communication, Mr Matt Newman, DairyNZ, 18 May 2014).

D.44.5 Summary

Table 137 sets out the GDP output share of plantain to the New Zealand economy.

Table 137 Plantain summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($1.1 million)	100%	0.39	$0.4 million
Farmgate sales ($13.0 million)	100%	0.39	$5.1 million
Domestic seed sales ($2.3 million)	100%	0.18	0.4 million
Dependent livestock industries			
Farmgate Dairy sales ($12,241 million)	0.2%	0.48	$11.8 million
Farmgate Other livestock sales ($5,039 million)	0.2%	0.39	$3.9 million
Domestic processing ($7,287million)	0.2%	0.25	$3.6 million
Domestic sales (processing and live) ($2,478.4 million)	0.2%	0.18	$0.9 million
Exports ($19,455.8 million)	0.2%	0.48	$18.7 million
Total GDP output share			**$44.8 million[1]**
Note (1) Numbers rounded.			

Source: BERL 2012, Beef + Lamb New Zealand estimates, Statistics New Zealand and NZIER estimates

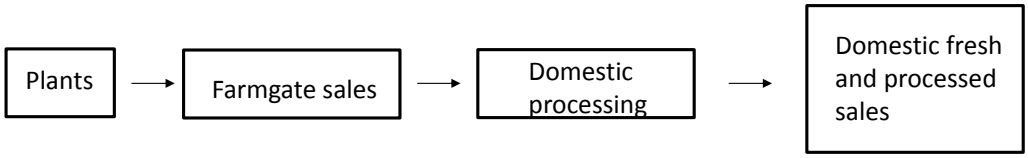
D.45 Roses (*Rosa* species)

Rose (*Rosa* species) production is focused on the domestic market. In recent years it has faced stiff competition from imports, particularly from markets such as India.

As with other cut flowers the ability to estimate value is hampered by the large number of marketing channels used (e.g. supermarkets, agents, direct buying etc.). Therefore we have relied on industry experts to give a general indication of value at each stage of the process.

The following figure sets out the marketing chain for roses.

Figure 48 Rose value chain



Source: NZIER

D.45.1 Rose bush production

We have no official information on rose bush production. As with other flower production business are vertically integrated. Bushes and cuttings for the next season are produced at the same time as this year's production and multiplied up.

The approximate cost or 'best guess' of the value of this process for roses is approximately $0.01 million (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014 and NZIER estimate).

D.45.2 Farmgate

Farmgate estimates are also hard to estimate for the same reason. The best guess by the industry is approximately $10.5 million (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014). Imports and the numerous marketing channels with differing pricing structures complicate estimates further.

D.45.3 Domestic sales

Domestic sales are estimated at $21.0 million. This is a highly approximate figure based on 60 million flowers sold at 0.35 cents per flower (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014).

D.45.4 Summary

Table 138 sets out the GDP output share of roses to the New Zealand economy.

Table 138 Rose summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.1 million)	100%	0.39	$0.04
Farmgate ($10.5 million)	100%	0.39	$4.1 million
Domestic sales ($21.0 million)	100%	0.18	$3.8 million
Total GDP output share			**$7.9 million**[1]
Note (1) Numbers rounded.			

Source: FloraMax

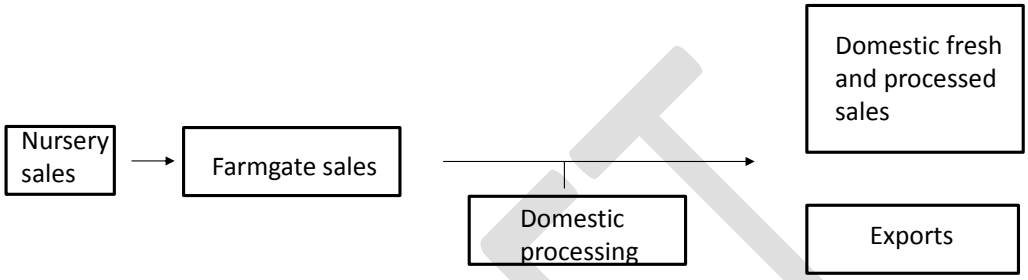
D.46 Rubus species

The *Rubus* species valued in this analysis are boysenberries (*Rubus* hybrid), blackberries (*Rubus fruiticosus*), and raspberries (*Rubus idaeus*). Boysenberries and raspberries dominate *Rubus* production, both of which are exported. Blackberries are focused on the domestic market only.

Most *Rubus* are grown in the Nelson and Hawke's Bay regions and have remained small industries, despite being established for nearly a century.

The figure below sets out the value chain for *Rubus*.

Figure 49 Rubus value chain



Source: NZIER

D.46.1 Plants sold

The number of *Rubus* bushes supplied to growers is small. Less than $0.05 million dollars on a per annum basis.

D.46.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately a half of domestic sales. Domestic sales of *Rubus* were approximately $10.7 million (Fresh Facts 2012, p14).

Table 139 Rubus value at farmgate

	Domestic sales	Adjustment factor	Farmgate value estimate
Rubus farmgate value	$10.7 million	0.5	$5.4 million

Source: Fresh Facts and Horticulture New Zealand

D.46.3 Processing

Processing value is tightly held by the companies in the industry. We have used domestic and export sales multiplied by 25% to estimate the size of the processing industry.

Table 140 Estimated Rubus processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated rubus processing value	$10.7 million	0.25	$2.7 million

Source: Fresh Facts and Horticulture New Zealand

D.46.4 Domestic sales

Domestic sales were approximately $8.2 million in 2012 (Fresh Facts 2012, p14).

D.46.5 Export sales

Export sales in 2012 were $2.5 million (Fresh Facts 2012, p14).

D.46.6 Summary

Below we set out the contribution of Rubus to the New Zealand economy.

Table 141 Rubus summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.05 million)	100%	0.39	$0.02 million
Farmgate ($5.4 million)	100%	0.39	$2.1 million
Processing value ($2.7 million)	100%	0.32	$0.9 million
Domestic sales ($8.2 million)	100%	0.18	$1.5 million
Exports (2.5 million)	100%	0.45	$1.1 million
Total GDP output share			**$5.6 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and Blackcurrants New Zealand Inc

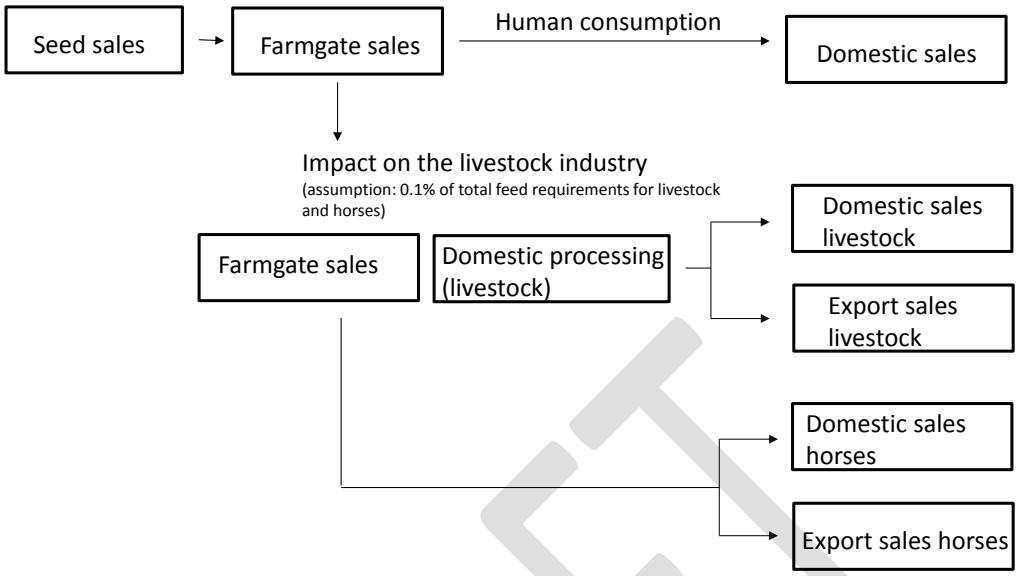
D.47 Rye (*Secale cereal*)

Rye (*Secale cereal*) is a very small crop and mainly grown in Canterbury as a stock feed, though some production goes to human consumption.

The following figure sets out the value chain.

Figure 50 Rye value chain

Note that all livestock industries include live animals, wool, dairy, meat processing, velvet and other co-products sold. Horses are also included.



Source: NZIER

D.47.1 Sales of rye seed

In 2012, 550 tonnes of rye seed was produced (personal communication, David Green, PGG Wrightsons, 20 March 2015). At $1,000 per tonne, seed value was approximately $0.6 million.

D.47.2 Farmgate

Farmgate value of rye was approximately $4.8 million ($480 per tonne[59] multiplied by 10,000 tonnes).[60]

D.47.3 Dependent industries

Human consumption

Little is known about rye production for bread etc. Companies hold this information tightly.

Fodder production

Rye is grown by farmers as a forage crop either for their own use or sold on the open market. DairyNZ suggest that rye is a minor but valuable addition to livestock feed requirements particularly in the South Island – approximately 0.1% of total livestock requirements (personal communication, Mr Matt Newman, DairyNZ, 18 May 2014). Horses are also assumed to be approximately 0.1% of total requirements (NZIER estimate based on Gee (2012)). Table 142 sets out the dependent industries and values.

[59] Lincoln Financial Budget Manual 2012/2013, p A58.

[60] Personal communication David Green PGG Wrightsons.

Table 142 Livestock industries that depend on rye

2012, June year, $ M per annum

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Dairy values	$12,241.2 million	$585.4 million	$1,045.6 million	$12,573.7 million
Other livestock values	$5,039.0 million	6,701.9 million	$1,432.8 million	$6,882.1 million
Horse values	$93.5 million		$57.0 million	$130.0 million
Note (1) For further information on gross output livestock values see Appendix B.				

Source: Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.47.4 Summary

Table 143 sets out the GDP output share of rye to the New Zealand economy.

Table 143 Rye summary

2012, June year, $M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($0.6 million)	100%	0.39	$0.2 million
Farmgate sales ($4.8 million)	100%	0.39	$1.9 million
Human consumption			Unknown but assumed small
Dependent livestock industries			
Farmgate Dairy sales ($12,241 million)	0.1%	0.48	$5.9 million
Farmgate Other livestock sales ($5,039 million)	0.1%	0.39	$2.0 million
Farmgate horses ($93.5 million)	0.1%	0.24	$0.02 million
Domestic processing ($7,287.3 million)	0.1%	0.25	$1.8 million
Domestic sales (processing and live) ($2,478.4 million)	0.1%	0.18	$0.5 million
Domestic sales horses ($57.0 million)	0.1%	0.12	$0.006 million
Exports livestock ($19,455.8 million)	0.1%	0.48	$9.4 million
Exports horses ($130 million)	0.1%	0.2	$0.03 million
Total GDP output share			**$21.6 million[1]**
Note (1) Numbers rounded.			

Source: BERL 2012, Beef + Lamb New Zealand estimates, Statistics New Zealand and NZIER estimates

D.48 Ryegrass (*Lolium* species)

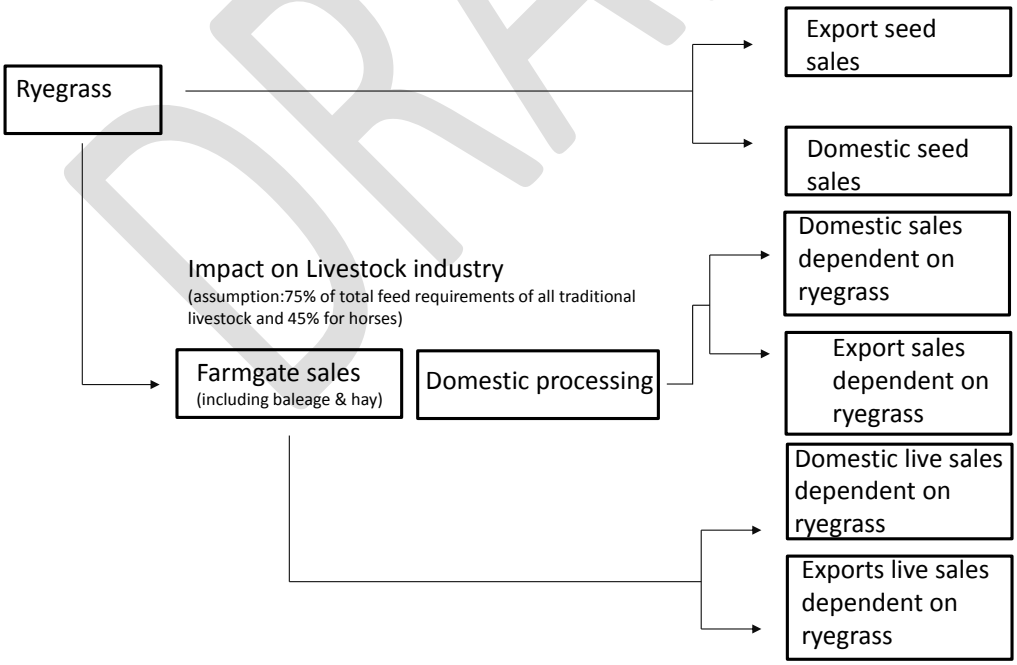
Ryegrass (*Lolium* species including *Lolium perenne, Lolium multiflorum* and *Lolium x boucheanum*) is the backbone of New Zealand's livestock industry. It is the dominant feed for cattle and sheep. This makes it one of the most important economic plants grown in New Zealand.

There is good data on ryegrass production in New Zealand. For industries that rely on ryegrass, Beef + Lamb New Zealand have credible estimates of livestock sales at the farmgate, processing and export values (personal communication, Mr Rob Davison, 5 June 2014). The main assumption made is that ryegrass is the dominant feed crop for the livestock industry making up approximately 75% of all livestock nutrient requirements (correspondence with Mr Matthew Newman (DairyNZ) and Mr Nick Pyke (FAR)).[61]

The ryegrass value chain is set out below. Ryegrass seed is sold domestically and exported. However, its main value is as a source of feed for the livestock industry. Other points to note include:

- farmgate sales is the total value received by farmers from livestock sales
- domestic processing is the value generated by the processing sector i.e. the service the processing sector performs
- domestic and exports sales are the total value received from sales.[62]

Figure 51 Ryegrass value chain



Source: NZIER

D.48.1 Seed production value

61 Also see http://www.beeflambnz.com

62 Export sales are valued in fob terms.

Most seed production takes place in Canterbury. Total ryegrass seed production in 2011 (December year)[63] was 32,500 tonnes (BERL 2011; Statistics New Zealand; Hampton et al 2012).[64] The total sales of ryegrass seed sold were approximately $84.5m (BERL 2012, p14). Most ryegrass seed is sold into the export market ($50.22m).

Table 144 Seed value at farmgate, domestic sales and exports

2011 sales

Specific part of the value chain	Calculation	Value	Source/assumption
Farmgate	50% of export and domestic sales value ($84.5m)	$42.3 million	Horticulture New Zealand assumption
Domestic sales	Total sales ($84.5) minus export sales	$34.3million	Derived from BERL 2012, p14 and Hampton et al 2012, p133
Export		$50.2 million	Hampton et al 2012, p133

Source: BERL 2012, Hampton et al 2012 and Horticulture New Zealand

D.48.2 Dependent industries value chain

Ryegrass contributes 75% of all nutrition needs for livestock industries. This makes perennial ryegrass New Zealand's preeminent economic plant in value terms.

Table 145 below illustrates ryegrass's importance by setting out the livestock value of farmgate, processing, domestic sales and exports that depend upon ryegrass. Export data comes from Statistics New Zealand through Beef + Lamb New Zealand (personal communication, Mr Rob Davison, 5 June 2014). Beef + Lamb New Zealand have also estimated processing margins and farmgate returns (personal communication, Mr Rob Davison, 30 July 2014) specifically for this project. Livestock (live) sales are a NZIER estimate based on historical data that suggests livestock sales are approximately 17% of the farmgate returns from livestock industries.[65]

63 The latest year available where exports and domestic production is reported.

64 Note that we have used 2011 June year to get consistent export and domestic use figures.

65 This is a tentative estimate but we are confident that it is of the right order of magnitude.

Table 145 Livestock industries that depend on ryegrass

2012, June year, $ M per annum

Subsector	Farmgate sales	Domestic Processing	Domestic sales (processed and live)	Exports
Beef	$1,282m	$1,706m	$401m	$2,469m
Dairy	$12,241m	$585m	$348m	$12,477m
Sheep	$2,963m	$3,941m	$804m	$3,125m
Wool	$618m	$822m	$43m	$984m
Deer	$174m	$231m	$8m	$270m
Goats				$7m
Export live sales				$120m
Domestic live sales			$871m	
Totals	**$17,280 m**	**$7,287m**	**$2,478m**	**$19,455 m**

Source: Beef + Lamb New Zealand estimates, Statistics New Zealand and NZIER estimates

Horse industry values are set out in Table 146. Ryegrass is a major contributor to forage consumption in the horse industry. We expect it to be similar to other livestock industries. Given that forage is at least approximately 60% of a horse's diet (Gee 2012) we expect the ryegrass contribution to the horse industry to be approximately 45%.

Table 146 Horse values

2012, June year, $ M per annum

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Horse values	$93.5 million		$57.0 million	$130.0 million

Source: Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.48.3 Ryegrass summary

Table 147 sets out the summary of ryegrass seed production and its dependent livestock industries. Estimates of the size at each stage of production have been calculated from Table 145 and multiplied by estimated industry impact, and GDP share of output[66] (to avoid double counting) equalling the value of ryegrass to each stage of production. These values are summed to get the total GDP share of output, which demonstrates the importance of ryegrass to the economy.

[66] The GDP share of output is calculated from estimates made in the Input-Output tables (see Table 1).

Table 147 Ryegrass summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Farmgate sales of seeds ($42.3 million)[1]	100%	0.39	$16.5 million
Domestic sales of seeds ($34.3 million) [1]	100%	0.18	$6.2 million
Export seed sales ($50.2 million) [1]	100%	0.45	$22.6 million
Dependent livestock industries[3]			
Farmgate Dairy sales ($12,241m)	75%	0.48	$4,406.8 million
Farmgate Other livestock sales ($5,039m)	75%	0.39	$1,473 million
Farmgate horses ($93.5 million)	45%	0.24	$8.4 million
Domestic processing ($7,287m)	75%	0.25	$1,366.4 million
Domestic sales (processing and live) ($2,478.4m)	75%	0.18	$334.6 million
Domestic sales horses ($57.0 million)	45%	0.12	$2.6 million
Exports livestock ($19,455.8 million)	75%	0.48	$7,004.1 million
Exports horses ($130.0 million)	45%	0.2	$9.8 million
Total GDP output share			**$14,670.6 million[2]**
Note (1) December year 2011. (2) Numbers rounded. (3) See Appendix B for more detail on gross output values for livestock industries.			

Source: BERL 2012, Beef + Lamb New Zealand estimates, Statistics New Zealand and NZIER estimates

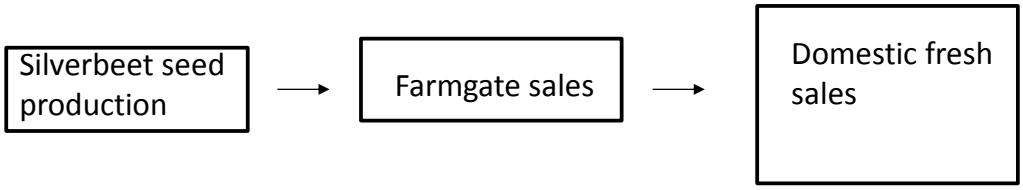
D.49 Silverbeet (*Beta vulgaris* var. *cicla*)

Silverbeet (*Beta vulgaris* var. *cicla*) is grown for the domestic market. It is a small industry based in market gardens around the major cities.

As a small domestic industry we are reliant on industry estimates for industry size.

Below we set out the value chain for silverbeet.

Figure 52 Silverbeet value chain



Source: NZIER

D.49.1 Seed production

Silverbeet seeds are imported with a small proportion grown in New Zealand. Seed production in New Zealand was approximately $0.02 million in 2012 (silverbeet and spinach industry grower).

D.49.2 Farmgate

Farmgate value is approximately $1.1 million in 2012 (silverbeet and spinach industry grower and Horticulture New Zealand).

D.49.3 Domestic sale value

Domestic sales are approximately $2.1 million (Fresh Facts 2012 and silverbeet and spinach industry grower).

D.49.4 Summary

Below we set out the contribution of silverbeet to the New Zealand economy.

Table 148 Silverbeet summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.02 million)	100%	0.39	$0.007 million
Farmgate ($1.1 million)	100%	0.39	$0.4 million
Processing value			Little processing
Domestic sales ($2.1 million)	100%	0.18	$0.4 million
Total GDP output share			**$0.8 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012

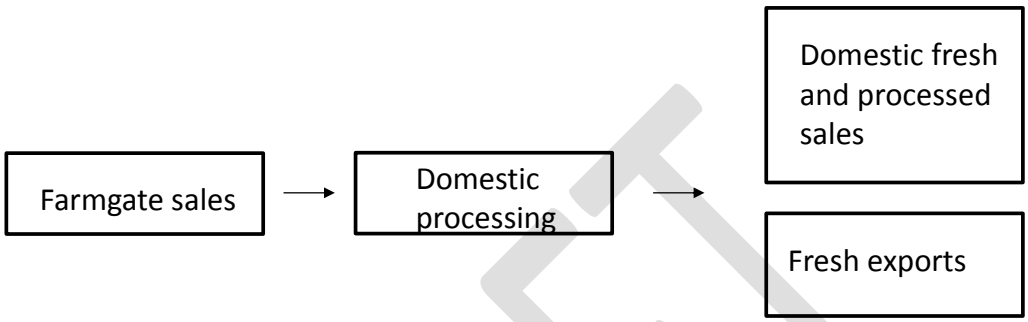
D.50 Sphagnum moss (*Sphagnum cristatum & C. subnitens*)

Sphagnum moss (*Sphagnum cristatum & C. subnitens*) production is harvested from swamps mainly on the West Coast of the South Island.

Information on production is scarce with the only official data focused on exports. Some estimates are available on the domestic market; however, generalised assumptions are applied to farmgate and processing sector values.

Below we set out the value chain for sphagnum moss.

Figure 53 Sphagnum moss value chain



Source: NZIER

D.50.1 Moss harvesting

Sphagnum moss is a natural resource harvested from Westland swamps therefore it has no sales value.

D.50.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately half of domestic and export sales. Domestic and export sales of sphagnum moss were approximately $5.6 million (Fresh Facts 2012, p14 and MAF 2008, p11).

Table 149 Sphagnum moss value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Sphagnum moss farmgate value	$5.6 million	0.5	$2.8 million

Source: Fresh Facts 2012 and MAF 2008

D.50.3 Processing

Processing value is tightly held by the companies in the industry. We have used domestic and export sales multiplied by 25% to estimate the size of the processing industry.

Table 150 Estimated sphagnum moss processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated sphagnum moss processing value	$5.6 million	0.25	$1.4 million

Source: Fresh Facts 2012 and MAF 2008

D.50.4 Domestic sales

Domestic sales are approximately 20% of export sales ($1.3 million (MAF 2008, p11)).

D.50.5 Export sales

Exports of sphagnum moss were $4.5 million in 2012 (Fresh Facts 2012, p21).

D.50.6 Summary

Below we set out the contribution of sphagnum moss to the New Zealand economy.

Table 151 Sphagnum moss summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales	100%	0.39	Harvesting a natural resource
Farmgate ($2.8 million)	100%	0.39	$1.1 million
Processing value ($1.4 million)	100%	0.32	$0.5 million
Domestic sales ($1.1 million)	100%	0.18	$0.2 million
Exports ($4.5 million)	100%	0.45	$2.0 million
Total GDP output share			**$3.8 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012 and MAF 2008

D.51 Spinach (*Spinacia oleracea*)

Spinach (*Spinacia oleracea*) is grown for the domestic market. It is a small industry based in market gardens around major cities.

As a small domestic industry we are reliant on industry estimates for industry size.

Below we set out the value chain for spinach.

Figure 54 Spinach value chain

Source: NZIER

D.51.1 Spinach seed value

Spinach seeds are imported, mainly from Australia (silverbeet and spinach grower).

D.51.2 Farmgate value

Farmgate value is approximately $2.0 million in 2012 (silverbeet and spinach grower and personal communication, John Seymour, Horticulture New Zealand, 19 March 2015).

D.51.3 Domestic sale value

Domestic sales are approximately $3.9 million (silverbeet and spinach grower and Fresh Facts 2012, p16).

D.51.4 Summary

Table 152 sets out the contribution of spinach to the New Zealand economy.

Table 152 Spinach summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales	100%	0.39	Imported
Farmgate ($2.0 million)	100%	0.39	$0.8 million
Processing value	100%	0.32	Little processing
Domestic sales ($3.9 million)	100%	0.18	$0.7 million
Total GDP output share			**$1.5 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012

D.52 Strawberries (*Fragaria x ananassa*)

Strawberries (*Fragaria x ananassa*) have been grown in New Zealand for over a century. Originating from crosses of North and South American species, they fruit well for up to four years, but are grown commercially as an annual crop.

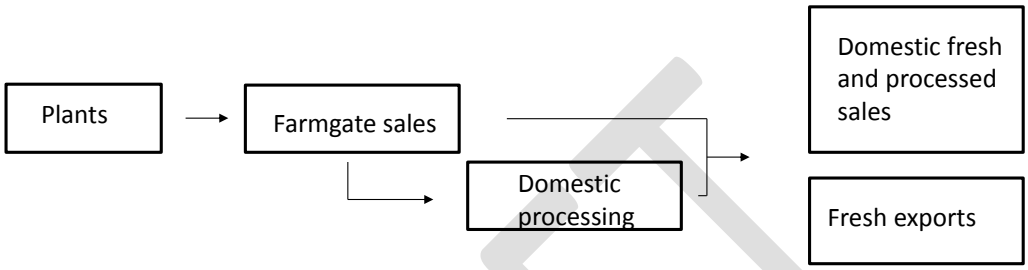
Strawberries are mostly grown for the domestic market. Approximately 6,500 tonnes are produced by 110 growers.

New Zealand's commercial strawberry fields cover a total of 170 hectares, mainly in the Auckland region. The fruit are harvested from spring to the end of summer, depending on the varieties.

Good information exists on domestic and export sales however we have relied on industry assumptions and estimates for other parts of the industry.

The value chain for strawberries is set out below.

Figure 55 Strawberry value chain



Source: NZIER

D.52.1 Bush production

Strawberries are approximately $3.5 million (personal communication, Michael Ahern and Geoff Langford, Strawberry Growers New Zealand Inc, 23 March 2015).

D.52.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately a half of domestic and export sales. Domestic and export sales of strawberries were approximately $26.1 million (Fresh Facts 2012, p14).

Table 153 Strawberry value at farmgate

	Domestic sales	Adjustment factor	Farmgate value estimate
Strawberry farmgate value	$26.1 million	0.5	$13.1 million

Source: Fresh Facts 2012, and MAF

D.52.3 Processing

The companies in the industry tightly hold processing value information. We have used domestic and export sales multiplied by 25% to estimate the size of the processing industry.

Table 154 Estimated strawberry processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated strawberry processing value	$26.1 million	0.25	$6.5 million

Source: Fresh Facts and Horticulture New Zealand

D.52.4 Domestic sales

Domestic sales are approximately $21.3 million (Fresh Facts 2012, p14).

D.52.5 Export sales

Exports are estimated at $4.8 million (Fresh Facts 2012, p14).

D.52.6 Summary

Table 155 sets out the contribution of strawberries to the New Zealand economy.

Table 155 Strawberry summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($3.5 million)	100%	0.39	$1.4 million
Farmgate ($13.1 million)	100%	0.39	$5.1 million
Processing value ($6.5 million)	100%	0.32	$2.1 million
Domestic sales ($21.3 million)	100%	0.18	$3.8 million
Exports (4.8 million)	100%	0.45	$2.2 million
Total GDP output share			**$14.5 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012

D.53 Tall fescue (*Festuca arundinacea*)

Tall fescue (*Festuca arundinacea*) is a deep rooted perennial grass that is more persistent than perennial ryegrass and can tolerate waterlogging, salinity, grass grub, heat and drought.

Slower to establish than perennial ryegrass, tall fescue is an excellent option where summer moisture stress may limit persistence or yield of perennial ryegrass, therefore

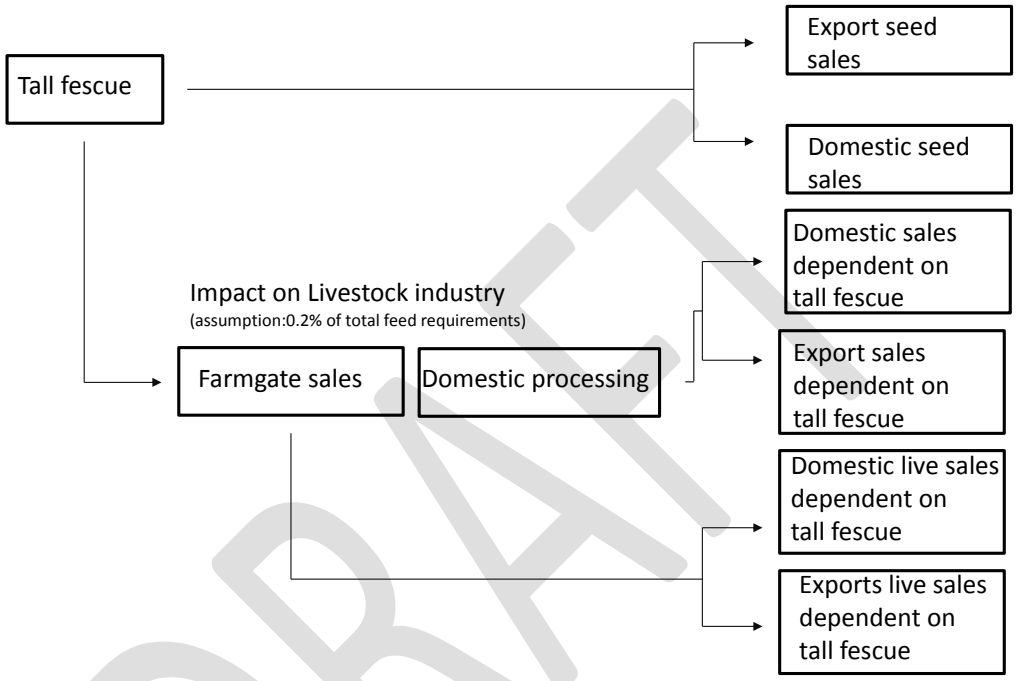
it has proven popular in drought prone environments. Sometimes it is mixed with white clover.

We have good information on seed sales and dependent industries (livestock other than dairy).

Below we set out the value chain for tall fescue.

Figure 56 Tall fescue value chain

Note that other livestock industries include live animals (including horses), wool, meat processing, velvet and other co-products sold.



Source: NZIER

D.53.1 Tall fescue seeds

Seed value was approximately a half of domestic sales plus export sales: $1.0 million (personal communication, John Seymour, Horticulture New Zealand, 12 December 2014).

Domestic seed sales are approximately $0.04 million ($2.02 million minus $1.98 million) (BERL 2012, p4 and Hampton et al 2012, p133).

Exports were 1.98 million (Hampton et al 2012, p133).

Table 156 Seed value at farmgate, domestic sales and exports

2011 sales

Specific part of the value chain	Calculation	Value	Source/assumption
Farmgate	50% of export and domestic sales value	$1.0 million	Horticulture New Zealand assumption
Domestic sales	Total sales minus export sales	$0.04 million	Derived from BERL 2012, p14 and Hampton et al (2012, p133)
Export		$1.98 million	Hampton et al (2012, p133)

Source: BERL 2012, Hampton et al 2012 and Horticulture New Zealand

D.53.2 Dependent industries

Tall fescue is grown by farmers to support their predominantly sheep and beef operations. It is a niche product approximately 0.2% of total livestock requirements other than dairy particularly in the South Island (personal communication, Mr Matt Newman, DairyNZ, 18 May 2014). We have assumed a similar contribution to the horse industry.

For livestock gross output values see Appendix B.

D.53.3 Summary

Table 157 sets out the GDP output share of tall fescue to the New Zealand economy.

Table 157 Tall fescue summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales ($1.0 million)	100%	0.39	$0.4 million
Domestic sales ($0.04)	100%	0.18	$0.007 million
Exports of seeds ($2.0 million)	100%	0.45	$0.9 million
Dependent livestock industries[2]			
Farmgate Other traditional livestock sales ($5,039m)	0.2%	0.39	$3.9 million
Farmgate horses ($93.5 million)	0.2%	0.24	$0.05 million
Domestic processing for traditional livestock industries ($6,701.9 million)	0.2%	0.25	$3.4 million
Domestic sales for other traditional livestock ($1,432.8 million)	0.2%	0.18	$0.7 million
Domestic sales horses ($57 million)	0.2%	0.12	$0.01 million
Exports other traditional livestock ($6,882.1 million)	0.2%	0.48	$6.6 million
Exports horses ($130.0 million)	0.2%	0.2	$0.05 million
Total GDP output share			**$16.0 million[1]**
Note (1) Numbers rounded. (2) For gross output values see Appendix B.			

Source: BERL 2012, Beef + Lamb New Zealand estimates, Statistics New Zealand, NZIER estimates, IER Pty Ltd 2010 and Statistics New Zealand HS Code 0101

D.54 Tamarillos (*Solanum betaceum*)

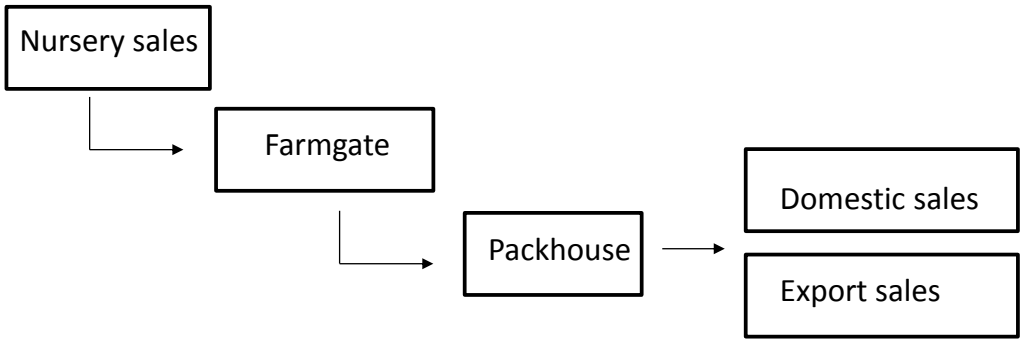
Tamarillos (*Solanum betaceum*) were introduced to New Zealand in 1891 in Auckland. A red-fruited variety was bred at Māngere East in the 1920s, and small-scale commercial production started.

The fruit was strongly promoted in the 1960s and the industry prospered for a few years. The area under cultivation has increased slowly until the arrival of the tomato potato psyllid which has devastated production. Tamarillos are mainly grown in the Bay of Plenty, Northland and Auckland.

Good information on domestic sales and exports is available. However the value of other parts of the industry is calculated from industry assumptions and export opinions.

Below we set out the value chain for tamarillos.

Figure 57 Tamarillo value chain



Source: NZIER

D.54.1 Trees/root stock production

Tamarillo tree supply has been relatively high in recent years because of the incursion by the Tomato Potato psyllid (TPP). Since 2008 between 60% and 70% of trees have been replaced because of the *Liberibacter* (a bacteria-like organism) carried by the TPP (personal communication, Jim Walker, Plant and Food Research, 16 September 2014). Taking this into account tree replacement will be at least 10% of orchard gate value each year or $0.08 million.

D.54.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately half of domestic and export sales. Domestic and export sales of tamarillos were approximately $1.5 million (Fresh Facts 2012, p14).

Table 158 Tamarillo value at farmgate

	Domestic and export sales	Adjustment factor	Farmgate value estimate
Tamarillo farmgate value	$1.5 million	0.5	$0.8 million

Source: Fresh Facts 2012 and Horticulture New Zealand

D.54.3 Domestic sales

Domestic sales are approximately 1.3 million (Fresh Facts 2012, p14).

D.54.4 Export sales

Exports sales of tamarillos were approximately $0.2 million (Fresh Facts 2012, p14).

D.54.5 Summary

Below we set out the contribution of tamarillos to the New Zealand economy.

Table 159 Tamarillos summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.08 million)	100%	0.39	$0.03 million
Farmgate ($0.8 million)	100%	0.39	$0.3 million
Processing value	100%	0.32	Little processing of tamarillos
Domestic sales ($1.3 million)	100%	0.18	$0.2 million
Exports (0.2 million)	100%	0.45	$0.1 million
Total GDP output share			**$0.7 million**[1]
Note (1) Numbers rounded.			

Source: Fresh Facts 2012

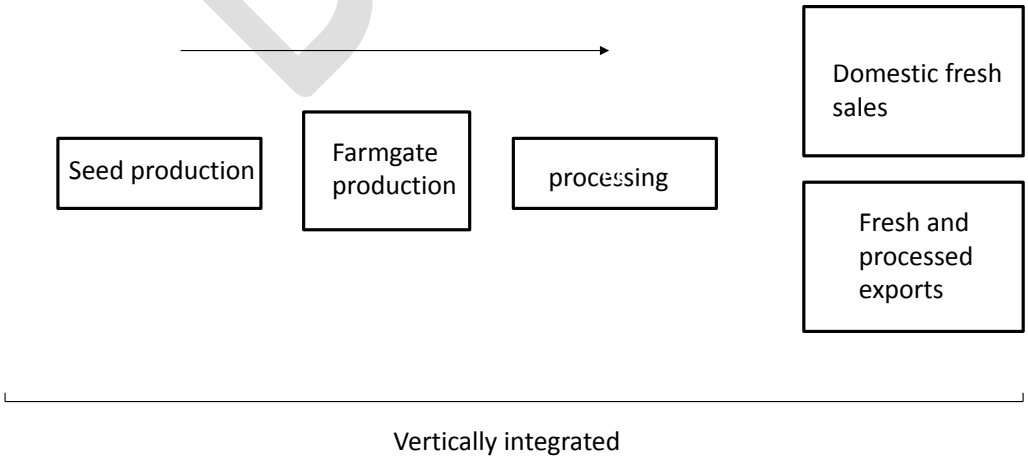
D.55 Tea (*Camellia sinensis*)

Tea (*Camellia sinensis*) is a relatively new venture in New Zealand and is based around one Waikato business growing tea for the Chinese and Asian markets (Zealong).

Export data for 2012 is available but other information on the industry is scarce. We have used industry assumptions to generate information for the industry.

Below we have set out the marketing chain for tea

Figure 58 Tea value chain



Source: NZIER

D.55.1 Trees/root stock production

Zealong have established a nursery to supply their operations. We estimate that the value of nursery plantings are approximately $0.01 million or 1% of the estimated farmgate returns.

D.55.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately half of domestic and export sales. Domestic and export sales of tea were approximately $2.3 million (Statistics New Zealand HS code 0902 and estimates of domestic sales).

Table 160 Tea value at farmgate

	Domestic + export sales	Adjustment factor	Farmgate value estimate
Tea farmgate value	$2.3 million	0.5	$1.1 million[1]
Note (1) Numbers rounded.			

Source: Statistics New Zealand and NZIER estimates

D.55.3 Processing

The companies in the industry tightly hold the processing value information. We have used domestic and export sale estimates multiplied by 25% to estimate the size of the processing industry.

Table 161 Estimated tea processing value

	Domestic plus export sales	Adjustment factor	Farmgate value estimate
Estimated rubus processing value	$2.3 million	0.25	$0.6 million[1]
Note (1) Numbers rounded.			

Source: Statistics New Zealand and NZIER estimates

D.55.4 Domestic sales

We have no reliable information on domestic tea sales. We have looked at other similar sized industries (e.g. sphagnum moss, parsnips, and blackcurrants) to estimate the possible size of the industry. No more than 20% of sales are expected to be in the domestic market (or $0.5 million).

D.55.5 Export sales

Statistics New Zealand report that tea exports were $1.8 million in 2012 (HS code 0902).

D.55.6 Summary

Table 162 sets out the contribution of tea to the New Zealand economy.

Table 162 Tea summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.01 million)	100%	0.39	$0.004 million
Farmgate ($1.1 million)	100%	0.39	$0.4 million
Processing value ($0.6 million)	100%	0.32	$0.2 million
Domestic sales ($0.5 million)	100%	0.18	$0.1 million
Exports (1.8 million)	100%	0.45	$0.8 million
Total GDP output share			**$1.5 million[1]**
Note (1) Numbers rounded.			

Source: Fresh Facts 2012

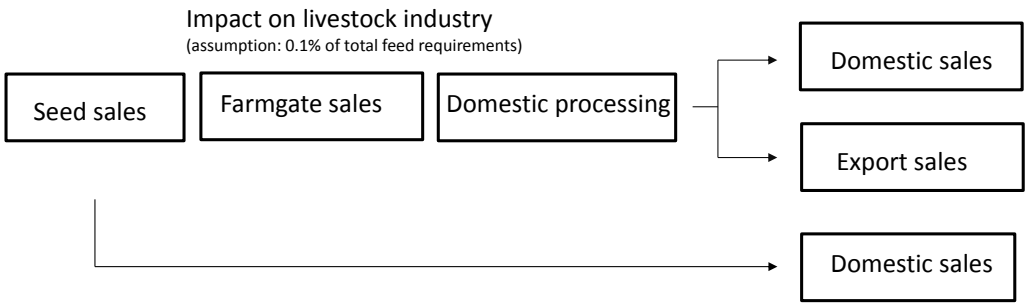
D.56 Timothy (*Phleum pratense*)

Timothy (*Phleum pratense*) is a very minor grass used as part of a grass mix in the colder and wetter regions of the South Island, mainly for beef pastures.

Below we set out the value chain for timothy.

Figure 59 Value chain for timothy

Note that other livestock industries include live animals, wool, dairy, meat processing, velvet and other co-products sold.



Source: NZIER

D.56.1 Seed and domestic sales production

Approximately 20 tonnes of timothy is produced in New Zealand with a value of $0.04 million in domestic sales (personal communication, Alan Stuart, PGG Wrightsons, 19th March 2015). Farmgate value is approximately half the domestic sales value ($0.02 million).

D.56.2 Dependent industry

We have assumed that most timothy is consumed by the beef industry. We have further assumed that it contributes 0.1% of the protein for the whole beef industry.

The value chain impacts for the dairy industry are set out below using Beef + Lamb New Zealand's estimates (personal communication, Mr Rob Davison, 5 June 2014) of farmgate value, processing, domestic and export sales.

Table 163 Estimated dairy value at each stage of the marketing chain

2012, $M

	Farmgate value	Processing estimate	Domestic sales estimate	Export value
Other traditional livestock values	$5,039.0 million	$6,701.9 million	$1,432.8 million	$6,882.1 million
Note (1) See Appendix B for gross output values.				

Source: Beef + Lamb New Zealand estimates and Statistics New Zealand

D.56.3 Summary

Table 164 sets out the contribution of timothy to the economy.

Table 164 Timothy summary

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Farmgate value ($0.02 million)	100%	0.39	$0.08 million
Timothy seed sales ($0.04 million)	100%	0.18	$0.07 million
Timothy impact on the beef industry[1]			
Farmgate Other livestock estimate ($5,039.0 million)	0.1%	0.48	$2.0 million
Other livestock processing estimate ($6,701.9 million)	0.1%	0.25	$1.7 million
Other livestock domestic sales estimate ($1,432.8 million)	0.1%	0.18	$3.3 million
Other livestock export estimate ($6,882.1 million)	0.1%	0.48	$3.3 million
GDP output share (total)			**$9.5 million**
Note (1) See Appendix B for gross output values of other traditional livestock			

Source: PGG Wrightsons

D.57 Tomatoes (*Solanum lycopersicum*)

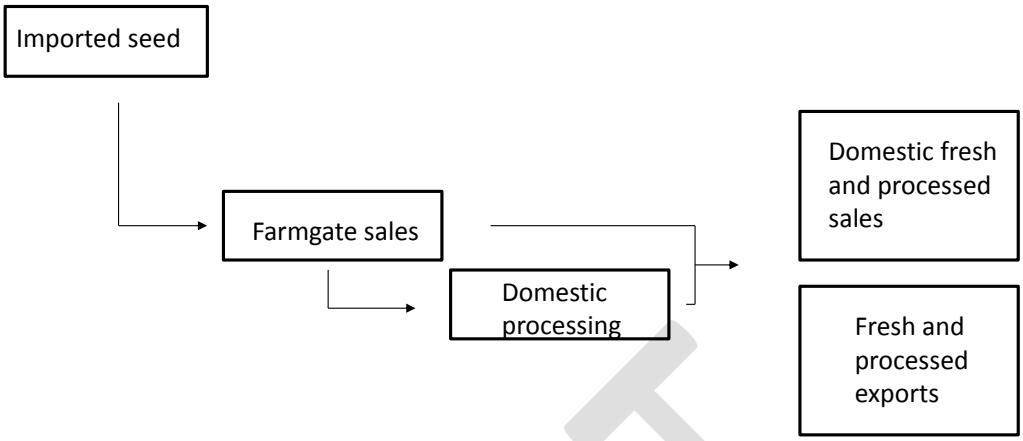
The tomato (*Solanum lycopersicum*) industry is based on covered production for fresh tomatoes (120 hectares in 2012) and outdoor production for processed tomatoes (757 hectares in 2012). Fresh tomato growers raise their plants in greenhouses and are based in Auckland, Pukekohe, Northland, Waikato, Bay of Plenty, Nelson and Canterbury. Processed tomatoes are mainly based in the Gisborne and Hawke's Bay regions.

In 2012 the trend for fresh tomatoes continued towards large tomato-growing enterprises of 20 hectares or more as the smaller players exited the industry. Some 150 growers produced 40,000 tonnes of tomatoes. Most fresh tomatoes are sold on the domestic market with a small export trade.

Good information exists on domestic and export sales. The amount sold in the processing markets is also known. Information on farmgate sales is based on industry assumptions and most commercial seed is imported.

Below we set out the value chain for tomatoes.

Figure 60 Tomato value chain



Source: NZIER

D.57.1 Seed production

Most tomato seeds are imported except for small quantities of heirloom tomato seeds grown for the domestic sector (personal communication, Lex Dillon, NZ Hothouse Ltd, 13 March 2015).

D.57.2 Farmgate

Horticulture New Zealand estimates that for many horticultural industries farmgate prices are approximately half of domestic and export sales. Domestic and export sales of tomatoes were approximately $127.8 million (Fresh Facts 2012, p14).

Table 165 Tomato value at farmgate

	Domestic and export sales	Adjustment factor	Farmgate value estimate
Tomato farmgate value	$127.8 million	0.5	$63.9 million

Source: Fresh Facts

D.57.3 Processing

The companies in the industry tightly hold processing value information. However, domestic sales of processed tomatoes are estimated at $8.4 million (Fresh Facts 2012, p16). To estimate the gross output from the processing sector we have used the domestic sales figure from processed tomatoes less an estimated retail margin of 28% equalling $6.1 million (NZIER estimate based on established retail margins).[67]

D.57.4 Domestic sales

[67] New Zealand Retailers Association 2013, p16.

Domestic sales of fresh and processed tomatoes were approximately $113.0 million (Fresh Facts 2012, p16).

D.57.5 Export sales

Exports sales of fresh and processed tomatoes were approximately $14.8 million (Fresh Facts 2012, p14).

D.57.6 Summary

Table 166 sets out the contribution of tomatoes to the New Zealand economy.

Table 166 Tomato summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Seed sales	100%	0.39	Mainly imported
Farmgate ($63.9 million)	100%	0.39	$24.9 million
Processing value ($6.1 million)	100%	0.32	$1.9 million
Domestic sales ($113.0 million)	100%	0.18	$20.3 million
Exports (14.8 million)	100%	0.45	$6.6 million
Total GDP output share			**$53.9 million**[1]
Note (1) Numbers rounded.			

Source: Fresh Facts 2012

D.58 Tulips (*Tulipa* species)

Tulip (*Tulipa* species) production is heavily focused on the export market. In recent years tulip bulb producers have filled an off-season niche within Europe increasing exports albeit from a low base.

As with other bulb industries, estimating total value is hampered by the large number of differing marketing channels used (e.g. supermarkets, agents, direct buying etc.). Therefore we have relied on industry experts to give a general indication of value at each stage of the process.

The following figure sets out the marketing chain for tulips.

Figure 61 Tulip value chain

Source: NZIER

D.58.1 Bulb production

We have no official information on tulip bulb production. As with other flower production, businesses are vertically integrated. Bulbs for the next season are produced at the same time as this year's production and multiplied up or bought from other growers.

The approximate cost or 'best guess' of the value of this process was approximately $0.6 million (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014 and NZIER estimate).

D.58.2 Farmgate

Farmgate estimates are also hard to estimate for the same reason. The best guess by the industry is approximately $6.2 million (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014). Furthermore, the sales channels are numerous with each channel having a different pricing strategy complicating estimates for farmgate production.

D.58.3 Domestic sales

Domestic sales are estimated at $3.0 million. This is a highly approximate figure based on 60 million bulbs sold at 0.05 cents per bulb (personal communication, Andre der Kwaak, GM FloraMax, 28 November 2014).

D.58.4 Export sales

Fresh Facts (2012, p20) estimates the export sales of tulip bulbs as $9.3 million.

D.58.5 Summary

Table 167 sets out the GDP output share of tulip bulbs to the New Zealand economy.

Table 167 Tulip bulbs summary

2012, June year, $ M per annum

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Nursery sales ($0.6 million)	100%	0.39	$0.2
Farmgate ($6.2 million)	100%	0.39	$2.4 million
Domestic sales ($3.0 million)	100%	0.18	$0.5 million
Exports (9.3 million)	100%	0.45	$4.5 million
Total GDP output share			**$7.4 million**[1]
Note (1) Numbers rounded.			

Source: Fresh Facts 2012, FloraMax

D.59 Wheat (*Triticum*)

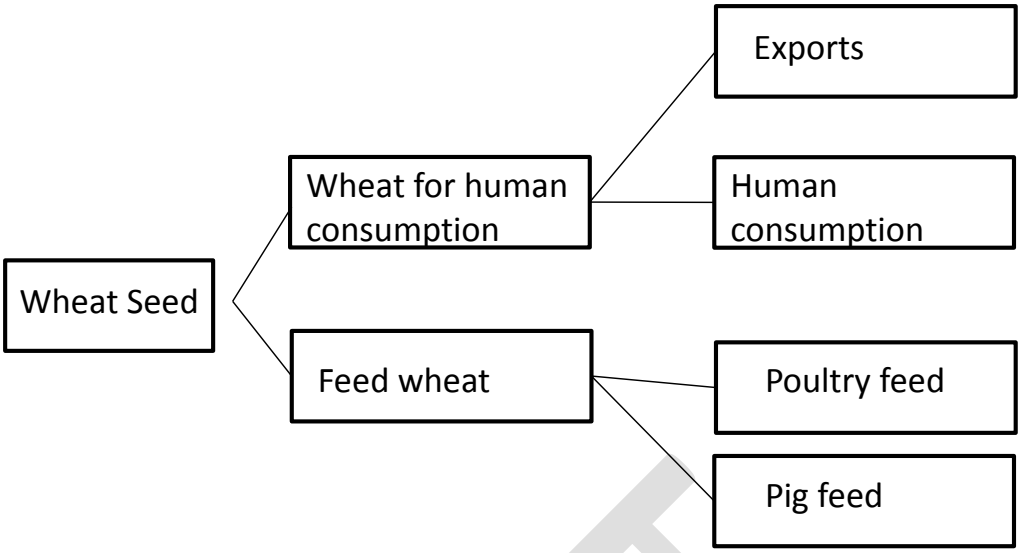
This analysis of wheat includes both *Triticum aestivum* and *T. durum*. Wheat arrived with European settlement. In the 19th century, wheat was the major crop in New Zealand. Its long decline began with refrigeration as other land uses became more competitive. Deregulation in the late 1980s has reduced the wheat crop further as it now has to compete with imported Australian wheat.

Feed wheat is grown in the North Island, while wheat for baking purposes is mainly grown in the Canterbury region.

Good information is available on wheat seed and farmgate value. This has been driven by a FAR initiative to improve the quality of data at the farmgate through the AIMI survey. Information on human consumption is not well documented because of the large number of uses of wheat and information on processing costs is closely guarded. Information on the impact on livestock industries is well documented.

Below we set out the value chain for wheat and its dependent industries.

Figure 62 Wheat value chain



Source: NZIER

D.59.1 Wheat seed production

Estimates for feed wheat and milling wheat are based on tonnes grown for each market and are set out in the following Table.

Table 168 Wheat seed sales

	Tonnes of wheat seed (percentage of wheat seed sold for each market)[1]	Price[2]	Value
Milling wheat	2,088 (32%)	$480 per tonne	$1.0 million
Feed wheat	4,418 (68%)	$430 per tonne	$1.9 million
Total			**$2.9 million**
Notes (1) Wheat seed sold in 2011: 6,500 tonnes, Hampton et al 2012, p131. (2) Lincoln Financial Budget Manual 2012/2013 pA49 to A51. (3) Numbers rounded.			

Source: Hampton et al 2012 and Lincoln Financial Budget Manual 2012/13

D.59.2 Farmgate

Farmgate value is estimated as $203.3 million in the 2012 year. The calculations are set out in Table 169.

Table 169 Wheat farmgate values

	Tonnes of wheat sold[1]	Price[2]	Value
Milling wheat	156,950	$450 per tonne	$70.6 million
Feed wheat	331,650	$400 per tonne	$132.7 million
Total			**$203.3 million[3]**
Notes (1) AIMI 2013 (2) Lincoln Financial Budget Manual 2012/2013 pA49 to A51. (3) Numbers rounded.			

Source: Hampton et al 2012 and Lincoln Financial Budget Manual 2012/13

D.59.3 Dependent industries

Human consumption

Estimates for processing, domestic sales and exports are set out in Table 170.

Table 170 Wheat values

	Sales	Conversation factor	Value
Processing	$142.3 million[1]	0.25[3]	$35.6 million
Domestic sales	$70.6 million[2]	2[4]	$141.3 million
Exports[5]			$1.1 million[6]
Notes (1) Domestic sales plus exports. (2) Milling wheat sold at farmgate. (3) Horticulture New Zealand's assumption that processing is approximately 25% of domestic and export sales. (4) Horticulture New Zealand's general assumption that domestic sales are twice farmgate values. (5) Statistics New Zealand. (6) Numbers rounded.			

Source: Statistics New Zealand, NZIER

Feed wheat

We have assumed that most feed wheat enters the poultry and pig industries. From the New Zealand Feed Manufacturers Association[68] we know that nearly 59% of all protein used in these industries is sourced from the wheat industry.

Farmgate value for the pork and poultry industries are estimates taken from industry publications and communications with New Zealand Pork and the Poultry Industry Association of New Zealand.

[68] http://nzfma.org.nz/media/reference/feed-manufacture/2013-annual-nzfma-feed-overview

Table 171 Farmgate value

$ M, June year 2012

Sector	Estimated farmgate value ($m)	Impact of wheat[1]	Value ($m)
Layer-hen feed[2]	$148.0 million	0.588	$87.0 million
Poultry feed[2]	$1,000.0 million	0.588	$588.0 million
Pig feed[3]	$176.6 million	0.588	$103.8 million
Total	**$1,324.6 million**		**$778.9 million**
Notes: (1) http://nzfma.org.nz/media/reference/feed-manufacture/2013-annual-nzfma-feed-overview (2) pers comm, Mr Steven Kerr, Poultry Industry Association of New Zealand, 24 July 2014. (3) pers comm, Mr Ian Braugh, New Zealand Pork, 12 August 2014. (4) Also see Appendix B.			

Source: Poultry Industry Association of New Zealand, NZ Feed Manufacturers Association and New Zealand Pork

Processing

Processing margins are based on assumptions from other livestock industries such as Beef + Lamb New Zealand and Horticulture New Zealand (personal communications, Mr Rob Davison, Beef + Lamb New Zealand, 30 July 2014 and John Seymour, Horticulture New Zealand, 12 December 2014) and are set out in Table 172. The processing margin is an estimate for the value of the poultry processing sector. Pork processing cost data (11.7%) was obtained from New Zealand Pork (personal communication, Mr Ian Braugh, 12 August 2014).

Table 172 Wheat processing

$ M, June year 2012

Sector	Estimated processing value of each industry[2]	Impact of wheat[1]	Industry values
Layer-hen feed	$189.4m x 33% = $62.5m	0.588	$36.8 million
Poultry feed	$1,280m x 33% = $422.4m	0.588	$248.4 million
Pig feed[3]	$200m x 11.7% = $23.4m	0.588	$13.8 million
Estimated total value	**$ 508.3 million**	**0.588**	**$298.9 million[4]**
Notes: (1) NZ Feed Manufacturers Association (2015). (2) Estimates are based on pers comm with Mr Rob Davison Beef + Lamb New Zealand, 30 July 2014. (3) Processing costs for pigs are estimated by New Zealand Pork at 11.7% (pers comm, Mr Ian Braugh, 12 August 2014). (4) Numbers rounded.			

Source: Beef + Lamb New Zealand, Poultry Industry Association of New Zealand and New Zealand Pork

Domestic consumption

The domestic retail margin is estimated at approximately 128% of farmgate value (New Zealand Retailers Association 2013). Therefore, the total domestic sales value is the

sum of each subsector value (farmgate value multiplied by impact of barley), plus an additional 28%.

Table 173 Domestic sales value

$ M, June 2012

Sector	Estimated value of retail sales[1]	Impact of wheat	Value
Hen-layer feed	$148m x 1.28 = $189m	0.588	$111.4 million
Poultry growers	$1,000m x 1.28 = $1,280m	0.588	$752.6 million
Pigs	$226.6m x 1.28 =	0.588	$132.9 million
Estimated total value	**$1,695.5 million**	**0.588**	**$997.0 million[2]**
Note (1) New Zealand Retailers Association (2013, p16) suggests that meat retail margins are around 28%. (2) Numbers rounded. (3) Also see Appendix B.			

Source: Beef + Lamb New Zealand, Poultry Industry Association of New Zealand and New Zealand Pork

D.59.4 Summary

Table 174 sets out the contribution of wheat to the New Zealand economy.

Table 174 Wheat summary

2012, $ M

Gross Output (price multiplied by quantity at stage of production)	Impact of plant species on industry or stage in value chain	Share of output value (attributable to stage in value chain) that contributes to GDP	Impact of the plant species on GDP
Wheat production			
Domestic seed production ($2.9 million)	100%	0.39	$1.1 million
Farmgate value ($203.3 million)	100%	0.39	$79.3 million
Wheat production for human consumption			
Processing ($35.6 million)	100%	0.32	$11.4 million
Domestic sales ($141.3 million)	100%	0.18	$25.4 million
Export sales ($1.1 million)	100%	0.45	$0.5 million
Wheat production as an input into various industries (feed wheat)[1]			
Farmgate (pig and poultry livestock, $1,324.6 million)	58.8%	0.24	$186.9 million
Processing (pig and poultry livestock, $508.3 million)	58.8%	0.68	$203.2 million
Domestic sales (pig and poultry livestock, $1,695.5 million)	58.8%	0.12	$119.6 million
Total			**627.5 million**
Note see Appendix B for gross output values of pigs and poultry and the various stages of the production chain.			

Source: Beef + Lamb New Zealand, DairyNZ, Poultry Industry Association of New Zealand and New Zealand Pork

Appendix E References

E.1 Appendix A, B & C references

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