

# Economic Impact Assessment of Arable Production in 2013

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## Background

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## Arable production in 2013

*Arable production is a significant contributor to the New Zealand economy. It added over \$1.0 billion in total to GDP in 2013. The direct sales value from arable production was \$923 million. When the indirect impacts to suppliers of arable producers are added, the direct and 'upstream' value of sales was nearly \$2.5 billion.*

*Employment of almost 14,000 FTEs in total in the the arable industry is similar to the employment in fruit-growing, including kiwifruit, apples and pears. It is not much less than the number directly employed in the dairy farming industry.*

*Productivity in grain growing increased by 18% in 2013. The area grown in grain reduced and the average yield of grain per hectare, or productivity increased by more, so total production and value of production increased. The industry got more from less.*

*Dairying and the rest of the pastoral livestock industry purchased feed worth an estimated \$368 million from the grain cropping and maize silage producers in 2013. The downstream value of milk, dairy products and meat and wool generated by this feed would be substantial, but is not included in our impact estimates.*

*Specialist grains and seeds feature now in value added products being generated for the local market as well as for export. These include health and exercise bars, muesli bars, and baking products like frozen croissant and ancient grains dough.*

*Seed production has developed a higher level of technology to support breeding new plant cultivars. Now the transfer from breeders to multiplication growers and final seed sales often involve businesses on opposite sides of the world.*

*The value of vegetable seeds produced (excluding brassica seeds) increased by 60% in 2013, to be worth \$66 million. Vegetable seeds, especially carrots and radish seeds are now major players alongside the traditional stalwarts, grass seeds worth \$106 million, and legumes especially white clover worth \$33 million.*

*The total value of sales generated by the seeds industry including the 'upstream' sales of suppliers to the industry, add a total value over \$650 million, up by 10% on the 2011 figure of \$594 million.*

*Forage brassicas cover the largest area of any crop in New Zealand. The 300,000 hectares of forage brassicas grow from seeds produced in New Zealand and provide supplementary feed in the livestock industry. Estimates indicate that the farm gate value of meat and milk solids produced from these forage brassicas are worth over \$700 million per year. This is a 'downstream' value and is not included in our impact estimates.*

*Other downstream industries to benefit from the New Zealand grown seeds include horticulture, especially market gardening, and all the retailers, restaurants, fast food outlets and exporters of vegetables.*

## Summary

In New Zealand, arable production is taken to be the industry that grows crops under cultivation to supply to industries that process these crops for use in other industries such as livestock production or for human food preparation. Arable production is broadly grouped into grain crops and seeds. In the grain crops we include maize grown for silage. It is harvested and sold for stockfeed.

Arable production is again a significant contributor to New Zealand's economy.

Grain production made up 74 percent (\$1.82 billion) of the overall direct and upstream economic impacts of arable production sales in 2013. Seed production made up the remaining 26 percent (\$653 million).

Overall arable production sales in 2013 (\$2.47 billion) were 6 percent higher than they were in 2011 (\$2.34 billion).

Direct and upstream grain production value added in 2013 was \$750 million while seed production made up the remaining \$270 million of arable productions contribution to GDP.

### Summary of arable production economic impacts, 2013

	2013			2011
	Tonnes	Total Value (\$Millions)	With Indirect Impacts (\$Million)	With total impacts (\$million)
<b>Gross output (\$M)</b>				
Grain production	2,248,531	\$678.6	\$1,435.4	\$1,815.9
Seeds	88,959	\$244.1	\$516.3	\$653.2
<b>Total</b>	<b>2,337,490</b>	<b>\$922.7</b>	<b>\$1,951.8</b>	<b>\$2,469.1</b>
<b>GDP (\$M)</b>				
Grain production		\$239.0	\$562.1	\$719.7
Seeds		\$86.0	\$202.2	\$245.3
<b>Total</b>		<b>\$325.0</b>	<b>\$764.3</b>	<b>\$965.1</b>
<b>Employment (FTEs)</b>				
Grain production		4,144	8,031	9,438
Seeds		1,491	2,889	3,217
<b>Total</b>		<b>5,635</b>	<b>10,919</b>	<b>12,655</b>

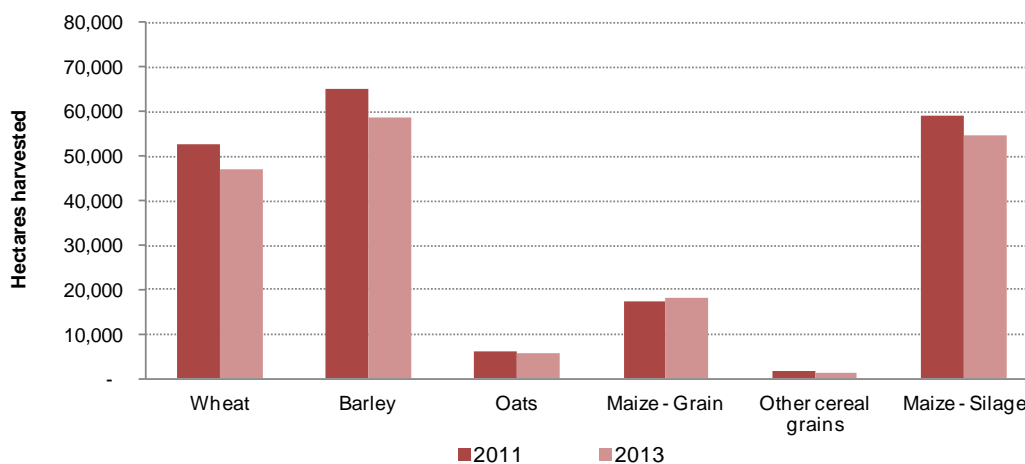
## Grain crops in 2013

### Hectares harvested

In 2013, 131,000 hectares of grain crops were harvested. Barley and wheat made up the largest share of hectares of grain crops harvested, at about 50,000 to 60,000 hectares. Maize grown for silage was a similar area.

Total grain crop hectares harvested in 2013 were down 8 percent on 2011 levels (142,000 hectares).

**Hectares of grain crops harvested, 2011 and 2013**



Source: Statistics New Zealand; FAR; BERL calculations

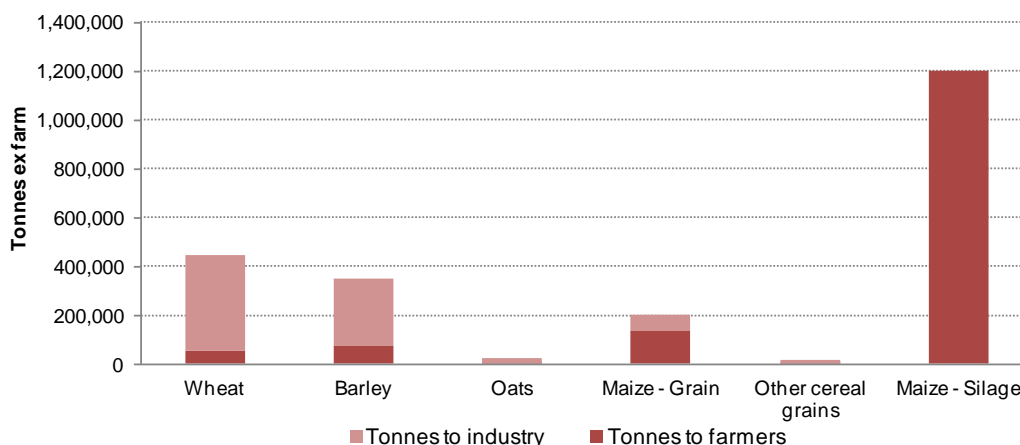
*Tonnes ex the farm*

There were 1.04 million tonnes of grain sold ex the farm in 2013. About one-quarter of this was sold to other farmers (274,000 tonnes), and three quarters sold to industry (768,000 tonnes).

There were 1.2 million tonnes of maize silage sold ex the farm, all of it to other farmers

Tonnes of grain ex the farm in 2013 were down 4 percent on 2011 levels, and maize silage down 7%.

**Grain and silage sold to farmers and industry, 2013**

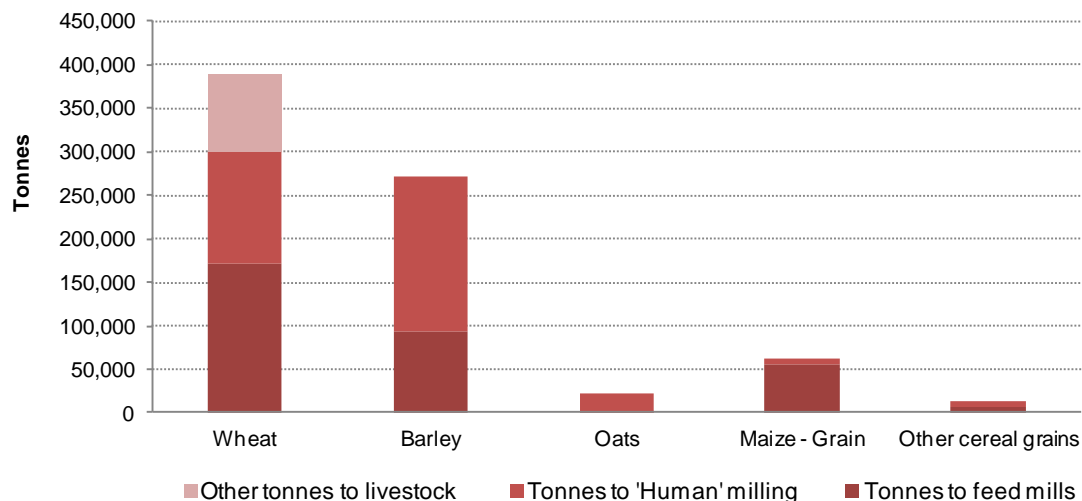


Source: FAR; AIMI; BERL calculations

### Grain and silage flows

Of the 757,000 production tonnes of grain sold to industry in 2013, 57 percent went to flour and malt mills (62 percent in 2011) and 43 percent went to animal feed mills (38 percent in 2011).

#### Production grain flows, 2013



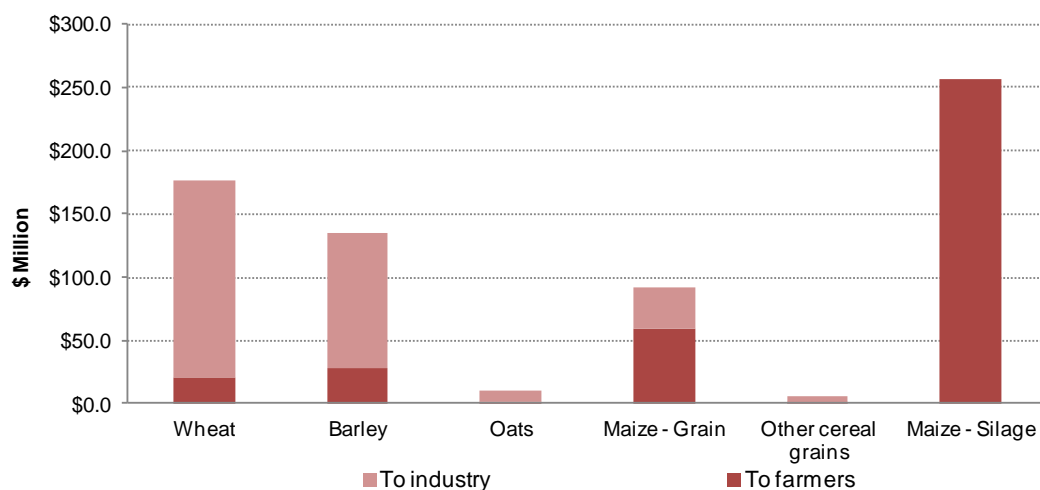
Source: FAR; AIMI; AQ; FAR; BERL calculations

### Value of sales of grain and silage

The sales value of grain in 2013 was \$421 million. Of this, \$110 million (one quarter) was to farmers and \$311 million was to industry. Maize silage sales in 2013 was worth \$257 million, all sold to farmers.

The value of grain sales in 2013 was up 7 percent on 2011 (\$392 million), and value of maize silage sales about the same (\$259 million).

#### Value of sales of grain and silage, 2013



Source: FAR; various; BERL calculations

*Direct and upstream economic impact of grains and silage*

The value of grain and silage sales (the direct impact) of \$679 million in 2013 is multiplied up to \$1.82 billion when the indirect impacts on upstream suppliers and associated impacts on household expenditure are taken into account. This is 4 percent higher than the 2011 level of \$1.72 billion.

The \$679 million of sales directly in 2013 generated \$239 million of value added. When upstream impacts are factored in, the additional GDP generated in 2013 was \$750 million. Total GDP generated in 2011 from grains was \$720 million.

There were approximately 4,100 FTEs employed in grain production in 2013. When upstream impacts are taken into account, total employment in 2013 in grain production was 9,800 FTEs.

***Direct and upstream economic impact of grains and silage, 2013***

	2013			2011
	Total Value (\$Millions)	With Indirect Impacts (\$Million)	With total impacts (\$million)	With total impacts (\$million)
Gross output (\$M)	\$678.6	\$1,435.4	\$1,815.9	\$1,742.7
GDP (\$M)	\$239.0	\$562.1	\$750.0	\$719.7
Employment (FTEs)	4,144	8,031	9,834	9,438

Source: BERL calculations

*Downstream economic impact*

Downstream industries that rely on arable production are varied and range from brewing (barley) to the fast food industry that uses pork and poultry fed on feed formulations including grains like maize. BERL believes that the economic impact of arable production on these downstream industries, while not quantified in this report, to be large.

The downstream uses of grain and silage has broadened in recent years. In the past animal feeds were formulated mainly for intensive industries such as meat chicken, egg producers and piggeries.

More recently the pastoral ruminant livestock industries like dairying have become more intensive with use of feeds such as imported palm kernel (PKE or palm kernel expeller), and greater volumes of maize silage, cereal silage, pure grains and formulated feeds and grains.

The grain millers and processors are also now producing specialised value added products. The latter include health and exercise bars, muesli bars, and baking products like frozen croissant and ancient grains dough.

## Seeds in 2013

An important activity in the arable sector is seed production. This sector has two main markets, the first is certified seed which is ‘certified’ to be purely of a single species, and will be purchased generally by farmers aiming to multiply the volume for sale to other producers. The second type is what we call ‘production’ seed and is that sold as generally of a single species or cultivar, but may possibly have some seeds of another in it. It is nevertheless perfectly suitable for general use in production.

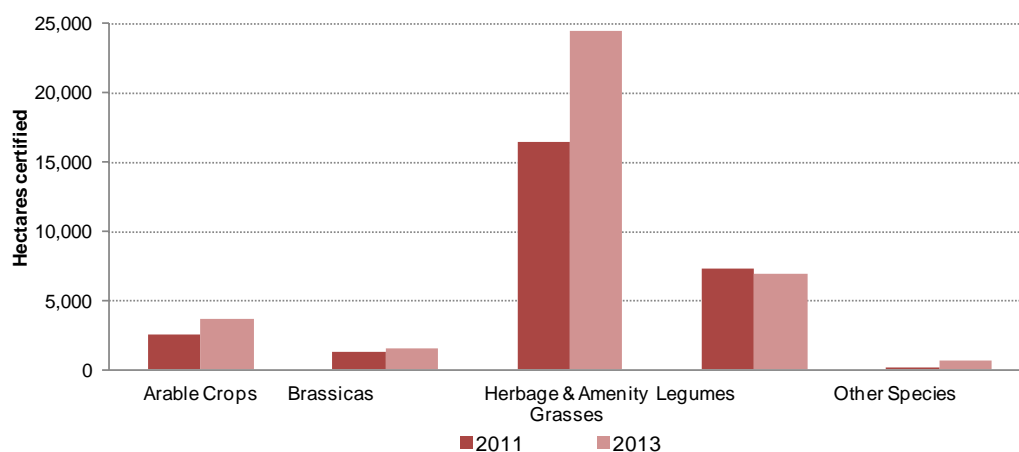
The seed sector has developed significantly over recent years, with the value of traditional stalwarts of grass seeds worth \$106 million, and legume seeds (mainly white clover) worth \$33 million being joined by vegetable seeds, especially carrots and radish seeds worth \$66 million in 2013.

### Certified Seed

In 2013, a total of 37,200 hectares of seed crops were entered for certification. Two thirds of the area entered for certification of seed was in herbage and amenity grasses (24,500 hectares). These were dominated by the hectares of Perennial (14,245), Italian (3,785) and Hybrid (3,128) ryegrass.

Hectares entered with certified seed in 2013 were up 33 percent on 2011 (27,800 hectares).

### Area entered for certification of seed, 2011 and 2013



Source: AsureQuality; BERL calculations

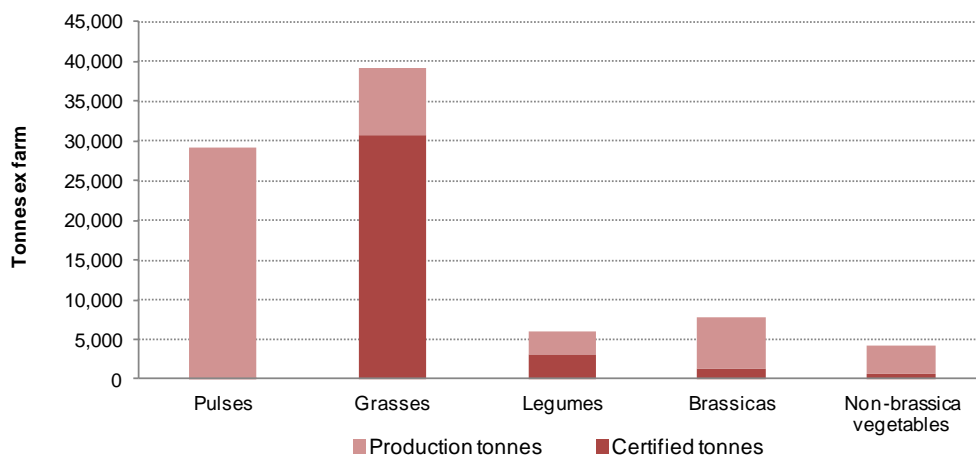
### Seed production

There were 89,000 tonnes of seed ex the farm in 2013 down 23 percent from 2011 (115,700 tonnes). Despite the decline in tonnes of seed ex the farm between 2011 and 2013, overall tonnes of certified seeds increased by 8,000 (29 percent).

Certified seeds made up 40 percent of total seeds produced by weight in 2013, up from 24 percent in 2011. The majority of certified seed produced in 2013 were grasses (83 percent).



**Certified seed and production seed produced, 2013**



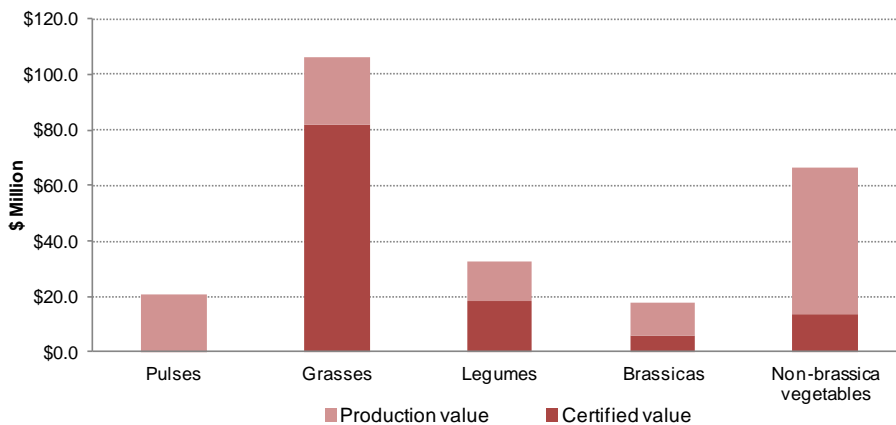
Source: FAR; AsureQuality; Statistics New Zealand; BERL calculations

*Value of seed production sales*

The overall value of seeds sales in 2013 was \$244 million. While certified seeds only making up 40 percent of total seeds produced by weight, the value of certified seeds was 49 percent of the total value of seeds sales (\$120 million).

The value of seed sales in 2013 was up 10% from \$222 million in 2011.

**Value of seed production, 2013**



Source: FAR; AsureQuality; BERL calculations

*Direct and upstream economic impact of seed production*

The value of seed sales (the direct impact) of \$244 in 2013 is multiplied up to \$653 million when the indirect impacts on upstream suppliers and increased household expenditure are taken into account. This is 10 percent higher than the 2011 level of \$594 million.

The \$244 million of sales directly generated \$86 million of value added in 2013. When upstream impacts are factored in, the additional GDP generated in 2013 was \$270 million. Total GDP generated in 2011 from grains was \$245 million.

There were approximately 1,500 FTEs employed in grain production in 2013. When upstream impacts are taken into account, total employment in 2013 in seed production was 3,200 FTEs.

**Direct and upstream economic impact of Seeds production, 2013**

	2013			2011
	Total Value (\$Millions)	With Indirect Impacts (\$Million)	With total impacts (\$million)	With total impacts (\$million)
Gross output (\$M)	\$244.1	\$516.3	\$653.2	\$594.0
GDP (\$M)	\$86.0	\$202.2	\$269.8	\$245.3
Employment (FTEs)	1,491	2,889	3,537	3,217

Source: BERL calculations

*Downstream economic impact*

While the downstream economic impact of seed production is not quantified in this report, BERL believes that the economic impact of seeds on downstream industries to be large. Downstream industries that rely of seeds produced in New Zealand include those associated with pastoral livestock production where the sheep and cows are fed on grasses and forage brassicas grown from New Zealand seeds.

The forage brassicas cover 300,000 hectares grown each year. This is the largest area of any crop in New Zealand, and provides supplementary feed to livestock. It has been estimated that the meat and milk solids produced from those forage brassicas have a farm gate value of over \$700 million.

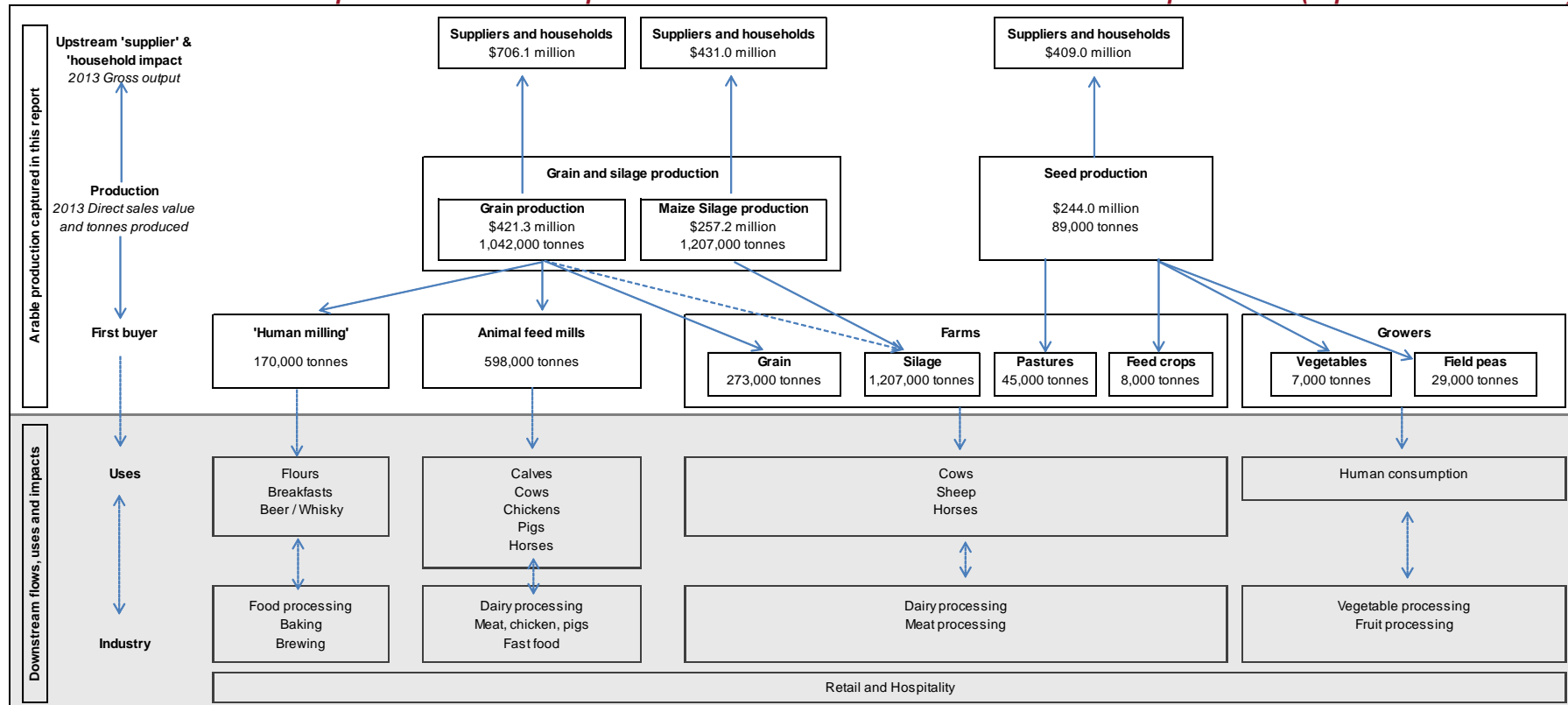
Other downstream seed users are the horticulture / market gardening industries. Downstream benefits therefore also accrue to retailers, exporters and restaurants/fast food outlets.

These downstream benefits are not included in our estimates of the impacts of arable seed production.

# Arable production flows

This report looks at arable production New Zealand in 2013 and estimates the direct, upstream and household impacts of arable production to the New Zealand economy. As the flow diagram below indicates, we believe that these arable products also have a considerable economic impact on downstream industries. BERL is keen to work with AFIC to identify the downstream uses of arable products and the associated economic impact. This would require further investigation into the industry structures of animal feed producers, grain millers and processors and of the animal production and human food industries they supply.

**Estimated 2013 direct and upstream economic impacts and indicative flows downstream of arable production (export is not included)**



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# 1 Introduction

This report has been prepared for the Arable Food Industry Council (AFIC), a Council which combines the interests of a number of groups serving the arable industry. It provides a comprehensive overview of the diverse arable production activities in New Zealand in 2013 and the associated direct and 'upstream' impact to the New Zealand economy.

This report is an update of the '*Economic Impact Assessment of Arable Production*' report that BERL completed for AFIC in 2012. The 2012 BERL report provided an economic assessment of arable production in New Zealand in 2011. Where practical, 2011 levels and estimates are provided for comparative purposes.<sup>1</sup>

## 1.1 Objective

The objective of this study is to define the core of the arable industry in terms of the arable producers and through to the mills and export. The analysis of this consistent production data set can then estimate the upstream impact of the arable production on the economy through the suppliers of goods and services to the arable producers.

## 1.2 Scope of the report

The arable production industry in the report is taken to be the industry that grows crops under cultivation to supply to those that process these crops for use in other industries such as livestock production or for human food preparation. There is a range of information available from a number of sources on different parts of the industry, and the data generated by these sources are not always consistent with each other.

Using the definition of arable production, existing data sources are used to estimate the direct and upstream impact of arable production. Upstream impacts captured are those through the supply of goods and services to arable producers. As was the case in the economic analysis that BERL provided AFIC of 2011 arable production, the economic impact of the downstream users of arable products are not included. Downstream industries that rely on arable production are varied and range from beer production and retail (barley) to the fast food industry that uses pork and poultry fed on, for example, wheat. The downstream economic impact of arable production is out of the scope of this report to enable comparability with the earlier economic analysis of 2011 arable production.

BERL notes that it is possible to capture the economic impact of the downstream users of arable products and is keen to work with AFIC on this as we believe the downstream economic impacts of arable production to be large. We believe that this would require research into industry structures of animal feed producers, grain millers and processors and of animal production and human food industries that they supply.

## 1.3 Sources of information used

Key information on various aspects of arable production in New Zealand used in this report is sourced from the following organisations

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<sup>1</sup> 2011 figures presented in this report may differ from those presented in the BERL (2012) '*Economic Impact Assessment of Arable Production*' report. The 2012 report drew on data from a wide range of sources, many of which have since been revised.

- **Statistics New Zealand (Stats NZ)** collects information on a range of aspects of arable production in New Zealand through various surveys and Censuses of agricultural production. Stats NZ have estimates of area and tonnages harvested for main crops. Stats NZ also provide the detailed export information on quantities and values of exports from New Zealand. For seeds the certified and uncertified seed types are recorded separately. This information enables estimates of average export prices per kilogram at FOB for a detailed range of grain and seeds.
- The **Foundation for Arable Research (FAR)** is a levy-funded research organisation. As part of its levy-collection function FAR collects detailed information on the volume of sales and value of all grain and seed. The levy on these values is collected at first point of sale, either to industry, or to another grower. This information on volume and value also enables an estimate of average prices per kilogram or tonne at each point of sale.
- **AssureQuality**: is responsible for operating the Seed Certification scheme in New Zealand. They therefore have information for each cultivar of each species on the number of sites entered for seed certification, the total area in hectares, and the weight of certified seed dressed, coming from the sites entered in the scheme. Taken with the total production information from the FAR levy data, this enables separation into certified and uncertified production.
- **Arable Industry Marketing Initiative (AIMI)** has begun collecting a range of information on the main grains, including the areas, production, stocks on hand, and marketing channels including feed grains and milling grains.
- The **New Zealand Feed Manufacturing Association (NZFMA)** collects detailed information on use of local product and imports for compound animal feed manufacture in both the North Island and South Island. The NZFMA includes most of the major players in the industry, and so provides an accurate estimate of the volumes of grains going into compound feed manufacture.

In addition to the above sources, we obtained limited information from individual industry players, mainly to cross check our interpretations from the above sources. The objective of this study was to estimate the economic impact from readily available industry information. It was not resourced sufficiently to complete research into specific production areas.

Following feedback from the industry and AFIC, we have based our analyses on the levy information from FAR for the 2013 year, and used other sources to estimate volumes and value going to different uses as shown in later sections.

## 1.4 Report structure

This report has two key sections:

- Section 2 provides an outline of arable production in 2013; and
- Section 3 uses information from Section 2 to estimate the direct and upstream economic impact of 2013 arable production in New Zealand.



## 2 Arable production in New Zealand

Arable production is an industry producing crops, in the main annual crops from cropping land. Arable production is defined to include everything that is grown and harvested as a crop. It includes all grains, all seeds and certain other plants grown as a crop, for example cereals and maize for silage and seeds of other crops e.g. fodder crops.

Historically, grain was the main crop in New Zealand and was a major export to fund development of the fledgling colony. As the livestock industry gained dominance, arable production tended to be subservient to livestock on farms. More recently, high quality, specialised arable production has grown, and is a very valuable part of the domestic and export economy. The high value part includes the grains, the specialised seed breeding, and more recently supplying grains and silage into the livestock industry, particularly the dairy industry.

In section 2.1 we examine grain production and in section 2.2 the seed production within the arable industry.

### 2.1 Grain Crops

In 2013, there were around 131,000 hectares of grains harvested, the largest areas being barley, 59,000 hectares, and wheat 47,000 hectares. There was 55,000 hectares of maize silage harvested. The areas of grains harvested in 2013 were 8 percent lower than two years earlier (142,000 hectares).

The 131,000 hectares of grains harvested in 2013 produced 1.09 million tonnes of grains, up 9% on the production in 2011 (1.0 million tonnes). The harvest and area numbers imply an increase in yield per hectare of grain by 18% from an overall average of 7 tonne to 8.3 tonne per hectare.

Table 2.1 shows the relationship between hectares harvested and tonnes ex the farm for grains and silage in 2011 and 2013.

**Table 2.1 Hectares and tonnes of arable grains and silage produced, 2011 and 2013**

Grain and silage types	Hectares		Tonnes harvested		Tonnes ex farm	
	Stats NZ/FAR		Stats NZ/FAR		FAR/ AIMI	
	2011	2013	2011	2013	2011	2013
<b>Wheat</b>	52,600	47,200	383,300	440,100	410,962	448,176
Milling					90,078	120,787
Feed					320,884	327,389
<b>Barley</b>	64,900	58,700	368,000	407,900	418,611	353,182
Malting					33,253	49,829
Feed					385,358	303,353
<b>Oats</b>	6,100	5,600	28,500	30,700	24,737	24,557
<b>Maize</b>						
Grain	17,269	18,100	210,200	201,600	210,200	201,600
<b>Other cereal grains</b>	1,700	1,400	9,500	8,800	16,933	14,516
<b>Sub-total grains</b>	142,569	131,000	999,500	1,089,100	1,081,443	1,042,031
<b>Maize silage</b>	59,018	54,841	1,298,394	1,206,500	1,298,394	1,206,500
<b>Total grains &amp; silage</b>	<b>201,587</b>	<b>185,841</b>	<b>2,297,894</b>	<b>2,295,600</b>	<b>2,379,837</b>	<b>2,248,531</b>

Source: Statistics New Zealand; FAR; AIMI; BERL calculations

### 2.1.1 Utilisation of grain crops

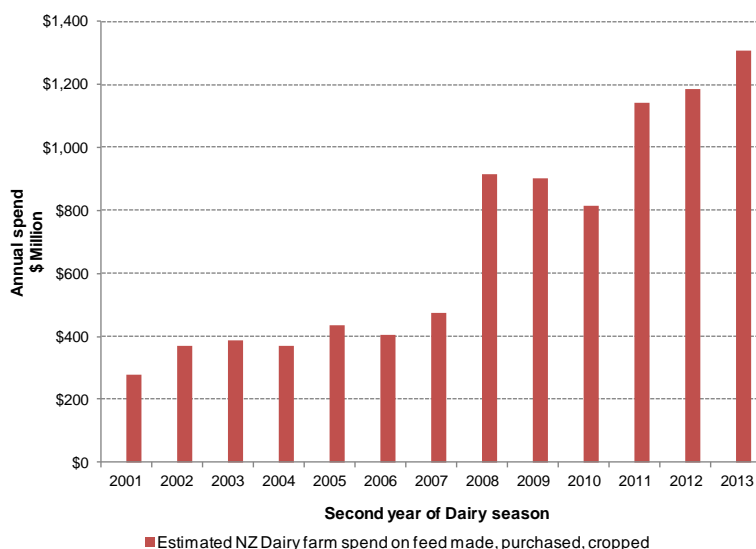
In our 2011 analysis, we attempted to integrate information from a number of sources to track grains through to their utilisation in the feed mills or the flour/malting mills industries. This initial draft framework indicated that there was a considerable volume of grain not accounted for in our estimates. Discussion among the main players in the industry indicates that there could be a significant change in structure of flows of grains in recent years. In particular there could be significant volumes of grain traded directly from the producing arable farmers to farmers using relatively unprocessed grain as animal feed.

### 2.1.2 Changing structure in grain flows

To explore the possibility that there has been a structural change in grain flows we have looked at information on animal feed usage in recent years by the dairy industry.

In order to test whether it is possible that there could be significant flows of grain direct to dairy farms as feed, we have estimated total dairy farm spending on feed for the years 2000-01 to 2012-13. The source data comes from the farm budgets in the *DairyNZ Economic Survey 2012-13* which show spending per cow on feed made, purchased and cropped. These per-cow figures were multiplied by the numbers of dairy cows in milk recorded in the *New Zealand Dairy Statistics 2012-13*. The estimates show spending at a level of \$370-\$370 million per year from 2002 to 2007, with a step change to \$800-900 million a year from 2008 to 2010 before a further step change in 2011. Spending has steadily increased from around \$1,150 million in 2011 to around \$1,300 million in 2013.

**Figure 2.1 Estimated spending on feed in New Zealand dairy farms, 2001-2013**



This is a very significant increase in the spending on animal feed on dairy farms. we investigated in 2012 ‘*Economic Impact Assessment of Arable Production*’ report, some of this increased spending comes from an in on-farm cropping, including feed maize, and an increase in the use of imported Palm oil kernel, expeller (PKE).

This information indicates that there has been a significant increase in spending on feed on New Zealand dairy farms. This increase could well include a major increase in purchase of unprocessed

grain obtained direct from arable farmers. To research this change further, the levy information from FAR has been separated into grain sold at first point of sale to another farmer or grower, separate from grain sold at first point of sale to industry. The former category includes any grains sold direct to for example, dairy farmers.

Table 2.2 shows that of the 1.04 million tonnes of grain sold ex the farms in 2013, about one-quarter (274,000 tonnes) were sold to other farmers and the rest was sold to industry (768,000 tonnes). There were 1.2 million tonnes of maize silage sold ex the farm, all of it to other farmers. Proportions of grains and silage sold to other farmers and to industry in 2013 are similar to those in 2011.

**Table 2.2 Grain and silage sold to farmers and industry, 2011 and 2013**

Grain and silage types	Tonnes ex farm		Tonnes to farmers		Tonnes to industry	
	FAR/ AIMI		FAR		FAR/ AIMI	
	2011	2013	2011	2013	2011	2013
<b>Wheat</b>	410,962	448,176	44,662	56,098	366,300	392,078
Milling	90,078	120,787	982	598	89,096	120,189
Feed	320,884	327,389	43,680	55,500	277,204	271,889
<b>Barley</b>	418,611	353,182	92,306	76,129	326,305	277,053
Malting	33,253	49,829	154	399	33,099	49,430
Feed	385,358	303,353	92,152	75,730	293,206	227,623
<b>Oats</b>	24,737	24,557	2,287	1,807	22,450	22,750
<b>Maize</b>						
Grain	210,200	201,600	128,565	139,411	81,635	62,189
<b>Other cereal grains</b>	16,933	14,516	1,832	747	15,101	13,769
<b>Sub-total grains</b>	<b>1,081,443</b>	<b>1,042,031</b>	<b>269,652</b>	<b>274,192</b>	<b>811,791</b>	<b>767,839</b>
<b>Maize silage</b>	<b>1,298,394</b>	<b>1,206,500</b>	<b>1,298,394</b>	<b>1,206,500</b>		
<b>Total grains and silage</b>	<b>2,379,837</b>	<b>2,248,531</b>	<b>1,568,046</b>	<b>1,480,692</b>	<b>811,791</b>	<b>767,839</b>

Source: FAR; AIMI; BERL calculations

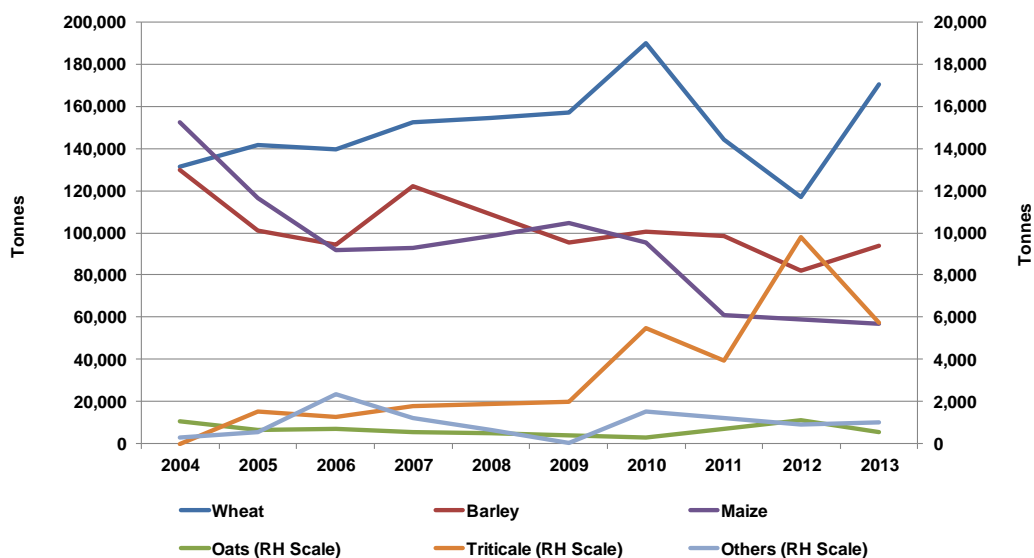
Section 2.1.4 outlines that grains and silage sold to farmers returned over \$368 million to the arable industry. This value is of a similar order-of-magnitude to the 'unallocated' amount estimated above to be spent on feed by the dairy farmers in recent years.

### 2.1.3 Use of grains in feed and food mills

The next step in our analysis of the utilisation of grains is to 'winnow off' the certified seed grains that will not be going to milling. This is achieved by deducting certified seed tonnes provided by AsureQuality from tonnes provided to industry. This provides us with 'production tonnes' of grains that go to milling.

Having identified the production grains that go to milling, we can now examine production grains that go into animal feed mills and those that go into flour and malt mills. The NZFMA holds information on production grains that go to feed mills. Figure 2.2 shows the amount of production grains that went to feed mills between 2004 and 2013.

**Figure 2.2 NZFMA usage of grains for feed, 2004 to 2013**



Source: NZFMA: BERL calculations

For the main grain components outlined Figure 2.2 there has been an increase in use of wheat for feed milling between 2004 and 2013 and a decline in usage of barley and maize for feed milling. For the minor grains, there has been an increase in use of triticale for feed milling.

We can also deduce the detailed information from the NZFMA on the tonnes of production grains that go to feed milling to estimate tonnes of production grains that go to human milling (largely flour and malt mills).

The steps outlined above and the associated volumes are summarised in Table 2.3. This indicates that of the 757,000 production tonnes of grain in 2013, 328,000 tonnes (43 percent) went to animal feed mills in 2013 and the remaining 430,000 tonnes (57 percent) went to flour and malt mills and other uses, not yet defined. In 2011, 38 percent of production grains went to animal feed mills while 62 percent went to flour and malt mills and other uses.

**Table 2.3 Grain and silage flows from farms to farms and to mills, 2011 and 2013**

Grain and silage	Tonnes ex farm		Tonnes to farmers		Tonnes to industry		Certified seed tonnes		Production tonnes		Tonnes to feed mill		Tonnes to 'Human' milling		Other tonnes to livestock	
	Source		FAR		FAR/AIMI		AQ		FAR/AIMI/AQ		NZFMA		FAR/AIMI/AQ/NZFMA			
	Year	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011
<b>Wheat</b>	410,962	448,176	44,662	56,098	366,300	392,078	2,360	2,994	363,940	389,084	144,183	170,722	130,000	130,000		
Milling	90,078	120,787	982	598	89,096	120,189										
Feed	320,884	327,389	43,680	55,500	277,204	271,889										
<b>Barley</b>	418,611	353,182	92,306	76,129	326,305	277,053	4,798	5,015	321,507	272,038	98,613	93,731	222,894	178,307		
Malt	33,253	49,829	154	399	33,099	49,430										
Feed	385,358	303,353	92,152	75,730	293,206	227,623										
<b>Oats</b>	24,737	24,557	2,287	1,807	22,450	22,750	1,932	1,613	20,518	21,137	671	529	19,847	20,608		
<b>Maize</b>																
Grain	210,200	201,600	128,565	139,411	81,635	62,189	0	160	81,635	62,029	61,204	56,626	20,431	5,403		
Other cereal grains	16,933	14,516	1,832	747	15,101	13,769	1,126	805	13,974	12,964	3,910	6,014	10,064	6,950		
<b>Sub-total grains</b>	1,081,443	1,042,031	269,652	274,192	811,791	767,839	10,216	10,587	801,574	757,252	308,581	327,622	403,236	341,268	89,757	88,362
<b>Maize silage</b>	1,298,394	1,206,500	1,298,394	1,206,500												
<b>Total grains and silage</b>	2,379,837	2,248,531	1,568,046	1,480,692	811,791	767,839	10,216	10,587	801,574	757,252	308,581	327,622	403,236	341,268	89,757	88,362

Source: FAR; AIMI; NZFMA;ASUREQuality; BERL calculations

In 2013 there is a residual figure of 88,000 tonnes of New Zealand wheat, surplus to the flow going to flour mills according to general industry information. This is not recorded in FAR information on farmer-to-farmer sales and so it could include some flow to feed millers that are not members of NZFMA and possibly some to additional, more informal operators supplying grain feeds to farmers

and growers. Nevertheless, the table gives a reasonable representation of the flow of grains from New Zealand farms in 2013.

### 2.1.4 Value of grains and maize silage

Having shown the general flow of grains and silage from New Zealand farms, we can estimate their value at the first point of sale, namely at sale to other farmers or to the industry. This grain will be sold either ex the farm or into merchants' store or into mill. Certified seed is measured and valued after dressing. Most of prices come from analysis of the FAR levy information.

**Table 2.4 Value of sales of grain and silage, 2011 and 2013**

Grain and silage types	Price Weighted average (\$/tonne)	2013 Sales (\$Million)		Total Sales (\$Million)	2011 Total Sales (\$Million)
		To farmers	To industry		
<b>Wheat</b>					
Milling	\$423	\$0.3	\$50.8	\$51.1	\$34.0
Feed	\$382	\$21.2	\$103.8	\$125.0	\$112.9
<b>Barley</b>					
Malting	\$439	\$0.2	\$21.7	\$21.9	\$11.5
Feed	\$373	\$28.1	\$85.1	\$113.1	\$124.1
<b>Oats</b>	\$450	\$0.8	\$10.3	\$11.1	\$10.1
<b>Maize</b>					
Grain	\$459	\$59.4	\$33.1	\$92.6	\$92.2
<b>Other cereal grains</b>	\$456	\$0.5	\$6.1	\$6.6	\$6.7
<b>Sub-total grains</b>		<b>\$110.4</b>	<b>\$310.9</b>	<b>\$421.4</b>	<b>\$391.6</b>
<b>Maize silage</b>	\$213	\$257.2	\$0.0	\$257.2	\$259.7
<b>Total grains and silage</b>		<b>\$367.7</b>	<b>\$310.9</b>	<b>\$678.6</b>	<b>\$651.2</b>

Source: FAR; various; BERL estimates

Table 2.4 shows that sales of grain and silage to other farmers had a sales value of \$368 million and sales of grain to industry had a value of \$311 million in 2013. Based on these estimates, the value of sales of grain and silage from arable farmers in 2013 was \$679 million. This is up 4 percent on the 2011 value (\$651 million).

As a general order of magnitude, the average value of grain sales per hectare harvested is approximately \$3,200 per hectare, and the value of maize silage \$4,700 per hectare. The tonnes recorded as sold ex the farm are somewhat less than the tonnes recorded as harvested and so the actual value of grain harvested is higher than the sales revenue recorded.

## 2.2 Seeds crops

An important activity in the arable sector is seed production. This sector has two main markets, the first is certified seed which is 'certified' to be purely of a single species, and will be purchased generally by farmers aiming to multiply the volume for sale to other producers. The second type is what we call 'production' seed and is that sold as generally of a single species or cultivar, but may possibly have some seeds of another in it. It is nevertheless perfectly suitable for general use in production.

The wide variety of species of seed produced are produced at a field scale in New Zealand. This sector has developed significantly over recent years, with the traditional stalwarts of grass seeds, and legume seeds (mainly white clover) being joined by vegetable seeds, especially carrots and radish seeds. The fourth main seed type is brassicas, the seeds used for growing forage brassicas for seasonal feed to livestock. Although the tonnages and/or values are not as large as the other seed types, the seeds are important to the livestock industry. The area of forage brassicas grown in New Zealand is recorded at about 300,000 hectares a year, the largest of any single crop.

As indicated above there are two main types of seeds or seed production systems in New Zealand:

- **Certified seed:** seed is grown so that it is certified to be only of the species and cultivar designated. The process of Certification is administered and operated by AsureQuality, a 100% government-owned commercial entity, related to the Ministry of Primary Industries.
- **Production seed:** seed grown is harvested from crops which may or may not contain some seeds from other cultivars, but is nevertheless perfectly suitable for general use in production.

### 2.2.1 Scope of Seed Certification in New Zealand

The Seed Certification service operated by AsureQuality for New Zealand farmers and seed producers handles at least 43 species of seed. Table 2.5 lists the hectares entered for certification by species in 2011 and 2013. In 2013, a total of 37,200 hectares were entered with certified seed, up 33 percent on 2011 (27,800 hectares).

**Table 2.5 Area entered for certification of seed, 2011 and 2013**

Species	Hectares		Species	Hectares	
	2011	2013		2011	2013
<b>Arable Crops</b>			<b>Herbage &amp; Amenity Grasses</b>		
Barley	995	1,117	Brome Grass	32	26
Beans	0	0	Brow ntop	559	514
Garden pea	0	0	Cocksfoot	1,024	694
Linseed	52	59	Crested Dogstail	0	57
Maize	293	1,229	Grazing Brome	0	34
Oat	445	407	Festulolium spp	123	866
Pea	59	40	Hybrid Ryegrass	1,220	3,128
Ryecorn	19	33	Italian Ryegrass	5,140	3,785
Triticale	67	72	Perennial Ryegrass	7,568	14,245
Wheat	648	666	Phalaris	0	11
<b>Sub-total</b>	<b>2,578</b>	<b>3,623</b>	Prairie Grass	130	62
<b>Brassic</b>			Red Fescue	67	0
Crambe	0	0	Tall Fescue	518	749
Ethiopian Cabbage	23	0	Timothy	0	0
Rape	483	942	Upland Brome	116	0
Kale	501	407	Westerw olds Ryegrass	0	0
Turnip	201	190	Yorkshire Fog	0	0
Sw ede	26	26	x Festulolium spp	0	296
<b>Sub-total</b>	<b>1,234</b>	<b>1,565</b>	<b>Sub-total</b>	<b>16,497</b>	<b>24,467</b>
<b>Other Species</b>			<b>Legumes</b>		
Chicory	23	158	Caucasian Clover	0	0
Fodder Radish	91	309	Lotus	22	11
Phacelia	0	0	Lucerne	112	200
Plantain	49	224	Red Clover	554	397
White Mustard	6	0	White Clover	6,637	6,284
<b>Sub-total</b>	<b>169</b>	<b>691</b>	<b>Sub-total</b>	<b>7,325</b>	<b>6,892</b>
			<b>TOTAL ALL SPECIES</b>	<b>27,803</b>	<b>37,238</b>

Source: AssureQuality; BERL calculations

To give an indication of the range of plant breeding and production there are large numbers of cultivars of most of the 43 species listed in Table 2.5. For example in 2013 there were 33 cultivars of Wheat. Of the three ryegrass species, Perennial, Italian, and Hybrid, there were a total of 99 cultivars in 2013. For the all-important legume, White Clover, there were 69 cultivars in 2013.

New Zealand's plant breeding and seed production initially developed to obtain grain species suitable to our climate, and to increase the productivity of core pasture species ryegrass and white clover. It then developed some special purpose pasture species. This activity has now extended into a much wider range of specialist crops including vegetables. In many cases, New Zealand activity includes out-of-season multiplication of new cultivars being developed by plant breeding corporations in the Northern Hemisphere. A very high level of technology is applied in this industry.

## 2.2.2 Certified and production seeds produced

Using information from FAR, AssureQuality and Stats NZ we can calculate the amount of certified seed and tonnes of production seed produced. Table 2.6 shows tonnes of seeds ex the farm sourced from FAR levy data and Stats NZ export data. The amount of certified seeds is sourced from AssureQuality and StatsNZ export data. The difference between the two is the amount of production seed produced.



**Table 2.6 Certified and production seed, 2011 and 2013**

Seeds	Tonnes ex farm		Certified tonnes		Production tonnes	
	FAR/ Export		AQ / Export		FAR/ AQ/ Export	
	2011	2013	2011	2013	2011	2013
Beans	4,215	2,435	0	0	4,215	2,435
Peas	30,957	22,965	24	9	30,933	22,956
Linseed	2,862	3,191	6	71	2,856	3,120
Other pulses	25,295	484	0	0	25,295	484
<b>Pulses</b>	<b>63,329</b>	<b>29,075</b>	<b>30</b>	<b>80</b>	<b>63,299</b>	<b>28,995</b>
Cocksfoot	440	616	440	280	0	336
Fescue	550	570	411	559	139	12
Ryegrasses	31,528	34,924	22,449	29,927	9,079	4,997
Other grass	934	3,152	362	0	572	3,152
<b>Grasses</b>	<b>33,452</b>	<b>39,261</b>	<b>23,662</b>	<b>30,765</b>	<b>9,789</b>	<b>8,496</b>
White clover	3,745	4,845	3,205	2,900	540	1,945
Red clover	189	254	127	106	62	148
Other legumes	271	970	23	29	248	942
<b>Legumes</b>	<b>4,205</b>	<b>6,069</b>	<b>3,355</b>	<b>3,035</b>	<b>850</b>	<b>3,035</b>
Rape	6,642	5,833	438	1,202	6,203	4,631
Kale	809	760	39	78	770	682
Turnip	344	389	172	50	172	339
Swede	31	48	31	47	0	2
Cabbage (Ethiopian)	1,341	832	23	9	1,318	823
<b>Brassicas</b>	<b>9,167</b>	<b>7,863</b>	<b>704</b>	<b>1,386</b>	<b>8,463</b>	<b>6,477</b>
Beet	108	132	0	0	108	132
Carrots	379	656	35	35	344	621
Radish	2,440	3,058	66	252	2,374	2,806
Plantain	84	345	84	345	0	0
Other vegetables	2,546	2,500	0	0	2,546	2,500
<b>Non-brassica vegetable</b>	<b>5,557</b>	<b>6,690</b>	<b>184</b>	<b>632</b>	<b>2,827</b>	<b>3,558</b>
<b>Total Seeds</b>	<b>115,709</b>	<b>88,959</b>	<b>27,935</b>	<b>35,898</b>	<b>85,228</b>	<b>50,561</b>

Source: FAR;ASUREQuality; Statistics New Zealand; BERL calculations

Table 2.6 shows that there were 36,000 tonnes of main certified seed produced in 2013. Certified seeds produced were dominated by the grasses, 31,000 tonnes and legumes, 3,000 tonnes.

Certified seed produced in 2013 was up 29 percent on the 2011 level (28,000 tonnes). Despite the overall tonnes of seed ex the farm declining from 115,700 to 89,000 tonnes (23 percent) over this period, certified seeds increased by around 8,000 tonnes (29 percent). The decline in production was thus in the production seed, which fell by 35,000 tonnes (41 percent) between 2011 and 2013. The main reduction was recorded in the pulses

Certified seeds made up 40 percent of total seeds produced by weight in 2013, up from 24 percent in 2011. Most of this increase was in Ryegrass, with certified tonnes produced increasing from around 23,000 in 2011 to 30,000 in 2013 (an increase of 30 percent).

### 2.2.3 Value of seeds

The value of sales of seeds shows a slightly different picture with the total value of certified seeds was \$120 million in 2013, nearly as much as the \$124 million value of production seeds.



In total the seed industry is estimated to have total sales of \$244 million in 2013, up 10 percent on total sales of \$222 million in 2011.

**Table 2.7 Value of seed production, 2011 and 2013**

Seeds	2013				2011	
	Price (\$/tonne)		Sales (\$Million)		Total sales (\$Million)	Total sales (\$Million)
	Production	Certified	Production	Certified		
Beans	\$525 <sup>1</sup>		\$1.28		\$1.28	\$2.39
Peas	\$700 <sup>1</sup>	\$1,000 <sup>3</sup>	\$16.06	\$0.01	\$16.07	\$23.87
Linseed	\$954 <sup>1</sup>	\$1,000 <sup>3</sup>	\$2.98	\$0.07	\$3.05	\$2.32
Other pulses	\$1,154 <sup>1</sup>		\$0.56		\$0.56	\$24.28
<b>Total pulses</b>			<b>\$20.87</b>	<b>\$0.08</b>	<b>\$20.95</b>	<b>\$52.85</b>
Cocksfoot	\$4,520 <sup>2</sup>	\$3,692 <sup>2</sup>	\$1.52	\$1.03	\$2.55	\$1.76
Fescue	\$3,144 <sup>2</sup>	\$2,311 <sup>2</sup>	\$0.04	\$1.29	\$1.33	\$2.05
Ryegrasses	\$2,535 <sup>2</sup>	\$2,657 <sup>2</sup>	\$12.67	\$79.52	\$92.19	\$78.36
Other grass	\$3,237 <sup>1</sup>		\$10.20		\$10.20	\$4.41
<b>Total grasses</b>			<b>\$24.42</b>	<b>\$81.84</b>	<b>\$106.27</b>	<b>\$86.58</b>
White clover	\$5,323 <sup>1</sup>	\$5,980 <sup>2</sup>	\$10.35	\$17.34	\$27.70	\$21.83
Red clover	\$6,603 <sup>1</sup>	\$7,893 <sup>2</sup>	\$0.98	\$0.84	\$1.81	\$1.33
Other legumes	\$3,302 <sup>1</sup>	\$1,551 <sup>2</sup>	\$3.11	\$0.04	\$3.15	\$1.27
<b>Total legumes</b>			<b>\$14.44</b>	<b>\$18.22</b>	<b>\$32.66</b>	<b>\$24.43</b>
Rape	\$702 <sup>1</sup>	\$4,283	\$3.25	\$5.15	\$8.40	\$5.99
Kale	\$5,317 <sup>2</sup>	\$6,945 <sup>2</sup>	\$3.63	\$0.54	\$4.17	\$3.39
Turnip	\$3,270 <sup>2</sup>	\$3,270 <sup>2</sup>	\$1.11	\$0.16	\$1.27	\$1.33
Swede	\$2,966 <sup>1</sup>	\$5,001 <sup>2</sup>	\$0.00	\$0.23	\$0.24	\$0.33
Cabbage (Ethiopian)	\$4,677 <sup>2</sup>	\$4,677 <sup>2</sup>	\$3.85	\$0.04	\$3.89	\$5.37
<b>Total brassicas</b>			<b>\$11.84</b>	<b>\$6.13</b>	<b>\$17.97</b>	<b>\$16.41</b>
Beet	\$6,041 <sup>2</sup>		\$0.80		\$0.80	\$0.65
Carrots	\$42,772 <sup>2</sup>	\$49,593 <sup>2</sup>	\$26.56	\$1.74	\$28.30	\$16.21
Radish	\$9,058 <sup>2</sup>	\$8,517 <sup>2</sup>	\$25.41	\$2.15	\$27.56	\$22.10
Plantain		\$27,780 <sup>3</sup>		\$9.59	\$9.59	\$2.76
Other vegetables	\$1,000 <sup>3</sup>		\$2.50		\$2.50	\$2.50
<b>Non-brassica vegetables</b>			<b>\$52.77</b>	<b>\$13.47</b>	<b>\$66.24</b>	<b>\$41.72</b>
<b>Total Seeds</b>			<b>\$124.35</b>	<b>\$119.75</b>	<b>\$244.10</b>	<b>\$221.98</b>

Source: (1) FAR, (2) Export FOB and (3) BERL Estimate

The seed sector is an exciting part of the arable industry. It has developed significantly, and changed composition in recent years. The traditional stalwarts of grass seeds worth \$106 million, and legume seeds (mainly white clover) worth \$33 million have been being by vegetable seeds, especially carrots and radish seeds worth \$66 million in 2013.

These non-brassica vegetable seeds have increased in value by over \$14 million since 2011, an increase by 60% in value compared with two years ago.

### 3 Economic Impact of Arable production

This section estimates the economic impact of arable production in New Zealand. To estimate the economic impact of arable production, the impact of the industry's gross output, the value added or GDP component and employment is calculated using multiplier analysis<sup>2</sup>. The arable industry's output generates three impact effects:

- **Direct** – initial spending of the company (i.e. operation expenditure);
- **Indirect** – the additional inter-industry spending from the direct impact;
- **Induced** – the impact of additional household expenditure resulting from the direct and indirect impact.

The multiplier captures the impact upstream through the economy, of the output produced by the arable sector. As discussed in section 1, this multiplier analysis does not capture the impact of downstream arable production on the downstream impact of arable production to the New Zealand economy.

#### 3.1 Economic Impact of grains and silage production

To estimate the economic impact of the grain and silage, we take the value of sales as estimated in Section 2, and use multiplier analysis to find the upstream indirect and total impacts from the suppliers to the arable production industry. A component of this gross output, usually about 40% is the value added, and value added from each industry goes to make up New Zealand's gross domestic product (GDP).

##### 3.1.1 Gross output

Gross output is economic jargon for 'value of sales' The 2013 gross output of grain was \$679 million.

**Table 3.1 Gross output multipliers for grain production, 2013**

Grain and silage types	2013			2011	
	Tonnes	Total Value (\$Millions)	With Indirect Impacts	With total impacts	With total impacts
<b>Wheat</b>	448,176				
Milling	120,787	\$51.1	\$108.0	\$136.6	\$91.0
Feed	327,389	\$125.0	\$264.4	\$334.5	\$302.1
<b>Barley</b>	353,182				
Malting	49,829	\$21.9	\$46.3	\$58.5	\$30.7
Feed	303,353	\$113.1	\$239.3	\$302.8	\$332.2
<b>Oats</b>	24,557	\$11.1	\$23.4	\$29.6	\$27.1
<b>Maize</b>					
Grain	201,600	\$92.6	\$195.9	\$247.8	\$246.8
<b>Other cereal grains</b>	14,516	\$6.6	\$14.0	\$17.7	\$17.8
<b>Sub-total grains</b>	1,042,031	\$421.4	\$891.3	\$1,127.6	\$1,047.8
<b>Maize silage</b>	1,206,500	\$257.2	\$544.1	\$688.3	\$694.9
<b>Total grains and silage</b>	<b>2,248,531</b>	<b>\$678.6</b>	<b>\$1,435.4</b>	<b>\$1,815.9</b>	<b>\$1,742.7</b>

Source: BERL calculations

<sup>2</sup> Multiplier analysis uses multipliers derived from inter-industry input-output tables at the territorial authority, regional level and for New Zealand. The input-output tables have been derived from the national input-output tables and other data by Butcher Partners, Canterbury – a recognised source for regional input-output tables and multipliers. Multipliers allow us to identify the direct, indirect and induced effects in terms of output (expenditure), value added (GDP) and Full Time Equivalent (FTE) employment at a regional level.

This \$679 million direct impact is multiplied up to \$1.44 billion when indirect impacts of suppliers are added. When the impacts of increased household expenditure by those working directly and indirectly in the arable industry are added, the total gross output impact in 2013 is \$1.82 billion.

The total gross output impact of grain production in 2013 was 4 percent larger than the 2011 total gross output impact of \$1.74 billion.

### 3.1.2 Gross Domestic Product (GDP)

GDP is the total of value added to a product in the New Zealand economy. This is obtained as the proportion of value added for each \$1 of sales of grains, obtained from industry analyses.

The table overleaf shows that the \$679 million of sales generated \$239 million of value added in 2013. When total impacts are factored in, the total GDP generated was \$750 million.

**Table 3.2 GDP multipliers for grain production, 2013**

Grain and silage types	2013			2011	
	Tonnes	Total Value (\$Millions)	With Indirect Impacts (\$Million)	With total impacts (\$million)	With total impacts (\$million)
<b>Wheat</b>	448,176				
Milling	120,787	\$18.0	\$42.3	\$56.4	\$37.6
Feed	327,389	\$44.0	\$103.6	\$138.2	\$124.8
<b>Barley</b>	353,182				
Malting	49,829	\$7.7	\$18.1	\$24.2	\$12.7
Feed	303,353	\$39.8	\$93.7	\$125.0	\$137.2
<b>Oats</b>	24,557	\$3.9	\$9.2	\$12.2	\$11.2
<b>Maize</b>					
Grain	201,600	\$32.6	\$76.7	\$102.3	\$101.9
<b>Other cereal grains</b>	14,516	\$2.3	\$5.5	\$7.3	\$7.4
<b>Sub-total grains</b>	1,042,031	\$148.4	\$349.1	\$465.7	\$432.7
<b>Maize silage</b>	1,206,500	\$90.6	\$213.1	\$284.3	\$287.0
<b>Total grains and silage</b>	2,248,531	\$239.0	\$562.1	\$750.0	\$719.7

Source: BERL calculations

Total GDP generated from grain and silage production in 2013 was 4 percent larger than the 2011 total GDP impact of \$720 million.

### 3.1.3 Employment

The third economic impact is the employment in the arable industry, and the indirect employment generated, measured in Full-Time Equivalent (FTEs). We have not completed a survey of employment in the diverse arable production industry, and so we have used national coefficients from the relevant section of the overall agricultural industry. These coefficients provide the employment generated from the estimated level of sales and GDP from grains production in 2013. The estimates are shown in Table 3.3.

**Table 3.3 Employment multipliers for grain production, 2013**

Grain and silage types	2013				2011
	Tonnes	Employment (FTEs)	With Indirect Impacts (FTEs)	With total impacts (FTEs)	With total impacts (FTEs)
<b>Wheat</b>	448,176				
Milling	120,787	312	604	740	493
Feed	327,389	763	1,479	1,812	1,636
<b>Barley</b>	353,182				
Malting	49,829	134	259	317	167
Feed	303,353	691	1,339	1,640	1,799
<b>Oats</b>	24,557	68	131	160	147
<b>Maize</b>					
Grain	201,600	565	1,096	1,342	1,337
<b>Other cereal grains</b>	14,516	40	78	96	96
<b>Sub-total grains</b>	<b>1,042,031</b>	<b>2,573</b>	<b>4,987</b>	<b>6,106</b>	<b>5,675</b>
<b>Maize silage</b>	<b>1,206,500</b>	<b>1,571</b>	<b>3,044</b>	<b>3,728</b>	<b>3,763</b>
<b>Total grains and silage</b>	<b>2,248,531</b>	<b>4,144</b>	<b>8,031</b>	<b>9,834</b>	<b>9,438</b>

Source: BERL calculations

Our analysis indicates that there were 4,100 FTEs employed in the grain and maize silage production in 2013. When we taken into account the indirect and induced employment generated, total employed in grain production in 2013 is found to be around 9,800 FTEs.

In summary, the total economic impact of grain production in 2013 is estimated to be:

- **Gross output:** \$1.82 billion
- **GDP:** \$750 million
- **Employment:** 9,800 FTEs.

## 3.2 Economic Impact of seeds

### 3.2.1 Gross output

The sales value or gross output of seeds in 2013 was estimated at \$244 million.

**Table 3.4 Gross output multipliers for seeds production, 2013**

Seeds	2013				2011
	Tonnes	Total Value (\$Millions)	With Indirect Impacts (\$Million)	With total impacts (\$million)	With total impacts (\$million)
Pulses	29,075	\$21.0	\$44.3	\$56.1	\$141.4
Grasses	39,261	\$106.3	\$224.8	\$284.4	\$231.7
Legumes	6,069	\$32.7	\$69.1	\$87.4	\$65.4
Brassicac	7,863	\$18.0	\$38.0	\$48.1	\$43.9
Non-brassicac vegetables	6,690	\$66.2	\$140.1	\$177.3	\$111.6
<b>Total Seeds</b>	<b>88,959</b>	<b>\$244.1</b>	<b>\$516.3</b>	<b>\$653.2</b>	<b>\$594.0</b>

Source: BERL calculations

With the indirect impact on sales of suppliers to seeds production, gross output of seeds in 2013 increases to \$516 million, and the total impacts are \$653 million. The total gross output impact of seeds in 2013 was 10 percent higher than the total gross output impact of \$594 million in 2011.

### 3.2.2 Gross Domestic Product (GDP)

On a similar basis as for the grain estimate, the direct sales of \$244 million of seeds in 2013 generated a value added of \$86 million. Taking into account the total impacts, the seeds industry made a contribution of \$269 million to New Zealand's GDP in 2013, up from \$245 million in 2011.

**Table 3.5 GDP multipliers for seeds production, 2013**

Seeds	2013			2011	
	Tonnes	Total Value (\$Millions)	With Indirect Impacts (\$Million)	With total impacts (\$million)	With total impacts (\$million)
Pulses	29,075	\$7.4	\$17.4	\$23.2	\$58.4
Grasses	39,261	\$37.4	\$88.0	\$117.4	\$95.7
Legumes	6,069	\$11.5	\$27.1	\$36.1	\$27.0
Brassicas	7,863	\$6.3	\$14.9	\$19.9	\$18.1
Non-brassica vegetables	6,690	\$23.3	\$54.9	\$73.2	\$46.1
<b>Total Seeds</b>	<b>88,959</b>	<b>\$86.0</b>	<b>\$202.2</b>	<b>\$269.8</b>	<b>\$245.3</b>

Source: BERL calculations

### 3.2.3 Employment

Again the employment is estimated from coefficients for the relevant part of the agricultural industry. This indicates that in 2013, seeds led to the direct employment of around 1,500 FTEs, and generated total employment of over 3,500 FTEs. In 2011 around 3,200 FTEs were generated by seeds.

**Table 3.6 Employment multipliers for seeds production, 2013**

Seeds	2013			2011	
	Tonnes	Employment (FTEs)	With Indirect Impacts (FTEs)	With total impacts (FTEs)	With total impacts (FTEs)
Pulses	29,075	128	248	304	766
Grasses	39,261	649	1,258	1,540	1,255
Legumes	6,069	199	387	473	354
Brassicas	7,863	110	213	260	238
Non-brassica vegetables	6,690	405	784	960	605
<b>Total Seeds</b>	<b>88,959</b>	<b>1,491</b>	<b>2,889</b>	<b>3,537</b>	<b>3,217</b>

Source: BERL calculations

In summary, the total economic impact of seeds in 2013 is estimated to be:

- **Gross output:** \$653 million
- **GDP:** \$269 million
- **Employment:** 3,200 FTEs.

### 3.3 Summary economic impact of the arable industry in 2013

Combining the separate information from the grains and the seeds production, we estimate that the annual value of sales of the arable industry in 2013 was \$923 million. This generated a total level of sales in the economy of \$2.47 billion.

**Table 3.7 Summary of arable production economic impacts, 2013**

	2013			2011	
	Tonnes	Total Value (\$Millions)	With Indirect Impacts (\$Million)	With total impacts (\$million)	With total impacts (\$million)
<b>Gross output (\$M)</b>					
Grain production	2,248,531	\$678.6	\$1,435.4	\$1,815.9	\$1,742.7
Seeds	88,959	\$244.1	\$516.3	\$653.2	\$594.0
<b>Total</b>	<b>2,337,490</b>	<b>\$922.7</b>	<b>\$1,951.8</b>	<b>\$2,469.1</b>	<b>\$2,336.7</b>
<b>GDP (\$M)</b>					
Grain production		\$239.0	\$562.1	\$750.0	\$719.7
Seeds		\$86.0	\$202.2	\$269.8	\$245.3
<b>Total</b>		<b>\$325.0</b>	<b>\$764.3</b>	<b>\$1,019.7</b>	<b>\$965.1</b>
<b>Employment (FTEs)</b>					
Grain production		4,144	8,031	9,834	9,438
Seeds		1,491	2,889	3,537	3,217
<b>Total</b>		<b>5,635</b>	<b>10,919</b>	<b>13,372</b>	<b>12,655</b>

The total contribution of arable production to GDP was \$1.02 billion in 2013, up from \$965 million in 2011. Arable production also generated almost 13,400 FTEs in 2013.

Arable production is again a significant contributor to New Zealand's economy.

The almost 14,000 FTEs employed directly and indirectly in the arable industry is similar to the employment in fruit-growing including kiwifruit, apples and pears, and is not very much less than the number directly employed in the dairy farming industry.

#### *Downstream economic impact*

Downstream industries that rely on arable production are varied and range from brewing (barley) to the fast food industry that uses pork and poultry fed on feed formulations including grains like maize. BERL believes that the economic impact of arable production on these downstream industries, while not quantified in this report, to be large.

The downstream uses of grain and silage has broadened in recent years. In the past animal feeds were formulated mainly for intensive industries such as meat chicken, egg producers and piggeries.

More recently the pastoral ruminant livestock industries like dairying have become more intensive with use of feeds such as imported palm kernel (PKE or palm kernel expeller), and greater volumes of maize silage, cereal silage, pure grains and formulated feeds and grains.

The grain millers and processors are also now producing specialised value added products. The latter include health and exercise bars, muesli bars, and baking products like frozen croissant and ancient grains dough.

Downstream industries also rely heavily on seeds produced in New Zealand. These include those using the outputs of with pastoral livestock production where the sheep and cows are fed on grasses and forage brassicas grown from New Zealand seeds.

The forage brassicas cover 300,000 hectares grown each year. This is the largest area of any crop in New Zealand, and provides supplementary feed to livestock. It has been estimated that the meat and milk solids produced from those forage brassicas have a farm gate value of over \$700 million.

Other downstream seed users are the horticulture / market gardening industries. Downstream benefits therefore also accrue to retailers, exporters and restaurants/fast food outlets.

These downstream benefits are not included in our estimates of the impacts of arable seed production.

## Appendix A Multiplier analysis

### Multiplier analysis

The analysis in this report uses multipliers derived from inter-industry input-output tables for New Zealand. Input-output tables have been derived and updated from the national input-output tables produced by Statistics New Zealand.

Multipliers allow us to identify the direct, indirect and induced effects in terms of expenditure, Gross Domestic Product, and Full-Time Equivalent (FTE) employment.

### Measures of economic activity

The three measures used are:

**Expenditure:** the value of production, which is built up through the national accounts as a measure of gross sales or turnover. This is expressed in \$million at constant prices (i.e. removing the effect of inflation), and includes GST.

**GDP:** the increase in output generated along the production chain, which when aggregated, totals Gross Domestic Product, or GDP. This is the sum of:

- compensation of employees (i.e. salaries and wages)
- income from self-employment
- depreciation
- profits, and
- indirect taxes less subsidies.

Note that expenditure is made up of the above (value added) plus:

- intermediate purchases of goods (other than stock in trade), and
- intermediate purchases of services.

**Employment:** the volume of employment is usually expressed as Full-Time Equivalents (FTEs). These are estimated as the number of full-time employees and working proprietors and one-third of the number of part-time employees, converted to an annual basis.

FTEs provide a measure of total labour demand associated with expenditure - e.g. four full-time jobs running for three months or three part time jobs running for a year would be shown as a single FTE.



