



economics

Report to:

The Arable Food Industry Council

**ECONOMIC IMPACT ASSESSMENT OF
ARABLE PRODUCTION**

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Economic Impact Assessment of Arable Production

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1 Summary

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. The arable industry held an important place in New Zealand's economy in the early days of establishing the colony, and has continued providing important inputs to the intensive livestock production industry, the food industry, and seeds development and increasingly grain and silage feed for the pastoral industry. The arable industry is now a high technology part of the primary sector, involved in high value seeds production, as part of global seed breeding and multiplication processes and as a supplier into vegetable and other production industries.

This report describes a study to use available industry data to obtain a consistent picture of arable production in 2011. This picture of production of grains and seeds is then used to estimate the impact on the New Zealand economy of the arable production. The sources used are all updated annually, and AFIC intends updating the economic estimates annually.

A summary of the estimates are that the direct sales from arable production were \$868 million in 2011. The indirect impact from suppliers to the arable producers brought the sales impact to \$2.2 billion. From these sales, the total contribution to GDP is estimated to be \$959 million, and the total addition to employment to be 12,580 FTEs in the 2011 year.

The details of the summary impacts are shown in the table.

Table 1-1: Summary economic impacts of arable production 2011

Arable Industry 2011	Tonnes	Direct Impacts	With Indirect Impacts	With Total Impacts
Gross output (\$million)				
Grains and silage	2,368,237	\$645.4	\$1,365.3	\$1,727.2
Seeds	115,028	\$222.6	\$359.1	\$454.3
Arable industry	2,483,265	\$868.1	\$1,724.4	\$2,181.5
Value Added (GDP, \$ million)				
Grains and silage		\$227.3	\$534.7	\$713.3
Seeds		\$78.4	\$184.4	\$246.1
Arable industry		\$305.7	\$719.1	\$959.4
Employment (FTEs)				
Grains and silage		3,942	7,638	9,354
Seeds		1,360	2,635	3,227
Arable industry		5,301	10,273	12,580

Arable production is again a significant contributor to New Zealand's economy. The 12,580 FTEs employment is similar to that in fruit-growing, which is about half the employment in dairy farming.

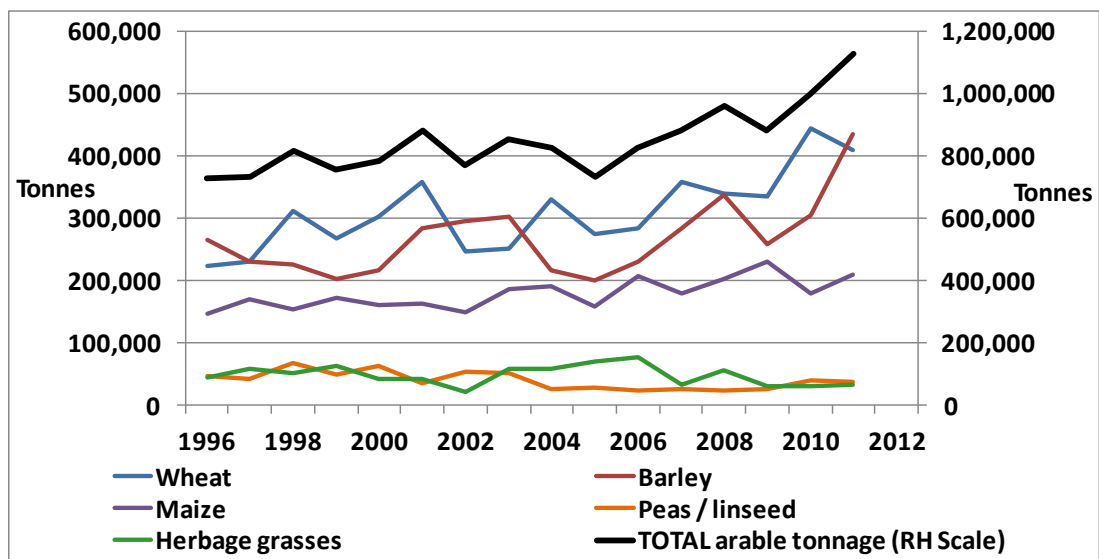
2 Arable production in New Zealand

The arable industry 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.

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Historically in New Zealand, grain was the main crop 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.

Figure 1: Arable production 1996 to 2011



The chart shows that the total volume of production of main grains and seeds has increased from about 700,000 tonnes in 1996 to over 1.1 million tonnes in 2011. These increases have been driven mostly by the important grains, wheat, barley and maize.

2.1 Scope of the report

This report backgrounds the historical importance of the arable industry. It assembles data on arable production from a range of sources, and obtains a consistent set of figures on the

diverse arable production activities. This provides a snapshot of the activities in the arable production industry in New Zealand in the year 2011 and provides the basis for estimating Arable production at present

In comparison with the grain dominance in the early days of the arable industry in New Zealand, there are now two main groups of crops. The first group is, as in the past, the grains for human and animal consumption. The second main group is seeds, comprised mainly of improved varieties of seeds for pasture improvement, and other crop seeds. These increasingly are high value vegetable seeds, mainly for export.

This section identifies the current hectares, tonnes, and values of arable crops of grains and seeds in New Zealand.

2.2 Scope of impact of arable crop production

The arable production industry is taken to be the industry that grows crops under cultivation to supply to industries that process the crop for use in other industries such as livestock production or for human food preparation. There are upstream linkages within the arable industry and in other industries to suppliers of goods and services to the arable producers. 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.

The objective of this small study is to define the core of the arable industry in terms of the arable producers and through to the mills and export, working from existing data sources. This consistent production data set can then be used as the base to estimate the upstream impact of the arable production on the economy through the suppliers of goods and services to the arable producers.

Should the industry require analysis of the economic impact of the downstream users of the arable products, it would require a significant body of work to research the structure of the animal feed industry, grain malting and milling, and the seeds breeding and supply industry.

2.3 Sources of information used

The sources of information on various aspects of arable production in New Zealand include the information from **Statistics New Zealand (Stats NZ)** collected in their various surveys and Censuses of agricultural production. They 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 other main sources are industry-based. The first is the **Foundation for Arable Research (FAR)**, 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.

A second source of production information is **AsureQuality** which 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.

A more recent source of information on the industry is the **Arable Industry Marketing Initiative (AIMI)** based at Lincoln. 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.

Finally there are organisations in the main industries using arable products. The **New Zealand Feed Manufacturing Association (NZFMA)** collects detailed information on use of local product and imports for compound animal feed manufacture in the North Island, South Island and total. 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.

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 2011 year, and used other sources to estimate volumes and value going to different uses as shown in later sections.

2.4 Grain crops

The high level information on grain crops comes from the FAR information on all except maize, and information from AIMI for maize. The tonnage totals can be compared with the StatsNZ data and this comparison indicates that the order-of-magnitude is correct. This information is shown in the table below.

2-1 Hectares and tonnes of arable grains and silage produced, 2011

Grain and silage types <i>Source</i>	Hectares	Tonnes harvested	Tonnes ex farm
	<i>Stats NZ/FAR</i>	<i>Stats NZ/FAR</i>	<i>FAR/ AIMI</i>
Wheat	54,800	393,400	410,962
<i>Milling</i>			90,078
<i>Feed</i>			320,884
Barley	65,700	367,700	418,611
<i>Malting</i>			33,253
<i>Feed</i>			385,358
Oats	6,100	29,100	24,737
Maize	76,287		
<i>Grain</i>	17,269	198,600	198,600
<i>Silage</i>	59,018	1,298,394	1,298,394
Other cereal grains	1,700	9,600	16,933
Total grains & silage	280,874	2,296,794	2,368,237

The tonnage numbers are generally similar from the two sources, except that the 'Other cereal grains' presumably include a different range for Stats NZ than for FAR.

The indication is that there were in 2011 about 150,000 hectares in grains, and they produced about one million tonnes of grains and 1.3 million tonnes of silage, ex the farms.

2.5 Utilization of grain crops

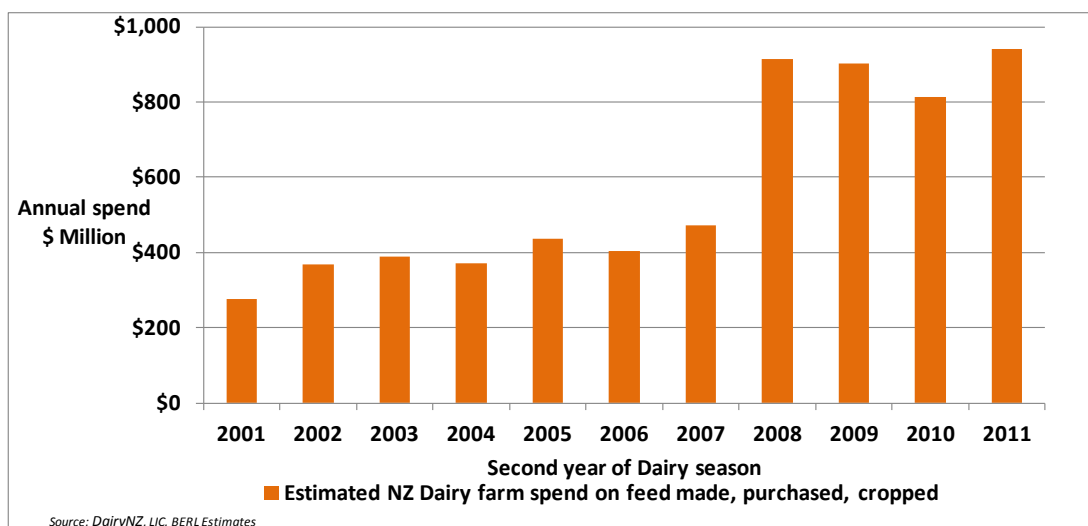
Initially we attempted to integrate information from a number of sources and to track the grains through to their utilization in the feed mills or the flour/malting mills industries. This initial draft framework indicated that there was a considerable volume of grain not accounted for in our estimates. 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.

2.5.1 Changing structure in grain flows

To explore the possibility that there has been such a structural change in grain flows we have gone to 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 2010-11. The source data comes from the farm budgets in the *DairyNZ economic survey 2009-10* 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 2010-11*. The estimates show spending at a level of \$400-\$500 million per year from 2002 to 2007, and then a step-change to about \$900 million a year for the four years since.

Figure 2: Estimated spending on feed on NZ dairy farms 2001-11



This is a very significant increase in the spending on animal feed on dairy farms. Undoubtedly some of that spending is an increase in on-farm cropping, including feed maize, and an increase in the use of imported Palm oil kernel, expeller (PKE). Other secondary sources of information indicate that the value of PKE used in feeds and fed direct may have grown to about \$100 million by 2007, and then increased to about \$250million plus a year for the three years 2008 to 2010. This increase by, say, \$150 million plus per year still leaves an increase of about \$200 million per year increase spent on feed. Information from elsewhere indicates that some of this is being spent on grain.

This information indicates that there has been a very significant increase in spending on feed on New Zealand dairy farms, and 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 would include any grains sold direct to, for example dairy farmers.

Of the 2.4 million tonnes of grain and silage sold ex the farms, 1.6 million tonnes was sold to other farmers, and about 800,000 tonnes sold to industry.

Table 2-2: Grain and silage sold to farmers and to industry

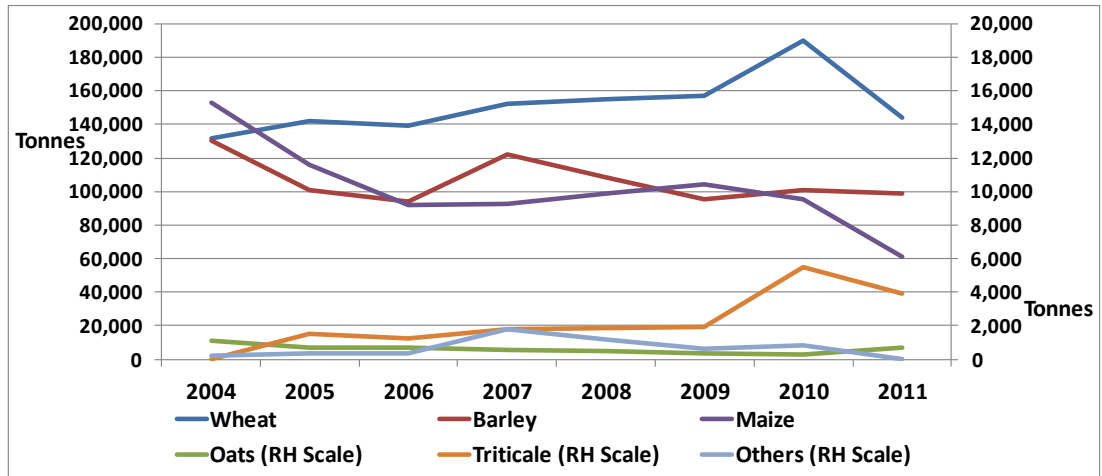
Grain and silage types <i>Source</i>	Tonnes ex farm <i>FAR/ AIMI</i>	Tonnes to farmers <i>FAR</i>	Tonnes to industry <i>FAR/ AIMI</i>
Wheat	410,962	44,662	366,300
<i>Milling</i>	90,078	982	89,096
<i>Feed</i>	320,884	43,680	277,204
Barley	418,611	92,306	326,305
<i>Malting</i>	33,253	154	33,099
<i>Feed</i>	385,358	92,152	293,206
Oats	24,737	2,287	22,450
Maize			
<i>Grain</i>	198,600	128,600	70,000
<i>Silage</i>	1,298,394	1,298,394	
Other cereal grains	16,933	1,832	15,101
Total grains & silage	2,368,237	1,568,081	800,156

We will see in section 2.6 below that these grains and silage sold to farmers returned over \$350 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.

2.5.2 Use of grains in feed and food mills

The next step in our analysis of the utilization of grains is to first 'winnow off' the certified seeds that will not be going to milling. Having done that, the uncertified grains can be separated into those going into the feed mills and those into the flour and malt mills. The NZFMA have provided us with time series data which shows the reasonably stable use of grains in the mills in the last eight years.

Figure 3: NZFMA usage of grains for feed 2004 to 2011



For the main grain components this shows some increase in use of wheat and a decline in usage of barley and maize. Of the minor grains there has been an increase in Triticale. The detailed information from NZFMA is now used to separate the flow of uncertified grains into the flow to feed mills and that to flour mills, malt mills and other. This indicates that at least 308,000 tonnes of grain went to animal feed mills in 2011 and the residual 580,000 tonnes of grain went to flour and malt mills, and other uses, not yet identified.

Table 2-3: Grain and silage flows from farms to farms and to mills in 2011

Grain and silage types <i>Source</i>	Tonnes ex farm <i>FAR/ AIMI</i>	Tonnes to farmers <i>FAR</i>	Tonnes to industry <i>FAR/ AIMI</i>	Certified tonnes <i>AQ</i>	Uncertified tonnes	Tonnes to Feed Mill <i>NZFMA</i>	Tonnes to (Human) milling	Other tonnes to livestock
Wheat	410,962	44,662	366,300	3,970	362,330	144,183	130,000	88,147
<i>Milling</i>	90,078	982	89,096					
<i>Feed</i>	320,884	43,680	277,204					
Barley	418,611	92,306	326,305	4,215	322,090	98,613	223,477	
<i>Malting</i>	33,253	154	33,099					
<i>Feed</i>	385,358	92,152	293,206					
Oats	24,737	2,287	22,450	1,607	20,843	671	20,172	
Maize								
<i>Grain</i>	198,600	128,600	70,000	191	69,809	61,204	8,605	
<i>Silage</i>	1,298,394	1,298,394						
Other cereal grains	16,933	1,832	15,101	551	14,550	3,910	10,640	
Total grains & silage	2,368,237	1,568,081	800,156	10,533	789,622	308,581	392,894	88,147

There is a residual figure of 88,000 tonnes of New Zealand wheat, surplus to the flow going to flour mills according to general information from the industry. It is not recorded in the FAR information on farmer-to-farmer sales and so it could include some flow to feed millers 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 2011.

2.6 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. The certified seed is measured and valued after dressing. Most of these prices come from the analysis of the FAR levy information

Table 2-4: Value of sales of grain and silage in 2011

Grain and silage types	Price	Sales		Total Sales \$Million
	Weighted average \$/tonne	To farmers \$Million	To industry \$Million	
Wheat				
<i>Milling</i>	\$378	\$0.3	\$33.7	\$34.0
<i>Feed</i>	\$352	\$13.9	\$99.0	\$112.9
Barley				
<i>Malting</i>	\$346	\$0.1	\$11.4	\$11.5
<i>Feed</i>	\$322	\$26.3	\$97.8	\$124.1
Oats	\$409	\$0.9	\$9.2	\$10.1
Maize				
<i>Grain</i>	\$435	\$51.4	\$35.0	\$86.4
<i>Silage</i>	\$200	\$259.7	\$0.0	\$259.7
Other cereal grains	\$393	\$0.6	\$6.1	\$6.7
Total grains & silage		\$353.2	\$292.2	\$645.4

The analysis shows that sales of grain and silage to other farmers had a sales value of \$353 million, and sales of grain to industry had a sales value of \$292 million in 2011. The total value of sales of grain and silage from arable farmers in 2011, based on industry information is estimated at \$645 million.

2.7 Seeds crops

There is a wide variety of species of seed produced at a field scale in New Zealand. The seed is either grown so that it is certified to be only of the species and cultivar designated, or it is harvested from crops which may or may not contain some seeds from other cultivars. These two types of seed are known as, and sold as Certified seed, and Uncertified seed respectively. The process of Certification is administered and operated by AsureQuality, a 100% government-owned commercial entity, related to the Ministry of Primary Industry.

2.7.1 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. The species listed in their certification entries in 2011, and the area of each certified species within the total of 27,800 hectares is shown in the table.

Table 2-5: Area entered for certification of seed 2011

Species	Hectares	Species	Hectares
Arable Crops		Herbage & Amenity Grasses	
Barley	995	Brome Grass	32
Beans	0	Browntop	559
Garden pea	0	Cocksfoot	1,024
Linseed	52	Crested Dogstail	0
Maize	293	Grazing Brome	0
Oat	445	Festulolium spp	123
Pea	59	Hybrid Ryegrass	1,220
Ryecorn	19	Italian Ryegrass	5,140
Triticale	67	Perennial Ryegrass	7,568
Wheat	648	Phalaris	0
<i>Sub-total</i>	<i>2,578</i>	Prairie Grass	130
Brassicas		Red Fescue	67
Crambe	0	Tall Fescue	518
Ethiopian Cabbage	23	Timothy	0
Rape	483	Upland Brome	116
Kale	501	Westerwolds Ryegrass	0
Turnip	201	Yorkshire Fog	0
Swede	26	<i>Sub-total</i>	<i>16,497</i>
<i>Sub-total</i>	<i>1,234</i>	Legumes	
Other Species		Caucasian Clover	0
Chicory	23	Lotus	22
Fodder Radish	91	Lucerne	112
Phacelia	0	Red Clover	554
Plantain	49	White Clover	6,637
White Mustard	6	<i>Sub-total</i>	<i>7,325</i>
<i>Sub-total</i>	<i>169</i>	TOTAL ALL SPECIES	27,803 hectare

To give some idea of the range of plant breeding and production, and the scope of the programme to enter, and monitor the certification of production of pure seeds, there are large numbers of cultivars of most of the 43 species listed in the table. For example there are 30 cultivars of wheat. Of the three ryegrass species, Perennial, Italian, and Hybrid, there are a total of 239 cultivars, and for the all-important legume, White Clover there are 70 cultivars.

New Zealand 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, and then to develop some special purpose pasture species. This activity has now extended into a much wider range of specialist crops including vegetables. In many of

these, the New Zealand activity includes out-of-season multiplication of new cultivars being developed by plant breeding corporates in the Northern Hemisphere.

2.8 Certified and uncertified seeds produced in 2011

The tonnage of production of seeds in total for each species is obtained from the FAR levy data, and the tonnage of certified seed produced, from the AsureQuality data. The difference between these two is the uncertified seed produced as shown in the table.

Table 2-6: Certified and uncertified seed production in 2011

Seeds	Tonnes ex farm	Certified tonnes	Uncertified tonnes
	<i>Source</i> <i>FAR/Export</i>	<i>AQ/Export</i>	
Beans	4,215	0	4,215
Peas	30,957	43	30,914
Linseed	2,862	80	2,782
Other pulses	25,295		25,295
Pulses	63,329	123	63,206
Cocksfoot	440	356	84
Fescue	542	405	137
Ryegrasses	31,528	21,117	10,411
Other grass	934	422	512
Grasses	33,444	22,300	11,144
White clover	3,745	2,956	789
Red clover	189	154	35
Other legumes	271	17	254
Legumes	4,205	3,127	1,078
Rape	6,642	404	6,238
Kale	809	39	770
Turnip	339	152	187
Swede	31	23	7
Cabbage (Ethiopian)	1,116	23	1,093
Brassicac	8,936	642	8,294
Beet	107	0	107
Carrots	378	45	333
Radish	2,012	99	1,913
Plantain	71	71	0
Other vegetables	2,546		2,546
Non-brassica vegetables	5,115	215	2,353
Total Seeds	115,028	26,407	86,075

This table shows that there were 26,000 tonnes of main certified seeds produced in 2011, dominated by the grasses, 22,000 tonnes, and legumes 3,000 tonnes. There was three

times the weight of uncertified seed, at 86,000 tonnes. This was dominated in weight by the pulses, with significant volumes (11,000 tonnes) of grasses also.

2.9 Value of seeds

The value of sales of seeds shows a different picture however. The total value of certified seeds was \$94 million, nearly as much as the \$128 million value of uncertified seeds.

Table 2-7 Value of seed production 2011

Seeds	Price		Sales		Total Sales \$Million
	Uncertified \$/tonne	Certified \$/tonne	Uncertified \$Million	Certified \$Million	
Beans	\$567 ¹		\$2.39		\$2.39
Peas	\$771 ¹	\$1,000 ³	\$23.83	\$0.04	\$23.87
Linseed	\$809 ¹	\$1,000 ³	\$2.25	\$0.08	\$2.33
Other pulses	\$960 ¹		\$24.28		\$24.28
Total pulses			\$52.74	\$0.12	\$52.87
Cocksfoot	\$5,430 ²	\$3,990 ²	\$0.46	\$1.42	\$1.88
Fescue	\$1,244 ²	\$4,562 ²	\$0.17	\$1.85	\$2.02
Ryegrasses	\$2,318 ²	\$2,859 ²	\$24.13	\$60.37	\$84.51
Other grass	\$2,872 ²	\$7,509 ²	\$1.47	\$3.17	\$4.64
Total grasses			\$26.23	\$66.81	\$93.04
White clover	\$4,731 ¹	\$6,016 ²	\$3.73	\$17.78	\$21.51
Red clover	\$6,570 ¹	\$7,230 ²	\$0.23	\$1.11	\$1.34
Other legumes	\$4,999 ¹	\$1,111 ²	\$1.27	\$0.02	\$1.29
Total legumes			\$5.23	\$18.92	\$24.15
Rape	\$650 ¹	\$4,471 ²	\$4.05	\$1.81	\$5.86
Kale	\$3,920 ²	\$9,520 ²	\$3.02	\$0.37	\$3.39
Turnip	\$3,861 ²	\$3,861 ²	\$0.72	\$0.59	\$1.31
Swede	\$2,287 ¹	\$10,840 ²	\$0.02	\$0.25	\$0.27
Cabbage (Ethiopian)	\$4,001 ²	\$4,001 ²	\$4.37	\$0.09	\$4.47
Total brassicas			\$12.18	\$3.12	\$15.30
Beet	\$6,041 ²		\$0.65		\$0.65
Carrots	\$42,770 ²	\$42,770 ²	\$14.24	\$1.92	\$16.17
Radish	\$9,058 ²	\$9,058 ²	\$17.33	\$0.90	\$18.23
Plantain		\$31,626 ³	\$0.00	\$2.25	\$2.25
Other vegetables	\$982 ³		\$2.50		\$2.50
Non-brassica vegetables			\$32.22	\$5.08	\$37.30
Total Seeds			\$128.61	\$94.04	\$222.65

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

While the grasses and pulses had a high value of sales, the carrots, radishes, cabbage and other vegetable seeds generated a surprising \$53 million worth of sales in 2011.

In total, the seeds industry is estimated to have had sales worth \$222 million in 2011.

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 analysis¹. 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.

3.1 Scope of the economic impact study

The objective of this small 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.

Should the industry require analysis of the economic impact of the downstream users of the arable products, there would be a significant body of work required to research the structure of the downstream industries. It would require research into the industry structures of the animal feed producers, the grain millers and processors and of the animal production and human food industries that they supply. Earlier, 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, and formulated feeds and grains.

As well, the downstream impacts would require greater research into the structure and flows of specialist seeds from breeders to multiplication growers and to final sale, some parts of this process being on opposite sides of the world.

¹ 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.

3.2 Economic impacts of grains and silage

To estimate the economic impact of the grain and silage, and then the seeds components of arable production, we take the value of sales as estimated in the previous section, and use our 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 GDP, or Gross Domestic Product.

3.2.1 Gross Output

Gross output is economic jargon for 'value of sales'. As we saw earlier, the estimated value of sales for grain production was \$645 million in 2011.

Table 3-1: Gross Output multipliers for grain production 2011

Grains and silage (2011)	Tonnes	Total Value (\$ Million)	With Indirect Impacts (\$ Million)	With Total Impacts (\$ Million)
Wheat	410,962			
Milling	90,078	\$34.0	\$71.9	\$91.0
Feed	320,884	\$112.9	\$238.8	\$302.1
Barley	418,611			
Malting	33,253	\$11.5	\$24.3	\$30.7
Feed	385,358	\$124.1	\$262.6	\$332.2
Oats	24,737	\$10.1	\$21.4	\$27.1
Maize				
Grain	198,600	\$86.4	\$182.8	\$231.3
Silage	1,298,394	\$259.7	\$549.3	\$694.9
Other cereal grains	16,933	\$6.7	\$14.1	\$17.8
Total	2,368,237	\$645.4	\$1,365.3	\$1,727.2

This \$645 million direct impact is multiplied up to \$1.36 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 is added also, to total gross output impact is greater than \$1.7 billion in 2011.

3.2.2 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.

Table 3-2: GDP multipliers for grain production 2011

Grains and silage(2011)	Tonnes	GDP (\$ Million)	With Indirect Impacts (\$ Million)	With Total Impacts (\$ Million)
Wheat	410,962			
<i>Milling</i>	90,078	\$12.0	\$28.2	\$37.6
<i>Feed</i>	320,884	\$39.8	\$93.5	\$124.8
Barley	418,611			
<i>Milling</i>	33,253	\$4.0	\$9.5	\$12.7
<i>Feed</i>	385,358	\$43.7	\$102.8	\$137.2
Oats	24,737	\$3.6	\$8.4	\$11.2
Maize				
<i>Grain</i>	198,600	\$30.4	\$71.6	\$95.5
<i>Silage</i>	1,298,394	\$91.5	\$215.1	\$287.0
Other cereal grains	16,933	\$2.3	\$5.5	\$7.4
Total	2,368,237	\$227.3	\$534.7	\$713.3

This table shows that the \$645 million of sales generated \$227 million of value added. In the overall picture the total output of over \$1.7 billion, generated an addition to GDP of \$713 million.

3.2.3 Employment

The Third economic impact is the employment in the arable industry, and the indirect employment generated, measured in Full-Time Equivalents (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 2011. The estimates are shown in the table.

Table 3-3: Employment multipliers for grain production 2011

Grains and silage (2011)	Tonnes	Employment (FTEs)	With Indirect Impacts (FTEs)	With Total Impacts (FTEs)
Wheat	410,962			
<i>Milling</i>	90,078	208	402	493
<i>Feed</i>	320,884	689	1,336	1,636
Barley	418,611			
<i>Milling</i>	33,253	70	136	167
<i>Feed</i>	385,358	758	1,469	1,799
Oats	24,737	62	120	147
Maize				
<i>Grain</i>	198,600	528	1,023	1,253
<i>Silage</i>	1,298,394	1,586	3,073	3,763
Other cereal grains	16,933	41	79	96
Total	1,069,843	3,942	7,638	9,354

Our analyses indicate that there were over 3,900 FTEs employed in the arable industry in 2011. When we take account of the indirect employment generated, the total employment is estimated at about 9,300 FTEs.

In summary, the total economic impact of grain in 2011 is estimated to be gross output of over \$1.7 billion; GDP of \$713 million, and employment of 9,300 FTEs, a very significant contribution to the economy.

3.3 Economic impact of seeds

This section repeats the process used for grain, to estimate the economic impacts of seeds production in 2011.

3.3.1 Gross Output

The sales value, or gross output of seeds was estimated at \$222 million.

Table 3-4: Gross Output multipliers for seeds production 2011

Seeds (2011)	Tonnes	Total Value (\$ Million)	With Indirect Impacts (\$ Million)	With Total Impacts (\$ Million)
Pulses	63,329	\$52.9	\$111.8	\$141.5
Grasses	33,444	\$93.0	\$196.8	\$249.0
Legumes	4,205	\$24.1	\$51.1	\$64.6
Brassicas	8,936	\$15.3	\$32.4	\$40.9
Non-brassica vegetables	5,115	\$37.3	\$78.9	\$99.8
Total Seeds	115,028	\$222.6	\$359.1	\$454.3

With the indirect impact on sales of suppliers to seeds production, the gross output increases to \$359 million, and the total impacts are \$454 million.

3.3.2 Gross Domestic Product (GDP)

On a similar basis as for the grain estimate, the direct sales of \$222 million of seeds generates a value added of \$78 million. Taking into account the total impacts, the seeds industry makes a contribution of \$246 million to the GDP in the New Zealand economy.

Table 3-5: GDP multipliers for seeds production 2011

Seeds (2011)	Tonnes	GDP (\$ Million)	With Indirect Impacts (\$ Million)	With Total Impacts (\$ Million)
Pulses	63,329	\$18.6	\$43.8	\$58.4
Grasses	33,444	\$32.8	\$77.1	\$102.8
Legumes	4,205	\$8.5	\$20.0	\$26.7
Brassicas	8,936	\$5.4	\$12.7	\$16.9
Non-brassica vegetables	5,115	\$13.1	\$30.9	\$41.2
Total Seeds	115,028	\$78.4	\$184.4	\$246.1

3.3.3 Employment

Again the employment is estimated from coefficients for the relevant part of the agricultural industry. This indicates direct employment of 1,348 FTEs, and a generation of employment of 3,199 FTEs overall.

Table 3-6: Employment multipliers for seeds production 2011

Seeds (2011)	Tonnes	Employment (FTEs)	With Indirect Impacts (FTEs)	With Total Impacts (FTEs)
Pulses	63,329	323	626	766
Grasses	33,444	568	1,101	1,348
Legumes	4,205	147	286	350
Brassicas	8,936	93	181	222
Non-brassica vegetables	5,115	228	441	540
Total Seeds	115,028	1,360	2,635	3,227

3.4 Summary economic impact of the arable industry in 2011

Taking the separate information from the grains and the seeds production, we estimate that the annual value of sales of the arable industry in 2011 was \$607 million. This generated a total level of sales in the economy of nearly \$1.5 billion.

Table 3-7: Summary of arable production economic impacts

Arable Industry 2011	Tonnes	Direct Impacts	With Indirect Impacts	With Total Impacts
Gross output (\$million)				
Grains and silage	2,368,237	\$645.4	\$1,365.3	\$1,727.2
Seeds	115,028	\$222.6	\$359.1	\$454.3
Arable industry	2,483,265	\$868.1	\$1,724.4	\$2,181.5
Value Added (GDP, \$ million)				
Grains and silage		\$227.3	\$534.7	\$713.3
Seeds		\$78.4	\$184.4	\$246.1
Arable industry		\$305.7	\$719.1	\$959.4
Employment (FTEs)				
Grains and silage		3,942	7,638	9,354
Seeds		1,360	2,635	3,227
Arable industry		5,301	10,273	12,580

The total contribution to GDP is \$960 million, and the total addition to employment is estimated at 12,580 FTEs in the 2011 year.

Arable production is again a significant contributor to New Zealand's economy. The 12,580 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.

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