final report

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Supply chain protocol for the importation of US maize into Australia

Abstract

Continued availability of grain for intensive livestock feeding in Australia is at risk due to current and future potential grain shortages. Importation of whole grain without significant treatment to control Quarantine Pests and associated Non-Quarantine Pests is difficult, costly and subject to strict Quarantine Authority restrictions. The consultant was engaged by Meat & Livestock Australia to develop a supply chain protocol for the importation of US maize into Australia. The protocol outlines processes to minimise the quarantine risks of contamination of the maize with pests and diseases present in US maize. By selecting maize of the appropriate quality from States such as Minnesota the initial Pest load of the maize is reduced. By using an Identity Preservation system and a supply chain pathway to either the PNW or Gulf ports, the maize can be sourced and quality maintained and enhanced through processes such as cleaning and fumigation. A request for importation of USA corn to Australia's Quarantine Authority has a greater chance of being approved with minimal costs of treatment of the grain by industry by following the processes outlined.

Executive Summary

Meat and Livestock Australia sought a consultant to develop a supply chain protocol to evaluate the potential pathways for the importation of United States corn as a feed grain in times of short supply in Australia. This report was written to enable Meat and Livestock Australia to determine the potential for imports into Australia of USA corn and outlines the potential costs of that process during periods of stockfeed shortage within Australia.

The project has taken into account the location of corn grown in the USA and the various pests, diseases and contaminants associated with that crop. Potential identity preservation pathways that reduce the risks of contamination have been explored as have processes to further reduce the risk of importing unacceptable product or preventing the need for additional uneconomic processes within Australia. The main focus is on reducing the risk of quarantinable material in imported corn.

The review of corn supplies and discussions with the USA corn industry indicate quality available for export is expected to vary but US No.2 Grade should be targeted as this is the major grade received. The physical quality parameters of the corn will not be known until harvest and discussions occur with the suppliers of the corn.

To minimise the risk of entry of Quarantinable Pests into Australia, the quality supplied should be as high as possible given pricing and availability restrictions. Quarantine requirements in Australia dictate that the corn should be dry and clean and insect free.

It is expected that corn will contain a level of weed seeds and the corn may have high moisture content. This will necessitate some form of processing prior to export, as corn with these levels of contaminants and moisture will not be suitable for shipping to Australia. Cleaning and drying of the corn will remove much of the contaminants and damaged corn, significantly reducing the quarantine risk associated with high levels of these parameters.

Non-GM corn should be targeted initially using various IP procedures along the supply chain to ensure the quality targeted is actually supplied. A range of other quality parameters of concern with corn, such as mycotoxins and chemical residues levels will need to be stipulated in the contract to ensure relevant Australian and international regulations are met.

Based on previous import risk analyses, there are several Quarantine Pests of concern associated with the importation of USA corn. No economically feasible processes are available at present to provide corn with a nil risk of the presence of these Quarantine Pests. However by reviewing the relative presence of these Quarantine Pests in the various crop production areas, areas of low Pest incidence can be found. Stock selection from corn-growing regions such as Minnesota can reduce the initial potential for these to be present.

As the actual presence of these Quarantine Pests is not known until the crop has been harvested and analysed the actual levels present can only be surmised based on previous surveys. Based on the analyses conducted on available information, Minnesota has been chosen as one of the States with the least likely or lowest Pest loading.

As a significant tonnage of corn is exported to a large number of international markets, there are a number of suppliers of corn and supply chain participants involved in exports.

There are two supply chain pathway options.

The majority of corn is exported from the Gulf through a range of port terminals. These terminals are generally fed by the river systems with corn supplied on barges. The barges are loaded in up-country locations from the corn-belt from a number of elevator companies. A number of these are considered suitable for supply of corn, ensuring the stock selected is of the appropriate quality and its identity remains intact. Initially, corn will be cleaned and dried at these up-country locations. Fumigation is also recommended while corn is being transported to port on these barges.

IP processes are currently used to meet requirements of many customers of USA corn and these same protocols will be used for supplying corn to Australia. This includes aspects such as cleaning, documentation and certification by FGIS or independent inspection companies. Clean down of structures along the supply chain can be achieved to meet a high degree of cleanliness and satisfy contract and quarantine requirements.

An alternative supply path exists for corn to be supplied by rail from these same country elevators to the Pacific North West for export. The grain will be moved by rail wagons to port. There would be focus on rail transport in the winter months when the upper river systems are iced over.

Vessels can be cleaned to a level required by Australian Quarantine Authorities and inspection of the loading of corn by AQIS could be considered as a final stage in the USA supply chain that verifies all required processes have been followed.

As an additional risk mitigation step, the corn will be fumigated on-route to Australia. On arrival, discharge into a separate isolated facility for subsequent denaturing if available will be the final step in the process to render any potential Quarantine Pests inert.

As an alternative, consideration should also be given to sourcing any commercial supplies of corn that meet any particular US Grade Standard and treating the grain upon discharge in Australia.

The cost of sourcing the corn varies greatly depending on a range of factors, many of which cannot be determined until the contract for the supply of the corn is drawn up and negotiated with potential buyers. The stipulations imposed by Biosecurity Australia will have a significant impact on the contract terms and conditions. Based on current prices, the cost to source non-GM corn, treat it and handle in an IP manner as described using all the processes outlined is approximately $40/tonne. There is an opportunity to reduce this cost over time as processes are improved.

As corn could be sourced from Minnesota either via the PNW or the Gulf, the cost could vary from $275/tonne via the PNW to $303/tonne ex the Gulf landed in Australia. A further cost of $ 16/tonne is required for discharge and storage for a minimal period at port. This figure excludes any costs associated with product denaturing in Australia.

Contents

1 Background

This report presented by GP McMullen Consulting is in response to a request for consultancy services by Meat and Livestock Australia.

A significant portion of the Australian intensive livestock industry is on the east coast, with a focus in Queensland. In recent years, the availability of stockfeed, mainly grains, has been limited due to drought conditions. Projected increases in grain for livestock and the ethanol industry, combined with the potential increased incidence of drought, places uncertainty on feed grain availability and ability of the meat industry to successfully operate in that part of Australia.

Corn is a good source of energy for stockfeed, being readily available. It is relatively cheap compared with other stockfeed grains. However the importation into Australia of grain and movement of wholegrain into country areas is difficult due to the strict quarantine regulations maintained by Australia's quarantine authority. The political environment within the grains industry has also made this task difficult.

Quarantine Pests are classified as such as they may be potentially capable of contaminating the Australian crop and surviving in Australian conditions, becoming a quarantine and economic impost. Unless processes can be developed that minimise or totally reduce the potential for Quarantine Pests to be present in imported grain, imports will not be permitted.

Biosecurity Australia is the Australian Government Quarantine Authority responsible for ensuring imports are only permitted where strict quarantine conditions are met. The Australian Quarantine and Inspection Service are responsible for monitoring imports against conditions developed. Imports are not permitted unless they are approved and subsequently inspected to ensure all processes as legislated are followed.

It is expected that he information in this report will be used by Meat and Livestock Australia to develop a proposal for seeking to import USA corn into Australia.

2 Project Objectives

2.1 Supply Chain Protocol

This report attempts to compile various data and research conducted to date and recommend a supply chain pathway to permit entry of corn from the United States of America (USA). The proposed pathways specifically deal with minimising the quarantine risks associated with the importation of USA corn. The pathways assist in the reduction of the pest and pathogen status of imported corn, reducing the risk of establishment of these pests and diseases in Australia and reducing the level of remedial action required to alter the quality of the imported corn.

3 Methodology

The quarantine status of a number of crops grown overseas that are potentially available for import into Australia is reasonably well known. To enable imports to occur at an economic level various studies have occurred to some extent in recent years and are continuing. For example, a review of suitable denaturing chemicals is currently underway.

Some of these previous reviews include:

- Analysis of potential grain types and tonnage availability
- Quarantine status of grain supplies
- Supply chain pathways
- Mechanisms to reduce the risk and load of pests and pathogens

A preliminary report was provided to Meat and Livestock Australia to determine whether imports were feasible from an economic and quarantine perspective. That report indicated there was potential for imports of USA corn that met the project objectives.

Information from the preliminary report, information gathered from further contact with the USA grain industry and data obtained following a visit by Meat and Livestock Australia to the USA has been used to compile this final report.

Data for this report was obtained from a wide range of sources, as indicated in the bibliography. The Appendices list the sources used and potential future sources of that information if required to update the data.

Data was obtained via reference to previous reports, information available from the internet, personal contact with industry in the USA and Australia and from personal knowledge of the consultants.

As stated, given the commercial sensitivity of some of that information, no guarantees can be given to its full accuracy.

The report was primarily developed by the consultant GP McMullen Consulting. Supply chain information in the USA was provided by Sampraz who are experts in supply chain pathways.

3.1 Scope and Limitations of this Report

This report has been written based on the information available at the time of writing. During the process of writing this report, the availability of USA corn only for importation into Australia has been reviewed. There may be other crops and other sources of grain that will provide a more economic and viable solution to the stockfeed grain shortage situation in Australia.

The crop tonnage figures are those obtained from relevant USA Government and private websites. The information is the most up to date that was available to the author at the time of writing however due to variable factors such as commercial ownership, domestic usage, export allocations and carryover stocks, the exact tonnage available may alter over time. Tonnage available for export from the USA can only be confirmed following detailed commercial contract discussions with the relevant owners of that stock.

The quarantine and quality status of the USA corn crop has been determined from a number of sources. As this status alters over time, including a particular crop year, there may be variations from one crop year to another or within a year as stocks are utilised. Further detailed analysis would be required at the time of seeking commercial partners to supply the crop from the USA.

Similarly, the supply chain pathways and companies available or willing to supply the grain were determined based on our discussions with those companies. Further details and a more accurate assessment of the options and costs of sourcing the grain and provision of supply chain services can only be determined following commercial discussions.

Additionally, all information obtained is the most recent data considered to be accurate at the time of writing the report. Follow-up would be required to ensure its accuracy at a future point in time, as tonnage availability and costs of services regularly alter over relatively short periods of time depending on the marketplace.

By removing various Sections of this report and the addition of any material of specific interest to Meat and Livestock Australia, this report is deemed suitable for presentation to Biosecurity Australia, if appropriate. Details of pricing and costs involved in the supply of corn have been included as reference material that is deemed useful in describing to all parties the requirements of the marketplace versus those of regulators and other interested stakeholders.

Disclaimer

The information contained in this report is based on sources believed to be reliable. However, GP McMullen Consulting gives no warranty that the said sources are correct, and accepts no responsibility for any resultant errors contained herein and any damage or loss, howsoever caused, suffered by any individual or corporation.

4 Results and Discussion

4.1 USA Corn Supply

4.1.1 World Supply

Corn is the biggest crop grown in the USA annually in terms of both volume and value. Worldwide corn is the third biggest crop after wheat and rice. The USA typically produces around 40 plus percent of the world's corn. China, the European Union and Brazil are also major producers of corn.

World Corn Production 2005-06		
Country	Thousand MT	Million Bushels
USA	282,245	11,112
China	133,985	5,275
EU	47,473	1,869
Brazil	42,494	1,673
Mexico	20,498	807
Argentina	16,789	661
India	13,487	531
Canada	9,474	373
Romania	8,992	354
South Africa	7,493	295
Others	100,508	3,957
Total	**683,438**	**26,907**

Source: NCGA 2006

The USA is by far the world's biggest exporter of corn, supplying typically over 50% of the worlds traded corn. It dominates the markets both from a supply and pricing point. Argentina and China are big players but their exports are minor compared to the USA. Seasonality does play a role in the export cycle and pricing of world corn trade.

World Corn Exports 2005-06		
Country	Thousand MT	Million Bushels
USA	47,498	1,870
Argentina	12,497	492
China	5,994	236
Ukraine	2,311	91
South Africa	1,499	59
Brazil	1,499	59
Romania	787	31
EU	610	24
Paraguay	406	16
Thailand	254	10
Others	2,007	79
Total	**75,362**	**2,967**

Source: NCGA 2006

Feed users in both Japan and South Korea are the biggest buyers of corn and for Japan this is predominately sourced from the USA. South Korea is much more of a price buyer than Japan and they will buy the worlds cheapest supplies. Japan still relies on loyalty and is very rigid in its buying patterns.

Top World Corn Importers 2005-06		
Country	Thousand MT	Million Bushels
Japan	16,510	650
South Korea	8,407	331
Mexico	6,706	264
Egypt	5,309	209
Taiwan	4,597	181
EU	2,997	118
Malaysia	2,489	98
Iran	2,311	91
Columbia	2,210	87
Canada	1,499	59
Others	23,851	939
Total	**76,886**	**3,027**

Source: NCGA 2006

Major USA Corn Export Markets						
Country	Thousand MT			Million Bushels		
	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Japan	14,376	14,605	15,494	566	575	610
Mexico	5,232	5,690	5,867	206	224	231
Taiwan	4,064	4,750	4,343	160	187	171
Egypt	2,692	3,200	3,861	106	126	152
Canada	3,912	2,032	2,362	154	80	93
South Korea	279	3,658	2,108	11	144	83
Colombia	1,600	1,778	2,032	63	70	80
Syria	508	787	1,295	20	31	51
Algeria	889	1,270	1,016	35	50	40
Dominican Rep.	940	813	991	37	32	39
Other	5,690	9,703	6,706	224	382	264
Total	**40,183**	**48,285**	**46,076**	**1,582**	**1,901**	**1,814**

Source: NCGA 2006

The end uses of corn have changed over recent years. Previously corn was predominately used as a stock feed and whilst it is still the biggest use of corn today, demand for other uses is rapidly growing. Over recent years due to the ever increasing oil prices, corns' usage in industrial applications for the production of ethanol is growing at tremendous rates. This is having a huge impact on the supply patterns of corn and its impact is being felt especially on USA exports. Subsequently prices are rising accordingly.

In August last year a new law was signed in the USA called the "Energy Policy Act of 2005". This legislation has set a target of 28.4 billion litres of renewable fuels (ethanol and biodiesel) to be produced in the USA by 2012. According to the US Grains Council this will be easily achieved. They forecast that the use of corn for ethanol will grow from roughly 38mmt today to more double this figure at 76mmt plus and usage will quickly surpass exports of corn.

USA Corn Usage by Segment		
	Thousand MT	Million Bushels
Feed / Residual	152,400	6,000
Export	46,990	1,850
Food, Seed, Industrial		
Ethanol	40,005	1,575
HFCS	13,589	535
Starch	7,239	285
Sweeteners	5,588	230
Cereal / Other	4,826	190
Alcohol	3,429	135
Seed	508	20
Total	**274,574**	**10,810**

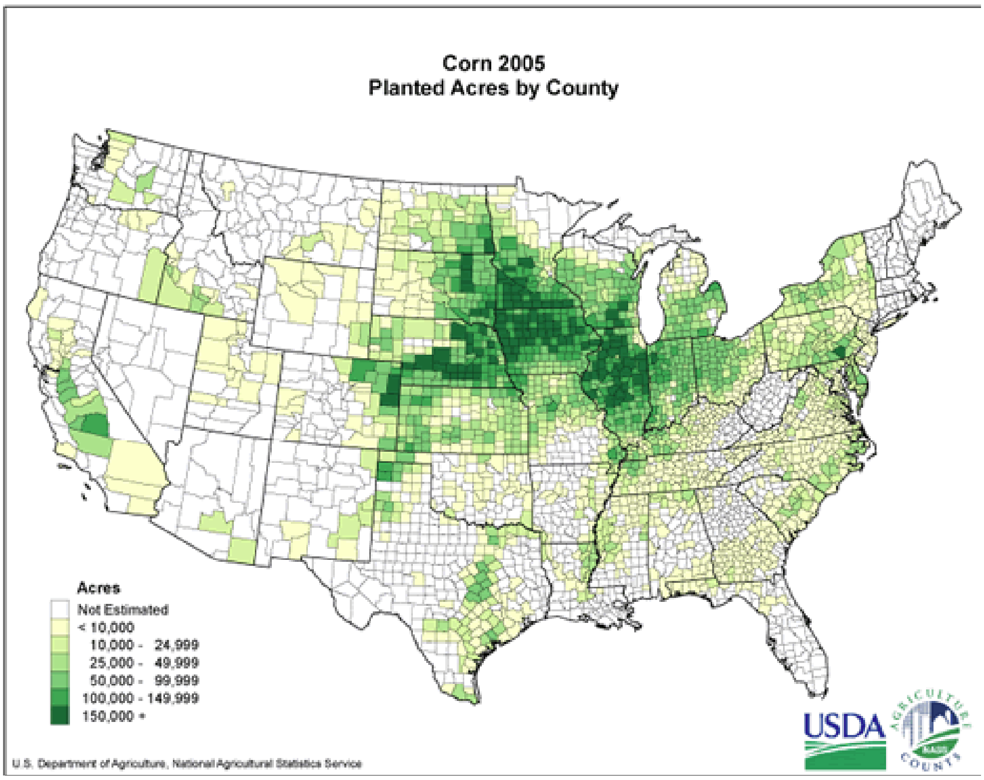
Source: NCGA 2006

4.1.2 USA Production Regions

The majority of corn grown in the USA is in a region called the Corn Belt, which is located in the Midwest of the USA (the red shaded region in the below map). The majority of corn grown in the USA is "dent" corn due to the kernel forming a dent on the cap at maturity. Whilst corn is grown in 48 USA States, by far the majority is produced in the Corn Belt region. The States of Illinois, Indiana, Iowa, Minnesota and Nebraska each produced over 20mmt in 2005. A further seven states comprising Kansas, Michigan, Missouri, Ohio, South Dakota, Texas and Wisconsin in 2005 produced over 5mmt and combined these twelve states produced more than 250mmt (89%) of the USA corn crop last year (USDA / NCGA).

Map showing Major USA Corn Belt:

Map Showing Entire USA Corn Belt:



The above graph information is depicted in the table below that shows the Corn Production figures for each State on the basis of the last 5 years.

USA Corn Production by State 2001 - 2005					
State	Total Production (thousand metric tonnes)				
	2001	2002	2003	2004	2005
Alabama	408	402	589	609	605
Arizona	148	132	106	123	109
Arkansas	681	885	1,245	1,085	765
California	691	648	569	667	481
Colorado	3,805	2,853	3,052	3,566	3,571
Connecticut*					
Delaware	601	352	506	591	559
Florida	57	83	81	73	67
Georgia	749	847	950	925	754
Idaho	171	203	178	324	259
Illinois	41,890	37,998	46,030	53,035	43,405
Indiana	22,467	16,043	19,988	23,598	22,570
Iowa	42,276	49,873	47,455	57,008	54,928
Kansas	9,839	7,366	7,620	10,973	11,830
Kentucky	3,967	2,694	3,758	4,401	3,956
Louisiana	1,154	1,735	1,702	1,406	1,140
Maine*					
Maryland	1,416	820	1,281	1,652	1,372
Massachusetts*					
Michigan	5,067	5,900	6,600	6,535	7,337
Minnesota	20,472	26,718	24,661	28,472	30,274
Mississippi	1,271	1,683	1,817	1,520	1,196
Missouri	8,783	7,201	7,681	11,851	8,374
Montana	49	46	60	54	64
Nebraska	28,937	23,896	28,555	33,520	32,271
Nevada*					
New Hampshire*					
New Jersey	188	103	175	262	192
New Mexico	210	224	219	265	244
New York	1,440	1,109	1,352	1,549	1,449
North Carolina	1,984	1,476	1,831	2,199	2,134
North Dakota	2,059	2,906	3,328	3,067	3,932
Ohio	11,111	6,415	12,165	12,481	11,805
Oklahoma	667	627	603	762	730
Oregon	64	79	130	121	102
Pennsylvania	2,464	1,503	2,600	3,485	2,975
Rhode Island*					
South Carolina	658	304	573	749	840
South Dakota	9,413	7,722	10,855	13,703	11,939

USA Corn Production by State 2001 - 2005

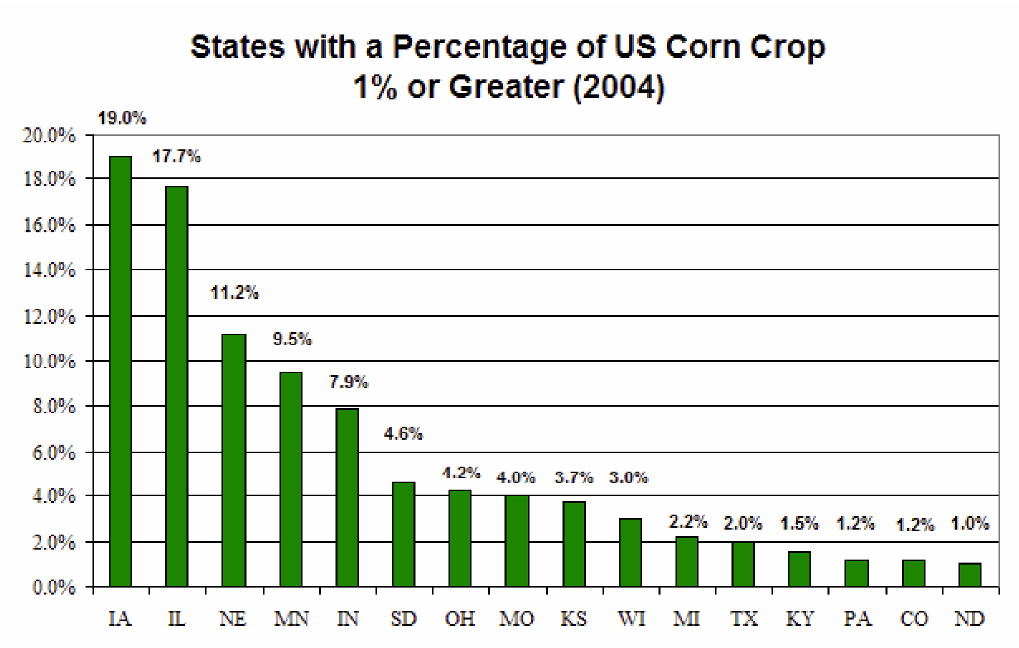
Tennessee	2,079	1,685	2,063	2,187	1,965
Texas	4,256	5,224	4,945	5,931	5,357
Utah	54	52	51	47	50
Vermont*					
Virginia	1,031	511	964	1,326	1,079
Washington	265	338	347	533	417
West Virginia	79	80	79	96	78
Wisconsin	8,387	9,944	9,338	8,981	10,902
Wyoming	162	113	164	166	174
Total USA	**241,474**	**228,795**	**256,266**	**299,900**	**282,247**

Source: USDA, NCGA

1 Metric tonne equals 39.368 bushels

* These States produce negligible amounts

Relative percentages on a State basis do not vary significantly over the short term and graphically this can be depicted by the following for 2004/05:



Key:

IA – Iowa	IL – Illinois	NE – Nebraska
MN – Minnesota	IN – Indiana	SD – South Dakota
OH – Ohio	MO – Missouri	KS – Kansas
WI – Wisconsin	MI – Michigan	TX – Texas
KY – Kentucky	PA – Pennsylvania	CO – Carolina
ND – North Dakota		

Based on the figures above, the various regions produce the following tonnages:

USA Corn Production by Growing Region	*Production Share*
Northern & Central	*56%*
Mid-Atlantic Ohio River Valley	*34%*
South	*2%*
West & South West	*8%*

4.1.3 Domestic & Export Supply

As can be seen from the following tables USA planted corn acreage is slightly lower this year. Production is forecast to be down by about 10mmt and carry in from the previous year largely unchanged. The big change in this years USA supply and demand (S&D) is the forecast increase in local consumption by over 25mmt mainly due to increased ethanol production. Use of corn for ethanol in the USA has grown 60% since 2004/05 (USDA 2006) and forecast to increase a further 40% by 2007 (WCA 2006). USA exports are forecast to increase by 15mmt. This has in turn reduced the USA carryover by about half on previous years. Subsequently forecast farm prices have significantly jumped in response to this low carry figure and strong demand.

USDA USA and World Corn Supply and Demand as at 12 July 2006			
	2004-05	2005-06	2006-07(f)
USA Corn Supply / Demand			
Planted (mill acres)	80.9	81.8	79.4
Harvested (mill acres)	73.6	75.1	72.1
Yield (Bushels / acre)	160.4	147.9	149.0
Production (mmt)	299.9	282.2	272.8
Carry In (mmt)	24.3	53.7	52.4
Imports (mmt)	0.3	0.3	0.3
Domestic (mmt)	224.7	228.2	243.5
Exports (mmt)	46.1	53.3	54.6
Carry Out (mmt)	53.7	55.3	27.4
Avg. Farm Price $/b	2.06	1.95-2.00	2.25-2.65
World Corn Production (mmt)			
USA	299.91	282.26	272.81
Argentina	20.50	14.00	17.50
Brazil	35.00	41.00	40.50
China	130.29	139.37	138.00
S. Africa	11.72	7.50	9.00
EU-25	53.48	48.32	48.43
Mexico	22.05	19.20	21.30
Other	139.35	140.09	139.21
World	712.30	691.74	686.75
World Corn Supply / Demand (mmt)			
Carry In	103.23	130.45	127.08
Production	712.30	691.74	686.75
Imports	77.09	75.57	76.86
Domestic	685.08	695.11	722.62
Exports	78.08	73.94	78.29
End Stocks	130.45	127.08	91.22
World Corn Ending Stocks (mmt)			
USA	53.70	52.37	27.35
Argentina	0.96	0.86	0.76
Brazil	4.38	4.86	2.94
China	36.56	35.00	28.10
S. Africa	3.02	1.49	1.49
EU-25	7.75	10.24	11.36
Mexico	4.42	2.71	2.71
Other	19.66	19.55	16.51
World	130.45	127.08	91.22

World ending stocks of corn are forecast to be down by over 35mmt this year representing one of the tightest carry figures for several years. Whilst there is still a long way to go with this year's corn crop, on the basis of today's stocks position and forecasts of increased usage, it appears we are heading into a strong bull market and this is likely to continue well into 2007.

4.1.4 Quality Specifications

Under USA law all mainstream grains must be officially certified that they have been accurately weighed and inspected. Certification is undertaken by the Federal Grain Inspection Service (FGIS). The Grain Standards Act provides the official standards that are used to measure and describe grain. FGIS provide a certificate of weight and quality on all export cargoes.

The USA has official standards for corn and there are six grades: Number 1 through to Number 5 Grade and Sample Grade. Number 1 is the premium corn. By far the majority of corn traded internationally is either Number 2 or 3 Grade. Corn grades are further subdivided into classes on the basis of colour - yellow corn, white corn and mixed corn - yellow being the major class. Grade 1 – 5 and Sample Grade applies to each of these colour classes. Special grades exist for specific quality / niches. Sample Grade is lowest and is for grain which does not make Grades 1 - 5 for any particular reason.

The specific quality parameters for the various grades are outlined in the table in Appendix 13.4. The important criteria are test weight, damaged kernels, foreign material and broken corn. There are numerous sub-categories under each of these heading for attributes such as mould, disease, sprouting etc as also outlined. Other important quality parameters such as moisture, protein and oil content are not part of the official USA Standards, but can be incorporated into export contracts at a cost.

4.1.5 Quality Availability

There is little information available on the quality of the current USA corn crop. Historical information is outlined below.

USA Corn Exports : No. of Lots and Quantity Exported by Class and Grade 2003-2005							
Class	Grade	2003		2004		2005	
		Number of Lots	M Tons	Number of Lots	M Tons	Number of Lots	M Tons
Yellow Corn	U.S. No. 1	101	762,681	137	1,146,183	159	1,097,793
	U.S. No. 2	1,043	22,465,854	1,152	25,918,108	999	22,709,322
	U.S. No. 3	601	14,805,318	582	16,225,733	625	16,005,644
	U.S. No. 4	4	13,972	6	27,415	8	44,142
	U.S. No. 5	1	14,988	3	1,276	2	18,841
	U.S. Sample Grade	2	6,423	1	13,676	1	1,670
	Not Inspected	1	8,395	1	1,559	0	0
	All Lots	1,753	38,077,631	1,882	43,333,950	1,794	39,877,412
White Corn	U.S. No. 1	25	242,857	44	343,421	63	375,117
	U.S. No. 2	23	144,797	31	300,547	37	208,942
	U.S. No. 3	5	13,751	1	2,680	2	14,854
	All Lots	53	401,405	76	646,648	102	598,913
All Classes	U.S. No. 1	126	1,005,538	181	1,489,604	222	1,472,910
	U.S. No. 2	1,066	22,610,651	1,183	26,218,655	1,036	22,918,264
	U.S. No. 3	606	14,819,069	583	16,228,413	627	16,020,498
	U.S. No. 4	4	13,972	6	27,415	8	44,142
	U.S. No. 5	1	14,988	3	1,276	2	18,841
	U.S. Sample Grade	2	6,423	1	13,676	1	1,670
	Not Inspected	1	8,395	1	1,559	0	0
	All Lots	1,806	38,479,036	1,958	43,980,598	1,896	40,476,325

0 = no. of lots reported in this category

Not Inspected = These lots were sold without grade designation

As outlined in the table, the major corn grades exported are No.2 and No.3.

The quality of grain exported within the various Yellow and White Grades is listed in the following table:

USA Yellow & White Corn Export Quality 2005								
Quality Parameter		No.1	No.2	No.3	No.4	No.5	Sample Grade	All Lots
Test Weight (lb/bu)	Grade Limit	56.0	54.0	52.0	49.0	46.0	n/a	n/a
	Average - Yellow	58.8	57.2	56.9	57.3	56.5	57.0	57.1
	Average - White	59.8	60.0	60.1				59.9
Moisture (%)	Grade Limit	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average - Yellow	14.2	14.3	14.3	14.2	14.2	14.8	14.3
	Average - White	14.1	14.0	13.7				14.0
Heat-damaged kernels (%)	Grade Limit	0.1	0.2	0.5	1.0	3.0	n/a	n/a
	Average - Yellow	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Average - White	0.0	0.0	0.0				0.0
Damaged kernels Total (%)	Grade Limit	3.0	5.0	7.0	10.0	15.0	n/a	n/a
	Average - Yellow	1.7	3.2	3.5	7.1	9.3	10.3	3.3
	Average - White	2.0	2.4	4.7				2.2
Broken Corn & Foreign Material (%)	Grade Limit	2.0	3.0	4.0	5.0	7.0	n/a	n/a
	Average - Yellow	1.5	2.6	2.9	4.0	3.4	3.2	2.7
	Average - White	1.6	2.0	2.9				1.7
Broken Corn (%)	Grade Limit	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average - Yellow	0.0	1.9	2.6	2.9	0.0	0.0	2.2
	Average - White	1.3	2.0					1.4
Foreign Material (%)	Grade Limit	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Average - Yellow	0.0	0.7	0.9	1.3	0.0	0.0	0.8
	Low - Yellow	0.0	0.4	0.6	1.3	0.0	0.0	0.4
	High - Yellow	0.0	1.1	1.2	1.3	0.0	0.0	1.3
	Average - White	0.5	0.5					0.5
	Low - White	0.1	0.4					0.1
	High - White	0.6	0.7					0.7

0 = no lots reported in this category

not inspected = These lots were sold without grade designation

The most relevant aspect is the low level of foreign material in the various grades for both Yellow and White corn. While the range of values (low and high) is not shown for all quality parameters, they are for Foreign Material. This indicates grain is exported well within the grade limit for Foreign Material. There is further potential to lower this level through cleaning at or prior to export, as outlined in other sections of this report.

The quality of the 2005 export Yellow versus the White corn crop is relatively similar with no real trends for each of the specifications. As stated, this varies with each harvest and location.

As the quality of the crop varies from year to year and as corn is exported, the exact quality of the corn remaining and/or available for export is not known at any one time. This can be determined at the time of seeking specifications and prices from exporters willing to offer stocks.

Similarly, the quality and quantity of the crop in the various States is not easily identified nor able to be sourced directly as many farmers store the corn on farm. Thus much of the information is commercially unavailable. However traders do have a reasonably accurate view of the various qualities available.

Additionally, other quality parameters such as mycotoxin levels, weed seeds, specific pathogens etc are not defined or listed in any information provided on the web or from the various USA Corn Associations, State Universities or the USDA. This testing and thus information is available at a State level, but only after much of the crop has been harvested and used/exported. Note that historical data is not directly relevant to the current crop, as this information is often several years old and is not in a format readily applicable to evaluate the entire corn crop in a particular State or County at the time of shipment.

Unlike most of the corn exporting areas of the world, the majority of USA corn is produced where cold, wet weather prevails at harvest time and during the first six months of storage. Moisture is not a grading factor in USA corn because it is “easily changed” without changing the inherent quality and nutritional value of the grain. As shown in the corn quality table, most USA corn is harvested at moisture contents too high for storage and is dried in grain dryers. Due to local conditions, corn is often stored at cold temperatures at moisture contents of 14–17%. The adequacy of the drying process and storability of USA corn is an issue, especially if corn is to be imported into Australia in the warmer months, leading to moisture migration.

In recent years, the average moisture content of exported USA corn has been about 14.3%, probably because of the 14.5% maximum moisture specifications in most contracts.

Of all the corn grown in the USA, the corn most likely to be exported is that grown near the rivers upon which it is transported to the export elevators. In this part of the corn-belt, corn is likely to be harvested when it contains at least 20% moisture. Typically, the corn is dried in grain dryers and stored at 15–17% moisture. During subsequent aeration and storage through the cold, winter months, the grain dries further. Grain lots from various origins and having different characteristics are blended to meet the moisture content, bulk density (test weight) and other specifications of the export contract. It is typical of USA traders to extensively blend differing qualities so as to just make contractual specifications and maximise returns via the use of variable priced / qualities of grain.

Rodents and birds are problems when grain is stored in open sheds. A barrier wherein vegetation is removed and water is not available is recommended around the warehouses. Birds may be a special problem at ports, where they may contaminate the grain before it arrives at the warehouse. Routine feed analysis for Salmonella and other disease organisms is recommended and carried out to varying degrees.

The specifications required of the corn crop in order to import the corn into Australia would be laid out in contracts with suppliers. Processes to ensure the quality meets the contract terms, reflecting potentially the quarantine requirements of Australia, are addressed later in this report.

4.1.6 GM Status

GM corn (biotech) crops were first commercially grown in the USA in 1996 and since then growers have eagerly taken to producing crops using this technology. Today more than 50% of the USA corn crop is GM. The remaining non GM segment is expected to continue to shrink as producers and consumers become more accepting of GM products.

There are 3 types of GM corn crops. These are:

- "Bt corn" - or specific insect resistant corn
- "HT corn" which are specific herbicide tolerant
- "Stacked traits" which combines both Bt and HT traits

Bt corn contains the gene from the soil bacterium *Bacillus thuringiensis* which provides the plant with a bacterium which produces a protein that is toxic to specific insects, protecting the plant over its entire life.

HT corn is Herbicide-tolerant which was developed to survive application of specific herbicides that previously would have destroyed the crop.

The use of hybrids for herbicide resistance or to express insect toxins is expected to increase, resulting in reductions in the pesticides used. Pest populations will also shift in response to the changes in herbicide and insecticide use. Overall, fields planted to varieties of corn with GM traits are expected to have fewer weed and insect problems in future.

For growers in the USA GM corn provides higher yield potential as opposed to non GM seed and there are less labour and input costs associated with growing a GM crop. In general growers have been actively raising the visibility of the benefits of GM crops as a main priority. Producers see GM crops as a logical means of improving the quality of their products as well as protecting the environment.

Most of the non GM corn is produced in Ohio and Illinois, with lesser amounts grown in Indiana, Iowa and Nebraska. GM and non-GM corn are not routinely segregated at the farm level. The exception would be if farmers are growing IP non-GM corn under contract or speculation of a future contract opportunity (NCGA). This year USDA estimates 61% of the USA corn crop is GM.

Although the majority of corn exports are mixed (GM and non GM), IP non-GM is readily available at a modest premium.

Use of GM corn is accepted in the USA, but export buyers who want GM free, need to pay a premium to source IP GM free corn. The major market for USA GM free corn is Japan and to a lesser degree the EU. The USA Grains Council report that subject to the grades and quality specifications, buyers pay growers between US $1.97 to $7.87 per mt. They forecast that production of non GM corn will remain flat and demand for this product will continue.

The following table lists the percentage of GM corn varieties by major corn producing States in the USA. In 2005 Bt corn was 26%, HT corn 17%, stacked traits 9% and total GM corn production was 52%.

Biotech Percentage Share of US Corn Acres Planted

State	Bt			Herbicide Tolerant			Stacked Traits			All Biotech Hybrids		
	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005
Illinois	23	26	25	4	5	6	1	2	5	28	33	36
Indiana	8	11	11	7	8	11	1	2	4	16	21	26
Iowa	33	36	35	8	10	14	4	8	11	45	54	60
Kansas	25	25	23	17	24	30	5	5	10	47	54	63
Michigan	18	15	15	14	14	20	3	4	5	35	33	40
Minnesota	31	35	33	15	17	22	7	11	11	53	63	66
Missouri	32	32	37	9	13	12	1	4	6	42	49	55
Nebraska	36	41	39	11	13	18	5	6	12	52	60	69
Ohio	6	8	9	3	4	7		1	2	9	13	18
South Dakota	34	28	30	24	30	31	17	21	22	75	79	83
Wisconsin	21	22	22	9	14	18	2	2	6	32	38	46
Others	17	19	20	17	21	25	2	6	7	36	46	52
Total US	**25**	**27**	**26**	**11**	**14**	**17**	**4**	**6**	**9**	**40**	**47**	**52**

Source : NCGA / NASS

The importation of corn would initially target non-GM corn and processes to meet this requirement are outlined later in this report.

4.1.7 Commercial Pricing & Supply

The following is a general description of pricing and supply mechanisms in the USA. Additional detailed analysis of supply chain costs are outlined later in this report.

4.1.7.1 Pricing

Most USA grains utilise a well established mechanism in order to establish an export price and corn is no exception to this. There are essentially two components to any corn export FOB price. These are the US futures price and the basis. The futures price is the settlement price on a given day for corn at the Chicago Board of Trade Futures exchange. This market theoretically operates fundamentally on a supply and demand basis, with hedgers trying to offset risk and speculators trying to make profits, but today given the influence of the massive investment funds, the futures markets do not necessarily work on the basis of S+D fundamentals.

US Futures prices are quoted real time on a daily basis by specific contract months. Prices are quoted in US$ per bushel, on the basis of a theoretical delivery to Chicago. However for export purposes, shipments are via the two main export regions in the USA. The cost of getting grain from Chicago to an export terminal and loaded onto a vessel is called the basis. Hence the basis is added to the relevant futures price to determine the FOB price. Basis prices vary due to supply and demand of rail and barge movements in the USA. Standard quotes on USA corn are made on the basis of Number 2 Yellow corn (2YC) with a moisture max of 15%.

Buyers of corn can establish the price for the grain two ways, either a flat agreed US$ MT FOB price or on what is called a basis contract, whereby each party is required to have US grain futures contracts and they agree what is called “the basis”. The basis is added to the applicable futures contract price at the time of settlement to establish the final FOB price. All grain in the USA is locally traded in bushels, but for exports they sell in metric tonnes.

USA grains are typically exported by the major grain trading houses. These are well established reputable companies, skilled at exporting USA grains. Purchases can be either on an FOB or C+F basis. Export contracts may be North American Export Grain Association contracts (NAEGA) or General and Feed Trade Associations contracts (GAFTA). These two organisations have standard FOB and C+F contracts which much of the world grain trade use as the basis for their contracts, especially GAFTA contracts. Grain inspection is undertaken by FGIS.

Given the location of the main USA Corn Belt, the majority of USA corn is exported via the US Gulf of Mexico. It is moved by truck and rail to the Mississippi river where it is loaded into barges prior to being moved down river to export terminals near the mouth of the river. Here it is loaded into ocean vessels. The other main export region for the USA is via the Pacific North West (PNW - Portland). Grain moved to the PNW is nearly all via rail. The USDA (2006) reported that that just under 30 mmt of yellow corn was exported last year via the Gulf and approximately 9.5 mmt ex the PNW.

Whilst corn can be exported via the PNW it is more costly than via the Gulf due to the higher basis cost (cost of moving grain across the USA from the eastern side to the west). The current indicative FOB price for 2YC as quoted by the US Grains Council on 14 July 2006 was US$120.76 ex the Gulf and US$127.10 ex the PNW. Obviously for buyers located in the Pacific basin, ocean freight rates are cheaper ex the PNW than via the Gulf.

The US Wheat Associates indicative freight rates published on 14 July 2006 shows that to take a Handymax vessel of 40 - 46TMT out of the PNW to South East Asia the indicative rate is US$36mt as compared to ex the Gulf at US$48mt. The Australian east coast rate would be very similar. For a Panamax vessel of 54 - 66TMT the rates ex the PNW are US$34mt and Gulf US$45mt. As such in today's market a buyer in the SEA region is paying a $6.50 premium for PNW FOB corn but saves at least $11 in freight, so an overall saving of at least US$4.50mt.

In essence therefore, from a purely commercial point of view in today's market, it is cheaper to export from the PNW to the Australian east coast ports. Further price considerations of grain supply and movement are outlined later in this report.

4.1.7.2 Certification & Testing

The majority of USA corn is purchased as Grade US No.2. On export of the corn, FGIS will provide a Grade certificate which is the buyers' guarantee that:

- Representative samples of the consignment have been taken and analysed by FGIS employees who are trained, certified and supervised in their jobs
- The grain meets the quality specifications of the applicable grade
- The samples have been handled according to FGIS standards
- The apparatus used in grading has been certified and maintained

Additional mandatory certificates under IPPC guidelines such as a Phytosanitary Certificate, Certificate of Weight, and Vessel Cleanliness etc will be provided as required.

If required, other quality certificates can be provided, however there will generally be a charge for this service. The charge will cover Certificates that could be provided for any of the following, depending on details of the contract with the supplier of the corn:

- Mycotoxin levels
- Weed seed content
- Other corn quality parameters not specifically mentioned in US Standards but of concern to Biosecurity Australia and AQIS

The cost of the testing and certification and the timing of provision of these certificates will depend on the level of testing and detail required and can only be determined accurately at the time of the corn sale. Additionally, it may be prudent to use the services of an Independent Inspection agency to verify much of the above. Further details of the nature and costs of this service are provided later in this report.

4.2 Pest Status of USA Corn

4.2.1 General Comments

4.2.1.1 Sources of Data

Surveys are generally conducted on an annual basis in the USA on a State basis for a range of Pests in crops such as corn. The information obtained from these surveys by various Government Authorities has been used in this report, as outlined in Appendix 13.1. As with any information on Pests, the data is only current and accurate at the time of reporting.

Note however that the latest survey data does not reflect the quality of the current corn crop available for export. That is, the incidence of various Pests such as weed seeds and pathogens may not be reported in the corn crop report for the current year, but is reported on an historical basis.

As with the quality of the crop, to get an accurate picture of the level of Pests in the current corn crop, reference must be made to the most recent survey data and the most recent corn crop report. This information has not been made public at the present time.

A comprehensive Pest list of the current crop can only be determined by one or a combination of:

- Further scientific analysis of representative samples of the crop from a particular State and or County within a State, or
- On-site visits to industry and Government Departments conducting those surveys, or
- Full commercial contract discussions with potential corn suppliers, or
- Analysis of representative samples of the current corn crop

4.2.1.2 Pest Risk Considerations

When considering the ability of industry to import corn from the USA in times of short supply, there are a number of risks to be considered. These include, but are not limited to the presence and level of the following Pests (as defined in this report) in the corn:

- Insects – Field Insects, Stored Product Insects, mites, molluscs
- Weed Seeds
- Pathogens
- Chemical Residues
- Mycotoxins

These Pests are discussed in detail below.

Various other risks associated with the supply of USA corn are outlined in other sections of this report.

4.2.1.3 Nil Risk

As corn for import into Australia from the USA will be as a bulk product, unless every grain is scientifically examined, a nil risk scenario will not be created. This also applies to container imports. In a commercial sense, it is impractical to assess all grains within a consignment. Therefore, representative sub-samples are taken on the basis that they represent the Pest load of the entire consignment.

Sub-sampling and further sub-dividing samples will create a more user-friendly size of commodity to be assessed. Unless this process is done accurately, it may also result in a sample being developed that does not represent the bulk of the commodity to be supplied.

Sub-sampling and sub-dividing will impact on the ability to detect a particular Pest at or above a certain level, when samples of a consignment at any point in the supply chain are taken. This applies to assessment on receival into the elevator in the USA, during transfer to an export terminal, loading of a vessel and during inspection and discharge of corn in Australia.

The processes outlined in this report are designed to minimise the risk of a particular Pest being present in the corn, being detected and subsequently leading to the consignment being rejected or requiring expensive remedial treatment.

4.2.1.4 Low risk

As described above, a nil Pest presence scenario cannot occur for the importation of USA corn into Australia. However, when appropriate management practices are applied, the risks of detection of a Quarantinable Pest are reduced, enabling greater confidence that the imported product will meet all regulatory controls imposed on that import.

By reviewing the presence of the particular Pest in the main corn production States the risks of contamination are reduced. The following section details the known presence of all relevant Pests in USA corn on a historical basis and the impact their presence may have on the importation of corn. The information is based on a worst case scenario and with appropriate management plans as outlined later in this report (grain sourcing, cleaning, fumigation etc) the potential presence of these Pests will be considerably lower than that outlined.

4.2.2 Insects

4.2.2.1 Insect Categories

Insects (arthropods) may be classified as a Pest for a number of reasons, including:

- Their potential to directly damage stored grain
- Their presence in the harvested grain with no corresponding damage to the quality of the grain (Field insects)

In addition to these types of insects, mites and molluscs may also be present in the grain. For the purposes of this report, Stored Product Insects, Field Insects, mites and molluscs will be referred to as Insects.

There have been a number of surveys and desktop reviews previously conducted within the USA and in Australia that have investigated the presence or potential presence, of insects in the growing corn crop or in harvested corn. These surveys have categorised insects as either Quarantine Pests or Non-Quarantine Pests.

Insects may be included in the category of Quarantine Pests due to a number of factors, but not limited to:

- Known presence in corn, capable of breeding and causing damage to stored corn (Stored Product Insects)
- Known presence in other grain crops, capable of breeding and causing damage to stored corn or other crops (Stored Product Insects)
- Presence in the USA supply chain and potential to contaminate corn moving through that supply chain
- Exist in both the field on the corn plant and in stored corn (but may not damage stored corn)
- Presence on corn and known to vector corn diseases
- Presence in the USA either associated with corn crops or other crops and not known to occur in Australia (i.e., admixture crop vectors are included)
- Have the potential of establishing in natural habitats and may have adverse consequences on the natural environment if introduced. In addition, once established in natural habitats, Official Control and Eradication may be difficult or impossible to accomplish

Insects may be included in the category of Non-Quarantine Pests due to a number of factors, but not limited to:

- Association with the corn plant in the field. Due to the different conditions between the field and stored corn, generally these Pests do not survive in stored corn
- Known presence in both the USA and Australia but are not under Official Control

4.2.2.2 Field Insects

The use of conservation tillage practices, which leaves crop residue on the soil surface and reduces or eliminates the use of tillage, provides a protective environment for soil inhabiting insects. This may result in greater insect injury to the corn crop than conventional tillage practices. For example, weeds and grasses present in no-till fields prior to planting are attractive egg laying sites for black cutworms which, when the larvae hatch, will move onto the corn.

Although many predatory and beneficial insects are also favoured by conservation tillage, the increase in such practices is in part responsible for some increases in the severity of some insect problems in the USA (and Australia).

As with Australian field conditions and field insects, the vast majority of field insects present in USA corn do not survive in stored corn and are not considered a significant Quarantine Risk and are thus not classified as a Quarantine Pest.

From the information obtained, there are no significant differences in the level of field insects of concern to Australia in the various States of the USA. However, as with any field crop production system, conditions within a particular State or cropping area may be more conducive to a particular field insect than in a neighbouring region. Thus in a particular season the incidence of a field insect may be higher in one area than another, however there is no effective mechanism to predict this. Selection of stocks from one State versus another to limit the level of field insects is not able to be done prior to a harvest.

Note however that post-harvest, surveys may be able to be done of stored corn to select stocks with lower levels of field insects. This can only occur following commercial discussions with potential grain suppliers on the location of suitable stocks and following taking of representative samples. In most situations this is not a feasible option due to the time required, the additional costs involved and the likelihood of reducing the level of field insects in the corn via cleaning prior to export.

It is also worth noting that contamination of cargo with field insects may occur at certain points in the supply chain even with strict control measures such as a nil tolerance in Receival Standards, cleaning of product prior to export, treatment of corn and strict hygiene and cleaning of all transport and storages used in the supply chain. Contamination may occur during ship loading due to these insects flying in and settling on the corn cargo. This type of contamination is difficult to control and is generally accepted provided contamination levels are not high and the insects are not of a significant quarantine concern.

4.2.2.3 Stored Product Insects

A range of small insects such as beetles and moths can infest USA corn. The genera and species of Stored Product Insects are generally similar throughout most of the world. Cosmopolitan beetles likely to be found in stored corn include but are not limited to the weevils (*Sitophilus sp*), the lesser grain borer (*Rhyzopertha dominica*), sawtooth grain beetle (*Oryzaephilus sp*), flour beetles (*Tribolium sp*) and flat grain beetles (*Cryptolestes sp*). These insects are found in all the growing regions of the USA and selection of corn from particular areas to limit the risk of the presence of Stored Product Insects is not a feasible option.

There may be different strains and insects with different chemical resistance in the USA than in Australia for any or all of the above insects and those not listed. As there are various chemical control methods available and no major resistance to the entire suite of chemicals available, there are no known insects for which a stored product chemical will not achieve a satisfactory kill.

Stored Product Insects can contribute to heating in corn stored under tropical or humid conditions. Weevils often are associated with the production of large amounts of heat and metabolic water. This heat and water facilitate the growth of certain storage moulds that greatly accelerate deterioration of stored corn. *Sitophilus sp* weevils and *Rhyzopertha dominica* borers can cause major damage even without mould involvement because immature forms develop within kernels. These are referred to as Primary Pests.

Other cosmopolitan pests, called Secondary Pests, do not significantly damage the grain, but can cause contamination as they feed on other material within the corn stack.

As stated above, there are effective chemical treatments available to control live insects present in a consignment of corn. Treatment of corn may be a mandatory requirement prior to loading corn for shipment to Australia and is a recommended practice. This treatment could be either through the use of contact insecticides or via fumigation. For various reasons such as ease of use, availability and cost, it is recommended that grain be fumigated with any of the range of fumigants available. Options available will depend on the source of the corn, suitability of the facilities and timeframe of stock selection prior to export. These factors, including the cost, can only be accurately determined at the time of contracting the corn. Further details are provided later in this report on the proposed methods to be used along the supply chain.

Upon discharge of the corn cargo in Australia, it would not be stored for lengthy periods prior to use. This could assist in maintaining a low risk of spread of any live insects that may be present that go undetected (as grain stored for long periods may enable any undetected eggs to hatch and become a major infestation).

There are some Stored Product Insects in the USA that are not present in Australia and are thus of quarantine concern. These are discussed below.

4.2.2.4 USA Grain Standards for Insects

Field insects are included in the category of Foreign Material in USA Corn Standards, whether live or dead. This reflects the relative low risk and inability of these insects to damage stored corn.

Dead Stored Grain insects are included in the Foreign Material category. Live Stored Product Insects are permitted in grain provided levels are low. Samples containing these low levels are classified as “Infested”. There are many importers of USA corn that impose a nil tolerance for these insects in contracts, thus there are existing supply chain mechanisms to ensure corn supplied for importation into Australia is insect free.

It is recommended that the contract with the USA corn supplier stipulate nil tolerance for live Stored Product Insects. The cost of this contract stipulation will be addressed as the fumigation charge, as discussed later in this report.

4.2.2.5 USA Industry views on Insects

Feed manufacturers in the USA usually are not especially sensitive to the presence of Stored Product Insects in raw grain. However, in recent times an increasing number of industry stakeholders are demanding insect free grain in most of the common grains including corn. Generally these industry stakeholders are supplying high value niche markets.

Many importers of USA corn produce flour, seed or milled rice or other products for human consumption at the same location as the animal feed. Thus the risk of cross-contamination is high. Additionally, many importing countries require a nil tolerance for Stored Product Insects in commodities such as corn. To reduce these risks, the USA grains industry is continually advised to minimise infestations in raw feed ingredients such as corn.

While the US Standards state that grain “may contain no more than nine live insects per kilogram of sample without receiving the special designation infested”, in reality most exported corn contains a much lower insect level. At high levels of insect infestation, damage to grains may be excessive, leading to other quality problems such as mycotoxins, as outlined in other areas of this report.

In a processing plant that is especially sensitive to Stored Product Insects, infestation levels are limited through contract specifications of the grain to be purchased or by specifying in-transit fumigation of the commodity. As stated previously, this nil tolerance requirement would also apply to corn imported into Australia. An option to be considered is in-transit fumigation either on barges in the USA or on the vessel leaving the USA. The latter is the least preferred of the two in-transit fumigation options as there are concerns from some industry sectors that this treatment is not as effective as may be required. Nevertheless, as a further risk reduction method, both scenarios are recommended and their costs are outlined in further detail later in this report.

4.2.2.6 Mites & Molluscs

Species of moths, psocids and mites also inhabit stored corn. Generally the same species of Stored Grain moths occur in the USA and Australia. This may also be the case for psocids and mites, although less information is available on these species. No assessment has been made on the occurrence of these insects in the different States of the USA.

Of note is that previous PRAs by DAFF did not highlight any of these types of insects as being of a significant quarantine concern for USA corn imported into Australia. The PRA of October 2002 also stated “…well-managed clean, dry grain is unlikely to contain significant numbers of mites”. Thus pre-cleaning of corn prior to export and fumigation is expected to sufficiently control mite numbers.

Similarly, the same PRA considers that the risk of importation of molluscs is low. As with mites, an assessment of the presence of particular molluscs in the various States of the USA has not been conducted.

Note however that some snails in Australia have been found to be difficult to kill post-harvest when present in commodities such as pulses and canola. This may be a factor of the commodity or the snail species arising from the difficulty of penetration of the fumigant or the species is tolerant to the fumigant. More research would be required to confirm this information, however all indications are that cleaned product would contain little if any molluscs and subsequent fumigation should successfully control most insects.

For corn, especially corn that has a low level of admixture, penetration of the fumigant is not considered to be a significant impediment to effective fumigation. Further research may be required on the ability to kill all species of molluscs present in USA corn. It is noteworthy that molluscs have not been a significant quarantine concern in recent imports of USA grain into Australia or other countries.

4.2.2.7 Quarantine Insects

The following table lists Quarantine Pests with a significant risk of being associated with bulk corn imported from the USA. The information was sourced from previous PRAs conducted by DAFF and from a review of material available from the various States (Universities and USDA). Note that it is considered relevant at present but may alter over time.

Similar to the control of Stored Product Insects, these Quarantinable Pests may be able to be effectively controlled and prevented from entering Australia through imported corn by fumigation prior to export and identity preservation processes in the USA prior to export.

Many of the insects are able to inhabit a range of environments and are thus listed in the table as present in a particular State. Insects such as the Tropical Warehouse Moth are not known to be present in the main corn producing States but are located in other areas of the USA. Insects such as the Flat Grain Beetle are declared as being present in a State because they have been detected in the past in infested grain that has been transported through the State.

Table: Quarantine Insects in USA Corn

Scientific Name	Common Name	Occurrence in the USA*
Pests capable of breeding in stored grain		
Cathartus quadricollis (Guérin-Méneville, 1829) [Coleoptera: Silvanidae]	*Tropical warehouse moth*	All – mainly Southern USA States
Caulophilus oryzae (Gyllenhal, 1838) [Coleoptera: Curculionidae]	*Broad nosed grain weevil*	All – mainly Southern USA States
Cryptolestes turcicus (Grouvelle, 1876) [Coleoptera: Laemophloeidae]	*Flat grain beetle*	All
Cynaeus angustus (Le Conte, 1852) [Coleoptera: Tenebrionidae]	*Large black flour beetle*	All
Pharaxanotha kirschi Reitter, 1875 [Coleoptera: Languriidae]	*Mexican grain weevil*	All
Prostephanus truncatus (Horn, 1878) [Coleoptera: Bostrichidae]	*Larger grain borer*	All – mainly Southern USA States
Tribolium audax Halstead, 1969 [Coleoptera: Tenebrionidae]	*American black flour beetle*	All – rarely in grain
Tribolium brevicornis (LeConte, 1859) [Coleoptera: Tenebrionidae]	*Flour beetle*	All
Tribolium destructor Uyttenboogaart, 1933 [Coleoptera: Tenebrionidae]	*Large flour beetle*	All
Tribolium madens (Charpentier, 1825) [Coleoptera: Tenebrionidae]	*Black flour beetle*	All
Trogoderma glabrum (Herbst, 1783) [Coleoptera: Dermestidae]	*Glabrous cabinet beetle*	All
Trogoderma inclusum LeConte, 1854 [Coleoptera: Dermestidae]	*Large cabinet beetle*	All
Trogoderma ornatum (Say, 1825) [Coleoptera: Dermestidae]	*Ornate cabinet beetle*	All
Trogoderma variabile Ballion 1878 [Coleoptera: Dermestidae]	*Warehouse beetle*	All
Pests associated with damp corn grain		
Glischrochilus fasciatus (Olivier, 1790) [Coleoptera: Nitidulidae]	Picnic beetle	All
Glischrochilus quadrisignatus (Say, 1835) [Coleoptera: Nitidulidae]	Four-spotted sap beetle	All
Pests associated with infestable pulses		
Callosobruchus chinensis (Linnaeus 1758) [Coleoptera: Bruchidae]	Cowpea weevil	All
Zabrotes subfasciatus (Boheman 1833) [Coleoptera: Bruchidae]	Mexican bean beetle	All
Additional pests of quarantine concern to Australia		
Trogoderma granarium Everts, 1898 [Coleoptera: Dermestidae]	Khapra beetle	Not established in any State, interceptions only

* presence in States

A brief précis of the main insects is outlined below:

- *Callosobruchus chinensis* Cowpea Weevil & *Zabrotes subfasciatus* Mexican Bean Beetle. These two insects infest pulses and do not infest or damage corn itself. These insects have been listed as being present in all States in the table above, whereas in reality as the corn-belt States are not major cowpea growing areas, the potential for contamination with cowpeas is relatively minor. Cleaning corn prior to export should significantly reduce the potential of contamination with pulses and these insects. Chemical fumigation would greatly reduce the potential of survival of any remaining insects that may be present in the corn.

- *Cryptolestes turcicus*, Flour Mill Beetle, is considered a secondary insect but given it is difficult to distinguish from C. ferrrugineus, it is often described as a primary insect. Clean dry grain will reduce the potential for contamination of this insect in corn.

- *Glischrochilus fasciatus* Picnic Beetle & *Glischrochilus quadrisignatus*, Four-spotted Sap Beetle are considered minor pests of field and sweet corn and clean dry grain will reduce the potential for contamination of these insects in corn.

- *Pharaxanotha kirschi*, Mexican Grain Beetle. As with many of the insects listed in the table above, are considered minor pests of grain and readily controlled when grain is clean and dry.

- *Prostephanus truncatus*, the Larger Grain Borer, has been found in the southern parts of the USA. It has been detected in grain moved into the northern States, especially Kansas, but is not thought to have survived for long periods or be capable of breeding. Sourcing grain from any of the abovementioned corn-belt States will limit the potential for contamination with this insect. Fumigation can effectively control this insect.

- *Tribolium audax* American Black Flour Beetle & *Tribolium madens* Black Flour Beetle. These two insects are secondary insects of relatively minor importance and clean dry grain will reduce the potential for contamination of this insect in corn. They are widespread in the USA but generally found in habitats other than grain. Sourcing clean dry grain and fumigation will limit the risks of infestation in grain.

- *Tribolium brevicornis*, the Flour Beetle, is considered a minor pest of grain and readily controlled when grain is clean and dry.

- *Tribolium destructor*, the Large Flour Beetle, is found in many States of the USA when grain is transported through the country. Sourcing clean dry grain and fumigation will limit the risks of infestation in grain. This insect has been found in Tasmania.

- *Trogoderma glabrum* Glabrous Cabinet Beetle & Ornate Cabinet Beetle *Trogoderma ornatum*. These insects are not often associated with stored grain, but have a range of other habitats. Insects can be readily controlled in clean dry grain that has been fumigated.

- *Trogoderma granarium*, the Khapra Beetle, was previously detected in the USA but now thought to be eradicated. This insect can be controlled in grain via fumigation. It is one of the major pests of grain world-wide.

- *Trogoderma inclusum*, the Larger Cabinet Beetle, is a scavenger that feeds on cereal products and dried animal matter. They are not frequently found in stored grain, but are easily controlled when present. As with all Trogoderma species, are not tolerated in many countries due to their similarity to the Khapra beetle.

- *Trogoderma variabile*, the Warehouse Beetle, is present in Australia and the USA and is under Official Control in some areas of Australia such as Western Australia. It can be controlled in grain by fumigation but is known to be a persistent insect in storage structures once established.

In reality, for the vast majority of the above insects, grain sourced from the main corn producing areas that is reasonably dry and clean, and has been treated following cleaning, will have low risks of containing these insects. On that basis, provided the QA & IP processes as described are conducted, there would not be any advantage in selecting grain from one State over another due to the presence or absence of these insects.

Note that clean dry grain will reduce the potential for insects to be present in the grain or to breed if present. The ability to source this grain quality, or clean and or dry the grain to levels suitable, will depend on a range of factors including price and available tonnage.

4.2.3 Weed Seeds

4.2.3.1 Importance of Weeds

Throughout the Midwest region of the USA, corn fields are closely managed and there is a general lack of tolerance for weeds by producers. This lack of tolerance is often exacerbated by the level terrain of much of the corn-belt and the ease with which uneven stands or weeds can be seen from the field's edge. A cleaner crop represents in the eyes of the viewer, a healthier crop.

Corn is typically grown in a rotation with soybeans and less often with wheat, sorghum or alfalfa. About 30 percent of the corn in the Midwest is grown as continuous corn.

Weeds reduce corn yield primarily by competing for water, sunlight and nutrients, thus diminishing total corn yield potential. Heavy weed infestations can also affect harvest efficiency by increasing grain moisture content at harvest and increasing foreign material levels in harvested grain, both resulting in added cost to the producer. Weeds can also harbour or host insect and plant diseases.

Within this document weeds are grouped in various categories for discussion purposes. A number of these weed seeds present in corn are herbicide resistant variants of species present in Australia.

4.2.3.2 Weed Risk Assessment

Based on previous studies by Biosecurity Australia, there are 80 weeds of quarantine concern to Australia that have been stated as a significant risk associated with bulk corn from the USA. No detailed assessment of other weeds or the reasoning for placement of these 80 weeds into this category has been conducted in this current report.

One weed of note is *Striga asiatica*. This weed is considered the most serious root parasite of corn and other grass crops in the world. Once established in an area it is extremely difficult and expensive to eradicate. Its seed size is very small (0.5 x 0.2 mm) and would be difficult to detect by normal sampling and analytical methods. That said there are many areas of the USA, and virtually the entire corn-belt, that is currently free and has previously been free of this weed.

4.2.3.3 Common Weeds Seed Types in the USA

Weeds commonly found in the corn-belt in the USA can be classified into many categories. A brief description of weeds using one classification system and a description of the more problematic weed seeds is described in Appendix 13.5. This also includes some of the weeds previously listed by DAFF as Quarantine Pests of concern.

4.2.3.4 Quarantine Weeds in the USA

The following table lists the weeds of concern that may be present in corn imported into Australia from the USA. These Quarantine Pests when present may have a significant impact on the crop growing regions of Australia if not controlled or removed from the imported corn.

Weed Seed Presence in USA Corn by State (as at 2006)													
Weed Seed Species	*Weed Seed Presence by State*												
	IA	*IL*	*NE*	*MN*	*IN*	*SD*	*OH*	*MO*	*KS*	*WI*	*MI*	*TX*	*KY*
Abutilon theophrasti (herbicide resistant)													
Abutilon theophrasti (herbicide resistant)				*N*			*N*						
Acanthospermum hispidum	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
Aeschynomene virginica	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
Amaranthus arenicola													
Amaranthus chlorostachys													
Amaranthus hybridus (triazine resistant)													
Amaranthus palmeri (herbicide resistant)	*N*			*N*	*N*						*N*		
Amaranthus retroflexus (triazine resistant)													
Amaranthus rudis (triazine resistance)													
Amaranthus tamariscinus													
Ambrosia artemisiifolia													
Ambrosia grayi	*N*	*N*		*N*	*N*	*N*	*N*	*N*		*N*	*N*	*N*	*N*
Ambrosia trifida													
Apocynum cannabinum													
Asclepias syriaca													
Bassia scoparia													
Berteroa incana													
Bidens aurea	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
Brachiaria platyphylla	*N*		*N*	*N*	*N*	*N*	*N*		*N*	*N*	*N*	*N*	
Brassica japonica													
Bromus tectorum													
Brunnichia ovata	*N*		*N*	*N*	*N*	*N*	*N*		*N*	*N*	*N*	*N*	*N*
Cenchrus incertus	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	
Cenchrus longispinus													

Weed Seed Presence in USA Corn by State (as at 2006)

Weed Seed Species	*Weed Seed Presence by State*												
	IA	*IL*	*NE*	*MN*	*IN*	*SD*	*OH*	*MO*	*KS*	*WI*	*MI*	*TX*	*KY*
Chamaesyce maculata													
Chenopodium album (atrazine resistant)													
Cirsium arvense													
Cocculus carolinus	*N*		*N*	*N*		*N*	*N*		*N*	*N*	*N*	*N*	
Conringia orientalis													
Convolvulus arvensis (herbicide resistant)													
Cynanchum laeve				*N*						*N*			*N*
Cyperus esculentus													
Cyperus rotundus	*N*	*N*	*N*		*N*	*N*	*N*		*N*	*N*	*N*	*N*	
Datura inoxia	*N*		*N*	*N*		*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
Datura inoxia (resistant to ALS herbicides)	*N*		*N*	*N*		*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
Datura stramonium													
Echinochloa crus-galli (herbicide resistant)					*N*								
Equisetum arvense													
Erigeron annuus													
Eriochloa villosa			*N*		*N*	*N*	*N*		*N*		*N*	*N*	*N*
Eupatorium capillifolium	*N*	*N*	*N*	*N*	*N*	*N*	*N*		*N*	*N*	*N*	*N*	
Helianthus annuus (herbicide resistant)													
Ipomoea hederacea var. *integriuscula*													
Ipomoea lacunosa			*N*	*N*		*N*			*N*	*N*	*N*	*N*	
Ipomoea purpurea													
Ipomoea turbinata	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*
Jacquemontia tamnifolia	*N*		*N*	*N*	*N*	*N*			*N*	*N*	*N*	*N*	*N*
Lolium multiflorum (herbicide resistant)													
Muhlenbergia frondosa													
Panicum capillare (herbicide													

Weed Seed Presence in USA Corn by State (as at 2006)													
Weed Seed Species	*Weed Seed Presence by State*												
	IA	*IL*	*NE*	*MN*	*IN*	*SD*	*OH*	*MO*	*KS*	*WI*	*MI*	*TX*	*KY*
resistant)													
Panicum dichotomiflorum													
Panicum fasciculatum var. *reticulatum*	N	N	N	N	N	N	N	N	N	N	N	N	N
Panicum ramosum	N	N	N	N	N	N	N	N	N	N	N	N	
Panicum texanum	N	N	N	N	N	N	N			N	N	N	
Paspalum boscianum	N	N	N	N	N	N	N	N	N	N	N	N	
Physalis heterophylla													
Polygonum aviculare													
Polygonum bungeanum			N		N	N	N	N	N	N	N	N	N
Polygonum lapathifolium													
Polygonum pensylvanicum													
Raphanus raphanistrum			N			N							
Rubus allegheniensis						N							
Rubus fruticosus													
Salsola collina					N								
Salsola kali (*Salsola kali* subsp. *ruthenica*)													
Salvia reflexa													N
Senna obtusifolia	N			N			N				N		
Setaria faberi													
Setaria lutescens (herbicide resistant)													
Sicyos angulatus													
Solanum ptychanthum													
Sorghum halepense				N									
Sorghum x almum	N		N	N	N	N	N	N	N		N	N	N
Striga asiatica	N	N	N	N	N	N	N	N	N	N	N	N	N
Thlaspi arvense													
Verbesina encelioides				N	N		N			N			N
Xanthium spinosum				N		N				N			

Weed Seed Presence in USA Corn by State (as at 2006)													
Weed Seed Species	*Weed Seed Presence by State*												
	IA	*IL*	*NE*	*MN*	*IN*	*SD*	*OH*	*MO*	*KS*	*WI*	*MI*	*TX*	*KY*
Xanthium strumarium													
Xanthium strumarium (resistant to imidazolinone)													
Total Weed Seeds not known to be present	*23*	*13*	*23*	*27*	*23*	*26*	*24*	*14*	*21*	*24*	*25*	*23*	*17*

Green - Present in USA, but not known in corn growing areas
N - Not known to be present in that State
Blank cell - Is known to be present in that State in any crop, which may or may not include corn
Red - Removed from the BA non-permitted weed seed list
Blue - Currently on the BA non-permitted weed seed list

The information in the above table has been obtained from various USDA State websites and State Universities. While the weed has been listed as present in that particular State, it may not necessarily be present in the corn growing areas of that State, or in corn. This information is unable to be obtained at present and will require significant discussions with individual State USDA Departments and State Universities.

Even then, it cannot be guaranteed the information will be provided or will be accurate. To quote a respected researcher "Some of the weed seed data is in print, some is on the web and some might be found in un-circulated university publications". Surveys on the current crop have also been done in the main corn growing States by a private organisation and the provision of data on weeds contaminating the corn crop by State would only be provided on a commercial charge basis. A charge for this information was not sought for the production of this report.

The figures show that as expected, many States contain a large number of the weeds of concern. This is expected as corn is moved interstate and growing conditions are relatively similar. Thus it is not expected that selecting grain from particular states for the absence of weed seeds is a major strategy in risk reduction. However, Illinois, Missouri and Kentucky do contain a higher level of different species than the other States. This does not necessarily indicate a higher number of weed species or weed seeds in the harvested corn. However as stated above, it could reasonably be expected that the weed seed load is higher in these three States given that the figures indicate the presence of the weed in any part of that State and in general have the potential to be present in field crops such as corn.

Of note also is that crop conditions and management techniques will have a greater effect on the weed seed load in harvested corn than the presence or absence of weed species in a State. Therefore the level of Foreign Material in the harvested corn and the ability to clean the corn will ultimately determine the total weed seed load.

When reviewing the weed species list, the majority are weed seeds that are significantly smaller than whole intact corn kernels. This will allow a relatively easy cleaning process to occur, enabling the majority to be removed from the sample. Those weeds seeds that are large (such as Downy Brome) are not of the same shape as corn or are significantly lighter. Thus a cleaning operation can be conducted using a variety of sieves and other methods such as aspiration in the one operation that effectively may remove most if not all weed seeds. Further discussions with corn suppliers at the time of specifying contract terms would be required to determine if the process could economically remove these weed seeds or to a level of suitable risk for importing corn into Australia. Further details are outlined in a later section of this report.

Those species as marked in blue are listed on the Biosecurity Australia website and contain species that are not permitted entry into Australia. There are several weed seeds that were on this list from the previous IRAs and thus listed as a Quarantine Pest, that are now no longer on this list.

In addition, those marked in red were recently proposed to be removed from the non-permitted seed list. Clarification is required regarding the herbicide tolerant forms of these species.

The following advice was received from Biosecurity Australia “The aim of the permitted seeds list review is to replace current genus level listings from Schedule 5 of the Quarantine Proclamation 1998 with species, from within those genera, which are present in Australia and not under Official Control. This will enhance Australia's favourable pest and disease free status by ensuring that species not already present in Australia are not permitted entry without, prior to importation, undergoing a weed risk assessment (WRA) to determine their weed potential in Australia.

Biosecurity Australia performs WRA’s on all new (that is, species that are not recorded as being present in Australia) plant species to determine the agricultural and/or environmental weed potential of the species before it is imported. Species with a low weed potential may be added to the permitted list and those species with a high weed potential are prohibited importation.

The ‘non-permitted’ list used in the review is not a list of prohibited species rather it is a list of species, from within currently permitted genera that are proposed not to remain on the permitted seeds list. Some of the species in the list are not necessarily prohibited. For example there are species on that list that were removed as permitted as a result of stage one of the review. These species may require a WRA to establish their weed potential in Australia. This ‘non-permitted’ species list will not appear anywhere in legislation as many of the species will merely not appear individually on the permitted seeds list.”

On the basis of the above advice, several of these weeds may no longer be of concern however a WRA may be required.

A further point of note is that corn is a tall plant and is harvested well above the ground. Many of the weed seeds listed above are plants that are shorter than a mature corn plant. This further reduces the potential for contamination of the harvested corn with weeds.

When the above information is combined with the States that have a low pathogen presence, there may be scope to reduce risks associated with corn imports and source corn only from the above States that have a lower weed species presence. This information will be discussed in a later section of this report.

The outcome of potentially sourcing the corn from States with the lower weed seed presence will significantly reduce the weed seed content in the harvested corn. However weeds of quarantine concern may still be present and thus require further treatment such as cleaning and potentially devitalisation treatment. These cleaning and devitalisation treatments come at a cost and these costs are outlined later in this report.

4.2.4 Pathogens

4.2.4.1 Introduction

Diseases of corn are present to some extent every year and are responsible for reductions in both yield and grain quality. Losses from diseases vary from year to year and their occurrence is strongly influenced by weather conditions. While some diseases occur commonly they may not cause much damage, yet others have the potential to be very serious.

Throughout most corn producing States, farmers are utilising conservation tillage systems that assist in soil and water retention. The presence of a mulch layer from previous crops modifies many of the physical, chemical and biological components of the soil and its ecosystem. Numerous studies have documented changes in temperature, water retention capacity, soil microbiology, soil tilth and structure and chemical composition when farmers have modified their tillage from conventional tillage to either reduced-tillage or no-tillage systems. These micro environmental changes can have a significant impact on crop diseases.

Conservation tillage practices result in a continuing emphasis on seed treatments for corn establishment. Also, a trend toward early planting exacerbates disease producing conditions in both conventional and conservation tillage. Although improved crop vigour and better planting methods will aid in crop establishment, there will be a continued reliance on inexpensive seed treatments for effective disease suppression.

4.2.4.2 Common Disease Types of Corn

There are a range of corn diseases of relatively high importance. Appendix 13.6 outlines the more common diseases and their control methods.

The Fusarium species of fungi, in particular, increase when crop residues are present. These fungi are common “root rotters” and also invade corn stalks, causing stalk rots. Higher disease incidence has also been reported with another common soil-borne fungus *Rhizoctonia solani* in conservation tillage scenarios. This fungus infects virtually all common field crops and can reduce early season vigour and growth.

Another group of fungi that thrive in cool, wet soils are the Pythium species. These fungi infect the mesocotyl region of corn (the mesocotyl tissue links the new plant with the primary root system). Mesocotyl infections, causing loss of the primary root system, result in reduced growth or death of the seedling. The cooler and wetter conditions associated with reduced tillage increase activity of Pythium fungi.

Methods of controlling plant diseases in field corn characteristically fall into three categories:

- Firstly, plant breeding efforts are the primary focus of improving plant resistance and tolerance to the chronic effects of plant disease wherever possible.
- Secondly, tillage and crop management options are utilised to minimise the impact of the disease.
- Third, fungicides both as seed treatments and as foliar applications are used where necessary to prevent crop losses where breeding and cultural management techniques fall short.

Corn diseases can be grouped below into the following broad categories:

- Seed Decay and Seedling Blights. Are soil-inhabiting fungi such as Pythium, Fusarium, Diplodia, Rhizoctonia and Penicillium. These fungi also may be seed-borne, except for Pythium.
- Root Rots. Root rots of corn are very common, and can be caused by a number of fungal pathogens including Pythium species, Fusarium species and *Exserohilum pedicellatum*. Root rots occur to some extent in every field. Root rots are generally not economically significant and are considered of minor importance to corn production. But under wet conditions, root rots cause economic losses. Root rots are primarily controlled by resistant varieties.
- Foliar and above ground diseases. There are various diseases present, several of which are outlined below under Diseases of Quarantine Concern. There are a number of fungi and a few bacteria that cause foliage diseases of corn. These various foliar pathogens cause leaf spots, leaf blights and similar symptoms on corn.
- Ear and Kernel Rots. There are various diseases but as they are not of any significant quarantine concern they have not been included in this analysis.
- Nematodes. The nematodes that attack corn are microscopic round worms, approximately 3/10 to 3/64 inch long. There are many species of nematodes that feed on corn. Dagger and spiral nematodes may be the most common and widespread nematodes. Every cornfield contains nematodes actively feeding on plants. Corn nematodes can feed without causing appreciable yield loss if nematode numbers are low and/or the environmental conditions are such that the corn crop is not stressed. Needle nematode probably is the most damaging, but is not widespread. The most important species that is a parasite on corn is the lesion nematode. Many effective nematicides have been removed from the market and very few new nematicides are being developed, but a few compounds are still labelled for control of plant-parasitic nematodes on field corn. Nematode-resistant corn hybrids are lacking.

4.2.4.3 Diseases of Quarantine Concern

From previous PRAs, there are several major diseases of quarantine concern that are present in the USA. The 17 pathogens listed below were identified as being present in the USA but not in Australia. The presence of these diseases in each State using data obtained from various USDA and State University websites is outlined in the table below.

Pathogen Presence in USA Corn by State (as at 2006)													
Pathogen Species	Pathogen Presence by State												
	IA	IL	NE	MN	IN	SD	OH	MO	KS	WI	MI	TX	KY
Cercospora zeae-maydis (grey leaf spot maize)	Y	Y	Y		Y		Y	Y	Y	Y	Y		Y
Clavibacter michiganensis subsp. *nebraskensis* (Goss's bacterial wilt of maize)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dolichodorus heterocephalus (Awl nematode)													
Heterodera zeae (maize cyst nematode)													
High Plains *tenuivirus* (maize, wheat)	Y		Y	Y		Y		Y	Y			Y	
Hoplolaimus columbus (lance nematode)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Longidorus breviannulatus (needle nematode)	Y	Y	Y	Y	Y				Y	Y	Y		
Maize chlorotic mottle *machlomovirus* (maize)			Y				Y		Y				
Maize dwarf mosaic *potyvirus* (maize)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Meloidogyne chitwoodi (root knot nematode	Y	Y	Y						Y		Y		
Pantoea stewartii subsp. *stewartii* (Stewart's wilt sweetcorn)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Peronosclerospora sorghi (downy mildew of maize, sorghum)	Y	Y	Y		Y		Y	Y	Y			Y	Y
Phymatotrichopsis omnivora (Texas root rot of cotton and other		Y						Y					

Pathogen Presence in USA Corn by State (as at 2006)

Pathogen Species	Pathogen Presence by State												
	IA	IL	NE	MN	IN	SD	OH	MO	KS	WI	MI	TX	KY
dicotyledonous plants)													
Pratylenchus scribneri (root lesion nematode)	Y	Y	Y						Y	Y			
Sclerospora graminicola (maize, sorghum, pearl millet and many grasses)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ustilaginoidea virens (false smut of maize)													
Wheat streak mosaic *rymovirus* (maize, wheat)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
No. of pathogens not present in corn	9	9	8	14	13	15	12	12	8	13	12	13	14

Y – very low frequency of detection in recent years, rare on corn or mainly present on other hosts
Y – known to be present in that State in corn

A brief précis of each of the above Quarantinable Pests (pathogens) is presented below:

- *Cercospora zeae-maydis*, Grey Leaf Spot is a problem in the eastern USA, and it has grown in importance in the western corn-belt as far west as central Nebraska. Grey leaf spot is much more common in the southern half of the North Central Region. It is particularly severe when corn follows corn and in areas of irrigation. In Michigan it is found predominantly where irrigation is used. This is a widespread and economically significant problem in corn production. Some varieties have tolerance but hybrids vary greatly in their susceptibility to grey leaf spot. Although high levels of resistance are not yet available for all corn maturity groups, more hybrids with resistance become available each year. Use of the best resistant hybrid adapted for an area is an important means of managing grey leaf spot.

- *Clavibacter michiganensis subsp. Nebraskensis*, Goss's bacterial wilt of maize, causes ratoon stunting disease of sugarcane and Bermuda grass stunting disease. While present in most States, it is rarely found in corn.

- *Dolichodorus heterocephalus*, AWL Nematode, prefers moist to wet soils and rarely occur in agricultural fields. They are found in corn in USA but mainly in eastern USA in the Florida region.

- *Erwinia stewartii* Stewart's Disease, overwinters in the gut of the corn flea beetle (*Chaetocnema pulicaria*). The occurrence of this disease is strongly linked to the winter survival rate of the corn flea beetle, because the beetle introduces the pathogen into the corn plants as it feeds and carries the bacterium from plant to plant. The disease can be spread by insects other than the flea beetle, but they are not as important. Stewart's disease is also seed-borne, but seed transmission is very rare as more than 100 countries have quarantine restrictions that prevent the importation of corn seed unless the seed is certified as Stewart's wilt free. This disease is more common in the southern and eastern parts of the corn-belt. Dent corn is not very susceptible except for a few in-breds, but sweet corn can be very susceptible. This disease is of increasing importance in recent years. This disease is considered of low to moderate importance to field corn production but economical losses are possible if severe insect problems are not treated. Stewart's wilt can be managed to a great degree with hybrid selection.

- *Heterodera zeae*, Corn Cyst Nematode, is a serious problem in only some areas of the world. It has been found in the USA in Maryland, where it has been quarantined since 1984. It has also been found in Virginia.

- *High Plains tenuivirus* (HPV) was first recognised in 1993 in the western plains of the USA in corn. The virus is transmitted between plants by the mite *Aceria tosichella* and can be lethal to corn, wheat, barley and other grasses. HPV has been positively identified in 10 States of the USA. The disease, while widespread, has little economic consequence in the USA although it is a more serious problem in other countries. However yield losses of up to 75% have been reported in some parts of the USA in some seasons. As the disease also affects wheat and barley it is regarded as a major threat to the Australian wheat industry. This mite has recently been discovered in Australia across the wheatbelt.

- *Longidorus breviannulatus*, Needle Nematode, is said to be the most devastating nematode attacking corn. However, largely it is restricted to soil with high sand content and is thus not a significant disease of corn.

- *Maize Chlorotic Mottle Machlomovirus* transmission risk is low in corn that is relatively clean.

- *Maize Dwarf Mosaic Virus* (MDMV) is a virus disease of corn and is spread by several species of aphids. Corn and sorghum are the main crop hosts of MDMV, however, Johnson grass and other wild grasses are also hosts. More than 15 species of aphids can transmit MDMV. Scattered, individual plants with symptoms of MDMV may be found in most years. Periodically weather conditions favour the large-scale movement of virus-carrying aphids from southern regions of the USA. These aphids may then “rain out” or be deposited in large numbers in fields in more northern areas of the corn-belt. Under these conditions, MDMV may be prevalent and serious over a significant acreage. Many commercial corn hybrids have high levels of tolerance to MDMV.

- *Peronosclerospora sorghi* Downy Mildew, presents one of the greatest quarantine risks to the Australian grains industry from the importation of bulk corn from the USA. The disease was first reported in the USA in Texas in 1961 and is now widely distributed in the USA from southern Texas to Central Illinois. Thus it would be difficult to source corn in areas of the USA that are free of this disease. Information from the USA indicates that the prevalence of this disease in USA corn is low but the pathogen is prevalent on other grasses that can be amongst the trash in bulk corn.

- *Phymatotrichopsis omnivore*, Texas Corn Rot, is a minor pathogen of corn but serious on cotton and many other dicotyledons. It is regarded as having a lower potential for establishment because it would be soil or trash-borne only. If an incursion did occur, however, and it became established, this pathogen would be extremely difficult to manage. Feedlots in Australia are present in cotton growing areas so there is the potential for the disease to establish on cotton if it were to be introduced in imports of bulk corn. This pathogen essentially occurs only in the southwest of the USA in cotton areas.

- *Sclerospora graminicola*, Pearl Millet Downy Mildew, has been reported in a range of hosts.

- *Ustilaginoidea virens*, False Smut, has been in the USA for many years, but was only first reported in Arkansas in 1997. It survives in soil or contaminated rice grain as spore balls and is thus is not generally believed to be in corn.

- *Wheat Streak Mosaic Rymovirus* (WSMV), causes a serious disease of wheat, particularly in the Great Plains region of the USA. Only occasional problems have been seen in corn. WSMV is both seed-borne and seed-transmitted, and is transmitted by the wheat curl mite *Aceria tosichella*. High Plains virus is often found in association with WSMV as they share a common vector. WSMV has a relatively broad host range, encompassing many plants in the grass family. Devitalisation of all seed should be an effective management strategy for this virus. It is now known to be present in Australia. With the broader discovery of the disease on commercial properties in Queensland & other states, intensive emergency response activities have been scaled down, as there is now no potential to contain or eradicate WSMV.

- *Tilletia indica* Karnal Bunt (Kb) of wheat was first identified in the USA in 1996. The USDA and State Departments of Agriculture established various programs to limit the spread of Kb, and surveys were initiated to document growing regions where Kb did not occur. A variety of research and extension programs were initiated to deal with the disease and a flurry of popular, technical, and scientific articles was written. Since that time, although Kb is still an issue for USA wheat producers and exporters, new rules have been issued that allow producers more flexibility in dealing with the disease.

To a large extent, these rule changes resulted from growing evidence that Kb is a non-aggressive pathogen that does not warrant its current status as a zero tolerance quarantine organism. To date it has been detected on durum wheat in Arizona, California, New Mexico and Texas. In general, disease incidence was localised and restricted to relatively small geographic areas. Based on previous Kb surveys and the fact that movement of USA wheat from Kb-regulated areas was being controlled and kept out of export channels, APHIS was able to provide and many importing countries accepted, the following additional declaration on the APHIS export certificate: “The wheat in this shipment originated in areas of the United States where Tilletia indica (Karnal bunt) is not known to occur.”

To confirm that Kb was a problem only in localised areas and not widespread in the USA crop, the National Karnal Bunt Survey was initiated in 1996. Today Karnal bunt is considered to be controlled and grain can be, and is frequently sourced, from areas free of the disease. This could readily occur for corn sourced from any of the main corn producing areas of the USA.

The above analysis indicates the various pathogens of Quarantine concern are present in many of the States either on corn or on other crops and thus potentially in corn imported from those States. Nevertheless, there are several States with a lower incidence of pathogens on corn than others. These States could be targeted for corn and assumed to contain a lower pathogen count than others. With identity preservation, cleaning and subsequent fumigation and/or denaturing, the risks of pathogens being transmitted in corn to Australia are low.

The process of cleaning corn will also significantly reduce the potential risk for those pathogens not generally found in corn but present in the State where the corn is grown, subsequently being present in the corn through contamination (marked Y in the above table).

However, to minimise the risks of the corn from these States containing pathogens not listed as being present in the above table, data on the distribution of pathogens in the current crop could be obtained from the relative suppliers of the corn. This information could be obtained on the current crop, rather than the above analysis which is based on historical information and thus may not be valid for the current corn crop to be exported.

4.2.5 Chemical Status

4.2.5.1 General Chemical Usage

As with the Australian cropping areas, there are a range of chemicals used during the corn crop growth cycle, including but not limited to:

- Insecticides
- Herbicides
- Fungicides
- Nematicides

These chemicals are used at various times of the corn growing cycle, depending on a range of environmental, economic and regulatory influences.

There are a wide range of insecticides used at various stages of the life cycle of the corn plant and post-harvest used to control various insects:

- Germination and emergence e.g., True white grub (*Phyllophaga sp*), wireworm (*Melanotus sp*), Japanese beetle grub (*Popillia japonica*)
- Vegetative stages e.g., Corn rootworm (*Diabrotica virgifera*) and Corn flea beetles (*Chaetocnema pulic*)
- Stored corn post-harvest for control of Stored Product Insects

Approximately 90% of insecticides used on field corn are for soil insects and are applied by the farmer at planting with planter box applicators. The use of insecticidal seed treatments, as well as the use of liquid formulation insecticides, is becoming more common.

Approximately half of all pesticides are applied by the farmer and the other half are applied by commercially licensed dealers and applicators. In general there is a trend for larger farmers to apply a greater proportion of their own herbicides than would producers with small farms.

Both pre and post emergence herbicides are used for annual grass control. Four classes of herbicide active ingredients are used:

- triazines (simazine, atrazine)
- acetamides (alachlor, metolachlor, dimethenamid, acetochlor)
- dinitroaniline (pendimethalin)
- thiocarbamates (EPTC, butylate)

In addition, glyphosate is sometimes used as a burn-down herbicide prior to planting, especially on no-till corn. EPTC and butylate have decreased in use for corn production due to increased use of conservation tillage and the availability of other viable options.

Although there are no post-emergence broadleaf herbicides with true “residual” activity some herbicides do provide a modicum of control through soil activity. These herbicides include post applications of Atrazine and dicamba. Though the trend for increasing use of post applied herbicides continues, concerns about crop injury and drift to off-target crops or plants remains a hindrance.

These changes to cropping production methods are having a significant influence on the type and frequency of use of herbicides and other chemicals used to control various Non-Quarantine and Quarantine Pests.

Fungicide use is generally limited to the seed treatments that have been applied prior to purchase.

4.2.5.2 Regulatory Control of Chemical Use

Many of the chemicals registered (active ingredients) in the USA are also registered for use in Australia on corn and other field crops. However as the range of crops and size of the cropping belt is larger in the USA, the number of chemicals and range registered and used is far greater. The specific registration status of each chemical in Australia versus the USA has not been considered in this report.

Chemical use is controlled by label rates and recommendations for use, as per Australia. In addition there are intervals required for Restricted Entry (REI) and for Pre-harvest Intervals (PHI).

The USA Environmental Protection Agency sets limits on how much of a pesticide residue can remain on food, being the tolerances. Inspectors from the Food and Drug Administration and the USDA monitor food in interstate commerce to ensure that these limits are not exceeded.

There are various programs for which EPA and its regulatory partners perform compliance monitoring activities such as inspections and investigations, overseeing imports and exports and providing training to Federal, State and local personnel. Some of the programs are implemented by Office of Enforcement and Compliance Assurance (OECA) directly while others are administered by the regions or States.

Various surveys are done on both domestic and exported commodities to ensure compliance with regulations and to determine the chemical load on those commodities that move into the food chain.

4.2.5.3 Chemical Residue Testing

Standard contract terms will require that the corn supplied by the particular exporter from the USA has pesticide levels that comply with any Federal or State legislation. In addition, the level of chemicals on the corn must also comply with any Australian Government regulations for imported product to be used for stockfeed.

All food for animals in Australia is covered by residue monitoring programs. Australian MRLs are set out in the MRL Standard published by the Australian Pesticides and Veterinary Medicines Authority (APVMA).

When procuring the corn, the importer could seek a certificate that stipulates what chemical treatments have been applied to the corn and whether it has been tested for residues.

The nature of the certification and price for this service will determine if testing is required to be conducted prior to importing the corn. In general, this would not be a requirement and a contract stipulation of corn meeting MRLs should suffice.

4.2.6 Mycotoxins

4.2.6.1 Risks to Corn & Management Techniques

Certain types of fungi, including those of the genus Fusarium commonly grow on corn plants. It is common to find these fungi in the outer tissues of freshly-harvested corn kernels.

Fusarium fungi cause stem rots, ear rots and other plant diseases, depending on environmental conditions. The growth of these fungi also can result in the contamination of the seed by mycotoxins. Mycotoxins are toxic substances produced by moulds. Deoxynivalenol (DON), fumonisin, T-2 toxin and zearalenone are examples of this type of toxin and are sometimes found in the harvested grain. Contamination by mycotoxins usually is a localised phenomenon present in some crop years and not in others.

Some fungi, principally *Aspergillus spp.* and *Penicillium spp*. specialise in attacking seeds in storage. Certain species of these genera can produce toxins under rare conditions. Well-managed storage prevents the production of mycotoxins. The same good storage practices that maintain grain quality prevent mycotoxin contamination. A variety of test kits are available commercially to analyse for mycotoxins in raw feed ingredients after storage. Routine sampling and testing help assure a toxin-free feed.

4.2.6.2 Presence on Corn

Because nearly 80% of all USA corn is used domestically, the presence of these substances and location of problem areas typically is discovered long before any contaminated grain enters export channels.

For example, the Iowa Agriculture and Land Stewardship noted in November 3, 2005 “The drought condition of 2005 in Southeast and East central Iowa has created the potential for possible aflatoxin contamination in the 2005 feed grain crop. The Iowa Department of Agriculture and Land Stewardship (IDALS) wishes to inform feed manufacturers and state licensed warehouse operators that corn containing aflatoxin contamination above 20 parts per billion (ppb) cannot be used for human consumption, dairy animals or immature animals. Secretary of Agriculture Patty Judge has requested permission from the Food and Drug Administration (FDA) to allow the blending of corn containing aflatoxin when the aflatoxin level is greater than permitted for the intended species. FDA has advised Secretary Judge that it does not object to the blending of the state's aflatoxin contaminated corn harvested during the 2005 growing season.

Corn contaminated with aflatoxin above 100 ppb may be blended with other corn to the extent that the resulting product is below the appropriate action level for feeding to finishing beef cattle, finishing swine greater than 100 pounds in weight, breeding cattle, breeding swine or mature poultry. Blending will not be permitted for the purpose of using for human consumption or for feeding to dairy animals or immature animals."

The FDA action level for aflatoxin in corn, as outlined in its Compliance Policy Guide 683.100, is shown in the following table. These are the same levels applied by IDALS in regulating aflatoxin in corn.

Corn Action Levels	*Species*
20 ppb or less	*Human food, dairy and immature animals*
100 ppb or less	*Breeding cattle, breeding swine and mature poultry*
200 ppb or less	*Finishing swine greater than 100 lbs in weight*
300 ppb or less	*Finishing beef cattle*

Field studies also have shown reduced kernel infection by *A. flavus* and lower aflatoxin concentrations in BT11 and MON810 hybrids compared with their non-Bt counterparts. However, these reductions have been less dramatic than those seen for fumonisins.

Another parameter important to storage of USA corn is the number of kernels infected by storage moulds. This information is generally not provided on the grade certificate because the test requires several days to perform. Mould infection is a function of the grain storage and handling history, including the length of storage, moisture and temperature during storage and the blending that has occurred during export handling. Recent research shows that the percentage of kernels infected by the most important storage moulds varies by season in exported USA corn, as shown below. When the infection rate is high, successful storage is more difficult. It appears likely that from January to June, USA corn will tend to be more easily stored. From July or August through November or December, more precautions may be necessary for successful storage.

Percentage of U. S. corn kernels infected with species of the storage mould *Aspergillus* at destination ports

4.2.6.3 Contract & Testing Requirements

All USA corn is tested at export for aflatoxin, the most common toxin in corn. Corn containing more than 20 parts per billion cannot be exported. A certificate will be provided on export detailing results of the test.

As mycotoxins vary depending on a range of factors as described, there is no advantage or requirement to source corn from any particular State that may or may not have low levels in a particular season. There are very limited national and international regulations for the presence of the above mycotoxins in grains including corn. However there are acceptable levels in grain as determined by industry according to the end-use of the corn.

Contract specifications should specify these requirements and will thus limit the presence of mycotoxins. Specifying limits is a standard contractual requirement when exporting corn from the USA.

Therefore it is recommended that mycotoxin limits for the common toxins listed above be included in the contract with the supplier. A certificate attesting to that compliance should also be obtained as detailed later in this report. These limits have not been addressed in this report, but are available for various animals if required.

4.2.7 Future Quality of Corn

There are several ongoing initiatives in the USA to improve the quality of the corn crop. The Germplasm Enhancement of Maize (GEM) Project is a cooperative research effort of the USADA-ARS, land grant universities, private industry and international and non-governmental organisations to broaden the germplasm base of corn.

Genetic uniformity may lead to vulnerability to crop pathogens, insects and abiotic factors, thereby compromising food security. In addition to reducing genetic vulnerability, broadening the germplasm base can provide unique traits, thus enhancing value to the final consumer of the corn.

The products of the GEM Project include new sources of germplasm that will be available to all researchers free of charge through the North Central Regional Plant Introduction Station (NCRPIS). Released germplasm can then be incorporated into corn breeding programs by the commercial and public sectors.

New research information to be generated under these programs and shared with the scientific community includes:

- Characterisation of germplasm for agronomic performance and traits
- Breeding methodology for enhancement of un-adapted (exotic) germplasm
- Germplasm with unique value-added traits for further research applications.

Bt hybrids are also an important tool in the integrated management of Fusarium and Aspergillus ear rots and corn stalk rots. New Bt hybrids now under development promise to exhibit more complete control of corn earworm and fall armyworm, and this should enhance their effects on insect-associated fungi. New events also are being developed for control of coleopteran pests such as corn rootworms (*Diabrotica spp*.). Control of corn rootworms has the potential to reduce stalk rot by maintaining better root health and reducing physical damage to the roots where the stalk rot fungi can enter the plant.

Coleopterans that feed on corn ears and silks, such as adult corn rootworms and sap beetles can contribute to ear rot. If new transgenic hybrids are resistant to these insects, there could be further contributions toward mycotoxin management. Transgenic control of insects and diseases offers an alternative that is much more effective, consistent, and economical and environmentally sound than use of foliar insecticides.

Available data show that Bt transformation of corn hybrids enhances the safety of the grain for livestock feed by reducing its vulnerability to mycotoxin-producing fungi. These mycotoxins also are likely to be detrimental to human health, so the lower concentrations of mycotoxins in Bt corn potentially have implications for food safety.

4.3 USA Supply Chain

4.3.1 General Overview

4.3.1.1 Introduction

Grain production is the major agricultural industry in the USA. Its grain exports account for more than half of the volume of grain traded internationally. As a consequence, the grain markets in the USA are strongly influenced by world supply and demand factors. On the other hand, the USA grain markets also exert major influences on the world price levels for most of the major traded grains.

Grain production in the USA occurs mainly within a wide inland belt stretching from the Canadian border in the north-west to the Gulf of Mexico in the south-east. Much of the growing area is remote from export ports, but good river and land transport systems connect the growing areas to ports. Climatic conditions range from cold in the north to hot and dry in the south. Production density is generally high by international standards.

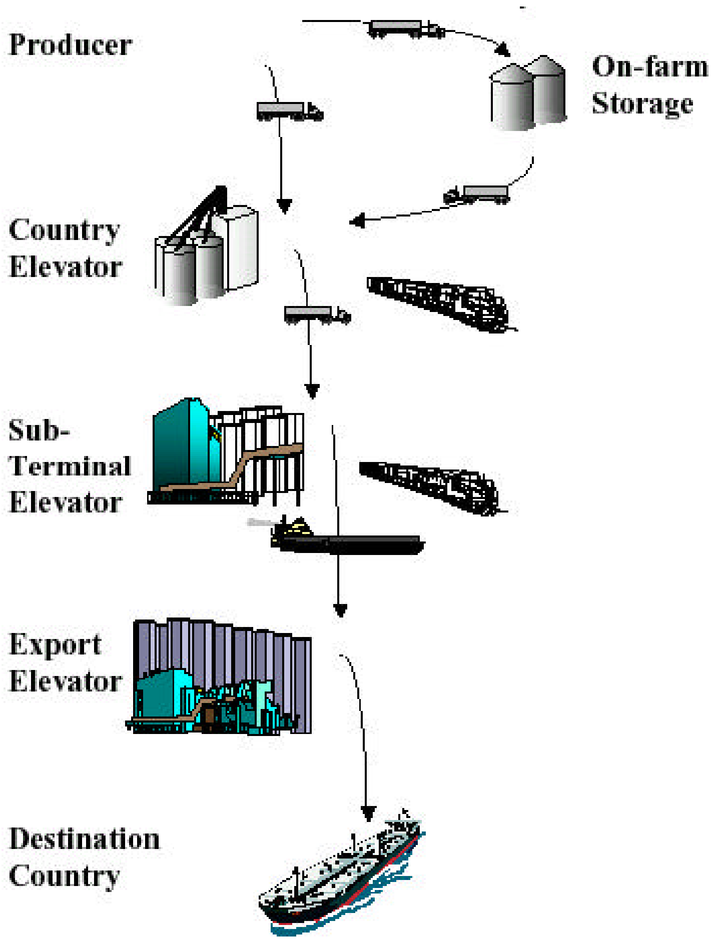
In recent years, the USA has produced an average of about 350 - 400 million tonnes of grain per year. Corn is by far the predominant crop, accounting for about 60% of total grain production, followed by wheat at about 18%, and soybeans at 15%, while sorghum amounts to about 5%. Over the same period, the average annual level of total grain exports was about 103 million tonnes, or about 30% of production. The main export crop is corn at 45%, followed by wheat at 31%, soybeans at 17% and sorghum at 5%.

4.3.1.2 Grain Marketing and Distribution

The grain marketing systems in the USA strongly interact and influence the nature and operation of the grain supply chain systems.

Grain marketing and distribution in the USA is nominally free from specific Government or administrative control. However, a number of Government agricultural programs can have a substantial impact on these activities. The marketing and distribution system is highly competitive, involves many participants and consists of a complex network of marketing and distribution paths from grower to customer. Grain frequently changes ownership as it moves along the distribution chain. A particular feature of the system is the high degree of grain blending undertaken to maximise returns while still meeting grade specifications.

A depiction of the general transport pathway is shown below.



4.3.1.3 Geographic Environment

In order to understand the grain handling transport and storage task in the USA, it is necessary to have an understanding of the physical environment and the many challenges involved in moving grain to market. The following is a summary description of the geographical environment.

The USA landmass consists of several major and topographically distinct features. The centre of the country consists of extensive interior lowland which reaches from the central western lowlands of Canada in the north, to the Gulf of Mexico in the south east. To the east and west this lowland area rises first gradually and then abruptly into mountain ranges.

To the east the Appalachian Mountains are generally low but unbroken, stretching from east of the Great Lakes in the north in a south westerly direction towards the Gulf of Mexico. They are separated from the Atlantic Ocean by a wide low coastal plain which widens as it sweeps south and westward, truncating the southern end of the mountain range and extending around the Gulf of Mexico. To the west of the central lowlands is the mountainous Cordillera, which in turn consists of three main features and encompasses most of the western third of the country. The eastern component is the high, diverse and discontinuous Rocky Mountains which stretch from New Mexico to and beyond the Canadian border. The most western element is a Pacific coastal chain of rugged mountains and inland valleys which rises virtually straight from the sea without any coastal plain. Between the Rocky Mountains and the Pacific chain, the third component is an extensive complex of basins, plateau and isolated ranges.

The climate is nominally temperate, with most of the landmass lying within the middle latitudes. Arctic type climates are therefore confined to the highest mountainous regions, while genuine tropical climate occurs only in a small part of southern Florida. Nevertheless, the middle latitudes are characterised by extreme variations in temperature and rainfall, and these are further influenced by the continental land mass of North America, the neighbouring oceans and the pattern of mountains and lowlands.

The USA has a comprehensive network of rivers and lakes, providing extensive inland transport capacity, particularly in the eastern half of the country. The Mississippi River, with its main tributaries, the Ohio and the Missouri, drain most of the mid-continent, and provide navigable transport from as far as Minneapolis to the Gulf of Mexico. The Great Lakes - St Lawrence system, which is connected to the Mississippi system by canals, forms the second part of the world's largest network of inland waterways. The Lakes system provides Lakers and ocean-going vessels with access as far inland as Duluth, Minnesota and Chicago via a system of locks.

A further major river transport system is the Columbia and Snake River transport system in the Pacific North West region of the USA. The tidewater terminals in the Port of Portland form the key export focus of this system along with other major ports (Puget Sound area) closer to the coast.

Most of the inland areas experience 'continental' extremes of climate, with hot summers and cold winters. Temperatures may range from lows of 20° Celsius or more below zero to record highs approaching 50° Celsius. Precipitation is usually received in the form of snowfall in the north, often driven by extreme winds. In the south, cold rain alternates with sleet and occasional snow. As for most continental climates, the change of seasons at spring and autumn are periods of milder conditions, but are relatively brief.

4.3.2 Farm Storage

The USA has approximately 550-600 million tonnes of grain storage capacity. Of this, the on-farm storage is concentrated in the corn-belt and to a lesser extent the spring wheat growing areas. This high proportion of on-farm storage provides growers with a considerable amount of flexibility in terms of marketing decisions. The balance of storage capacity is located off-farm at country elevators, terminals, sub-terminals and export facilities.

As at 2002, the USA on-farm grain storage capacity totalled 11.175 billion bushels (285mmt) while the off-farm storage totalled 8.419 billion bushels (214mmt). Iowa lead all States in on-farm storage capacity with 1.6 billion bushels (41mmt), followed by Illinois, Minnesota, Nebraska and North Dakota. These five States accounted for 53 percent of the USA on-farm grain storage capacity, while the leading states with off-farm storage included Illinois (29.2mmt), Iowa (26.8mmt) and Kansas (20.2mmt).

There is no significant difference in the tonnage of corn held on-farm versus other grains.

While the potential tonnage able to be stored on-farm is large, a significant portion of corn is transported directly from the field to grain elevators that provide drying and storage services. For that corn stored on-farm, many farms have grain dryers and large grain bins.

4.3.3 Country Storage

About 65% of country storage capacity is located on-farm, providing growers with substantial marketing flexibility. Most off-farm storage facilities are owned by local grower co-operatives, and excluding the storage of government-owned grain stockpiles, are run as throughput facilities. Regional storage and handling terminals are mainly owned by associations of local grower co-operatives and by the international traders, and they function largely as assembly points for forwarding grain to export terminals.

The off-farm storage tends to be concentrated in the corn-belt and the hard red winter wheat areas. The country elevators, of which there are around 3,000, account for approximately 75% of the off-farm storage capacity. Country terminals and sub-terminals provide approximately 15% while export facilities account for the remaining storage capacity.

Many of the country based elevators are relatively small and only service local areas. The terminals and sub-terminals are regionally oriented and have substantial storage capacity.

Most local grower co-operatives set prices on a commercial basis, and as most have separate ownership, little or no pooling of costs occurs. The co-operatives purchase grain outright or offer growers a warehousing service. A high proportion of the local co-operatives grain is sold to regional co-operatives which either market the grain to end users, or in turn, on-sell it to international traders.

A major influence on country storage capacity has been US Government support programs which results in the accumulation of grain stocks by Government. Grain may be held in such stockpiles for a number of years. Such stocks are generally stored both on farm and in private facilities throughout the country at rates negotiated between Government and the storer.

The number of commercially licensed grain handling facilities in major grain producing States and terminal exports is presented in the Table below.

Location	Number of Elevators by Storage Capacity	
	<1 million bushels (<25,500mt)	>1 million bushels (>25,500mt)
Illinois	534	357
Iowa	373	293
Kansas	656	160
Minnesota	134	100
Nebraska	339	204
Gulf Terminal	-	12
Atlantic Terminal	-	4
Pacific Northwest	-	9
Great Lakes	-	18

4.3.4 Transport Network

4.3.4.1 General

Grain destined for export passes through country elevators, inland sub-terminals and export terminals where it is loaded onto vessels, ranging in capacity from 20,000mt to 120,000mt, with many vessels over 50,000mt capacity.

Grain transport is highly competitive, with many areas having the choice of rail, barge or road modes. Rail is the dominant mode, accounting for just under 50% of the total transport task, including domestic and export movements. Barge accounts for just over 20% of the total task, while road provides the balance of slightly less than 30%.

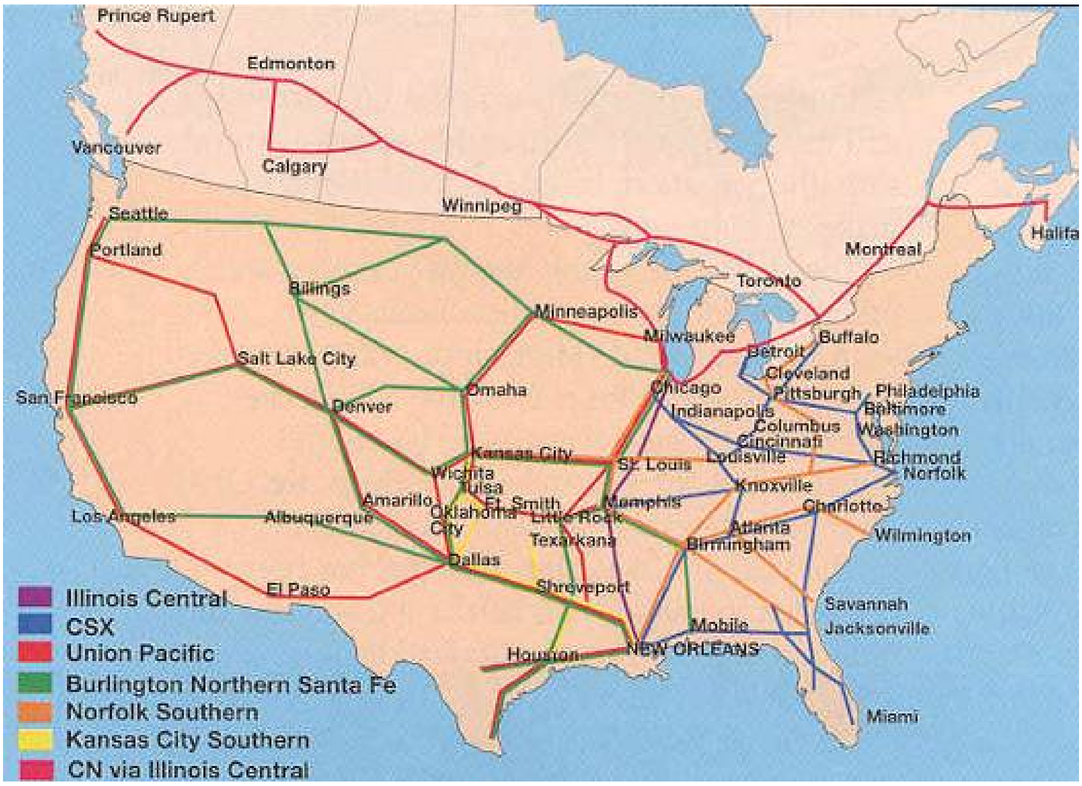
As previously noted, the modal shares of the export task are somewhat different. The extensive network of 24,000 kilometres of navigable waterways provides effective and relatively cheap grain transport, particularly from the corn-belt and soybean production areas to the Gulf of Mexico, via the Mississippi River system. Barge transport therefore captures around 45% of the grain export task, similar to rail at about 45%, while the balance of around 10% of export tonnage is moved by road.

Containers for export are usually loaded at an upcountry location and transport by rail and or road to a port location. The containers are moved through inter-modal facilities were they are unloaded from rail and loaded onto Container vessels. The product within the container remains unchanged despite the numerous number transfers between different modes of transport.

There are numerous container terminals at both Gulf and Pacific Northwest port locations, all capable of facilitating grain exports in containers.

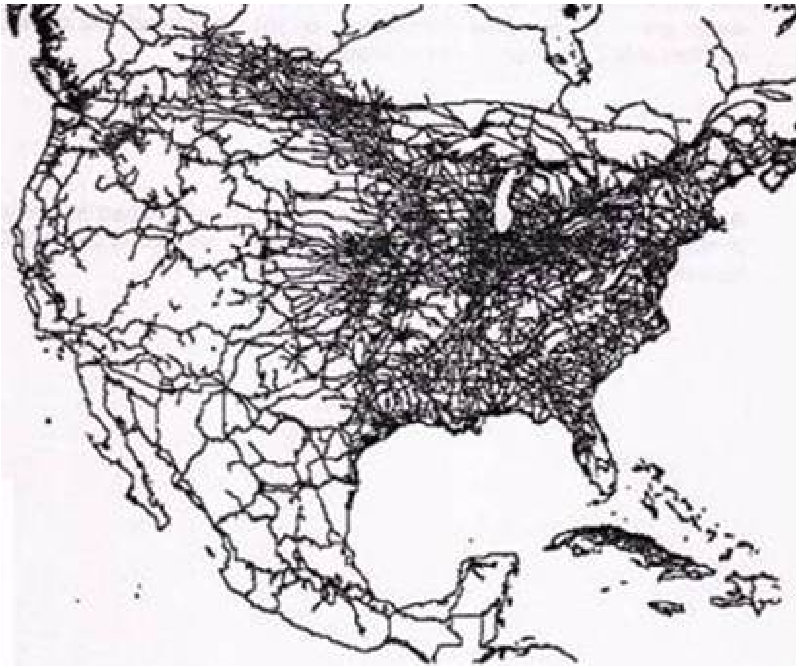
4.3.4.2 Rail

Detailed in the following map is a summary of the major US railway networks.



The majority of grain transport by rail is undertaken on standard gauge track by about ten major, privately owned rail companies, such as the Illinois Central, Norfolk Southern, Kansas City Southern, Burlington Northern Santa Fe and Union Pacific. There are many more regional or smaller railways, also privately owned, which may act as feeder systems to the bigger trans-continental systems. Most of the companies own their track and locomotives; some may be leased or contracted. Approximately half of the wagons, typically 100 tonne capacity hopper cars, may be owned by rail users as opposed to operators.

The rail network is depicted below to indicate the extent of the system and congregation around the port terminals near the corn-belt.

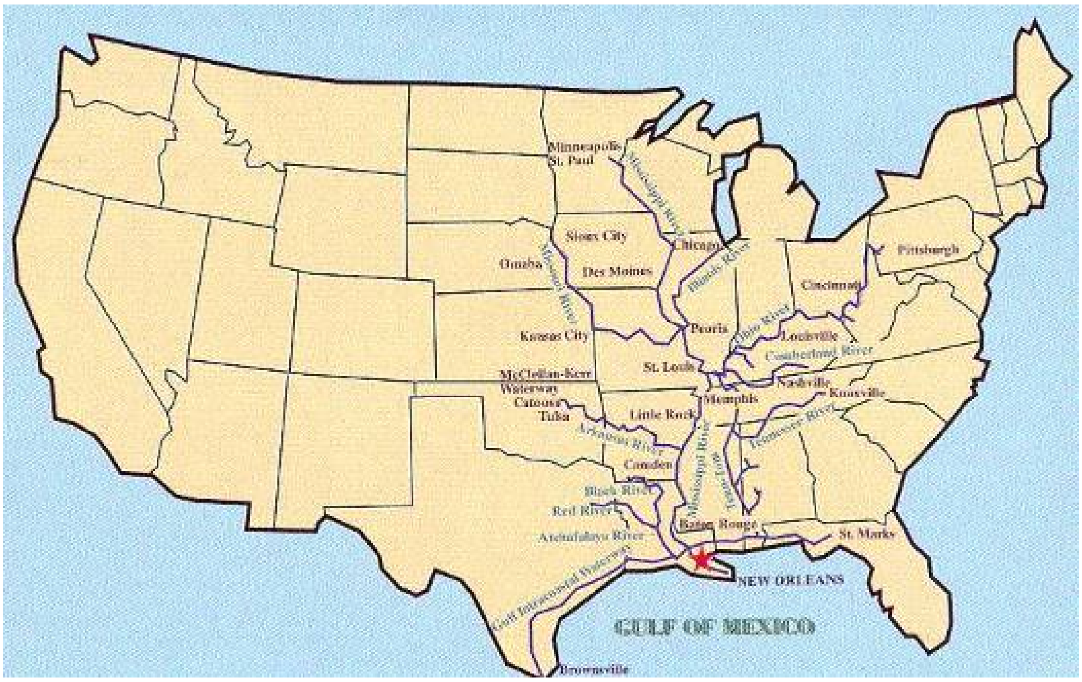


The Association of American Railroads provides co-ordination services to assist the many railroads to integrate services where inter-company movements are involved.

4.3.4.3 Barges

Barges are used for grain transportation on the extensive navigable waterways which flow through a large part of the grain producing areas. Barges, generally of 1,500 tonne capacity, are owned by private barge lines, a number of which are in turn owned by the large grain companies. Given the distance to be covered, journeys by barge can take from two to three weeks from loading point to port terminal. Many millions of tonnes of grain may be on the water at any particular time and this provides considerable buffer stock to the port terminals. Barge transport is typically highly cost effective.

Detailed in the following image are the primary waterways used for transporting grain by barge.



4.3.4.4 Road

Road transport by growers is undertaken in farm trucks, typically of lower capacity. Contract grain vehicles are generally used for hauls of less than 500 kilometres. Many of the river based barge transfer elevators do not provide for rail in-loading and much of the grain delivered to the barge network can only be sourced by road.

4.3.5 Port Infrastructure

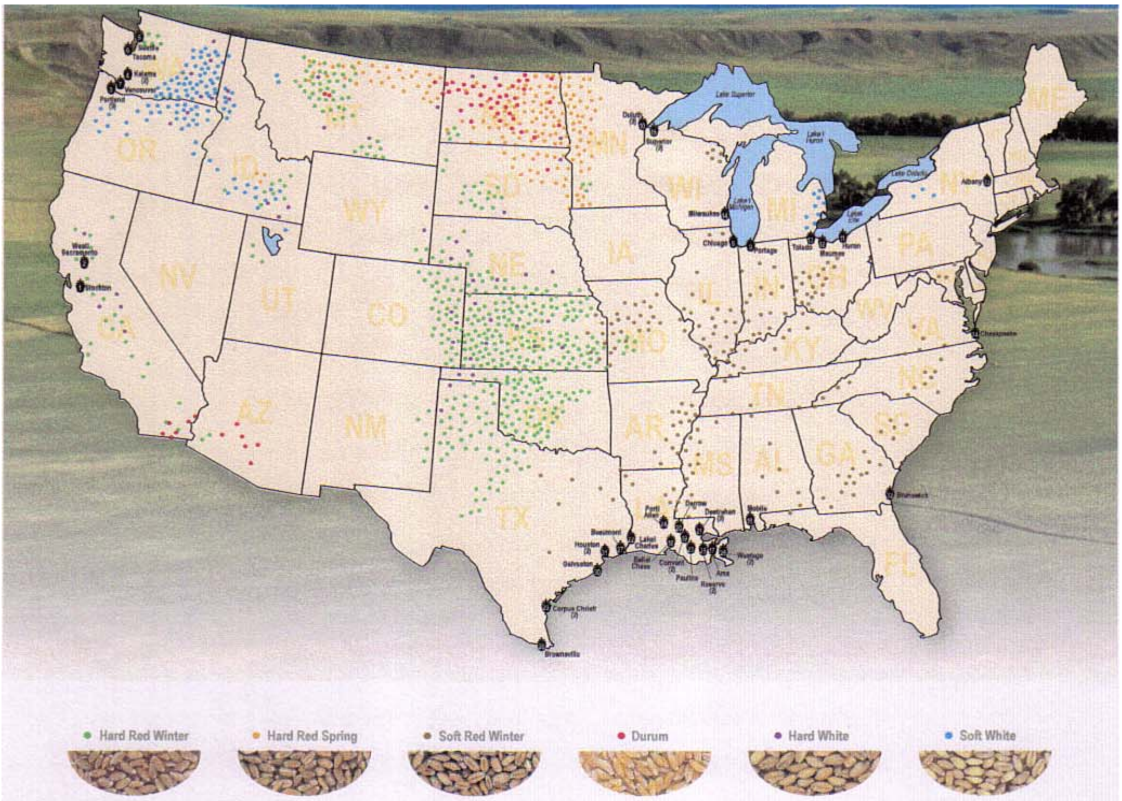
4.3.5.1 General

Most export marketers own export terminals at various points around the USA coast and Great Lakes system. The terminals operate as throughput facilities, with barges providing substantial back-up storage, and in effect, substituting for permanent storage in port.

The USA has grain export ports on the Atlantic and Pacific coasts, on the Gulf of Mexico, and on the Great Lakes system. Most ports have a number of terminals (elevators) and most are owned either by private traders, Port Authorities or co-operative associations. While vessel size capacity varies, many ports are capable of loading the largest of vessels engaged in the international grain trade. Outloading and storage capacity at terminals also varies, as does the degree of operating sophistication.

The average export pattern has been dominated by movements through the Mississippi-eastern Gulf complex, accounting for approximately 60% of total exports of capacity. The Pacific North West is the next largest outlet, exporting approximately 20% of the total. The Texas Gulf area accounts for about 10% of exports. The Lakes, Atlantic and other export origins collectively account for the balance of approximately 10% of exports.

The primary export terminals for US wheat are detailed in the following image. These facilities are also the principal terminals used for the export of corn and soybeans.



U.S. Wheat Export Port Elevators

(Numbers below correspond to the numbered ports indicated on the map above.)

PACIFIC COAST

California

1 • Stockton:
  (a) Penny-Newman Grain Co.

2 • West Sacramento:
  (a) Port of Sacramento

Oregon

3 • Portland:
  (a) CLD Pacific Grain LLC
  (b) Columbia Grain, Inc.

Washington

4 • Kalama:
  (a) Kalama Export Co., LLC
  (b) United Harvest, LLC

5 • Seattle:
  (a) Louis Dreyfus Corp.

6 • Tacoma:
  (a) Tacoma Export Marketing Co.

7 • Vancouver:
  (a) United Harvest, LLC

GREAT LAKES

Illinois

8 • Chicago:
  (a) Chicago & IL River Marketing LLC

Indiana

9 • Portage:
  (a) Cargill, Inc.

Minnesota

10 • Duluth:
  (a) AGP Grain
  (b) Cargill, Inc.
  (c) General Mills, Inc.

Ohio

11 • Huron:
  (a) Peavey Co. (division of ConAgra, Inc.)

12 • Maumee:
  (a) Andersons

13 • Toledo:
  (a) ADM Grain Company
  (b) Andersons

Wisconsin

14 • Milwaukee:
  (a) Chicago & IL River Marketing

15 • Superior:
  (a) Cenex Harvest States
  (b) General Mills, Inc.
  (c) Peavey Co. Connor's Point (division of ConAgra, Inc.)

GULF OF MEXICO

Alabama

16 • Mobile:
  (a) Farmers Grain Dealers, Inc.

Louisiana

17 • Ama:
  (a) ADM/Growmark

18 • Belle Chase:
  (a) Cenex Harvest States

19 • Convent:
  (a) Cargill, Inc.
  (b) Zen-Noh Grain Corp.

20 • Darrow:
  (a) Cooper/T. Smith
  (b) Stevedoring, Co., Inc.

21 • Destrehan:
  (a) ADM/Growmark
  (b) Bunge Corporation
  (c) Total Transportation, Inc.

22 • Lake Charles:
  (a) Public Elevator

23 • Paulina:
  (a) Peavey Co. (division of ConAgra, Inc.)

24 • Port Allen:
  (a) Cargill, Inc.

25 • Reserve:
  (a) ADM/Growmark
  (b) Cargill, Inc.

26 • Westwego:
  (a) Cargill, Inc.

Texas

27 • Beaumont:
  (a) Louis Dreyfus Corp.

28 • Brownsville:
  (a) Public Elevator

29 • Corpus Christi:
  (a) ADM/Growmark
  (b) Interstate Grain Corp.

30 • Galveston:
  (a) ADM/Farmland Industries, Inc.

31 • Houston:
  (a) Cargill, Inc.
  (b) Louis Dreyfus Corp.

ATLANTIC

Georgia

32 • Brunswick:
  (a) Georgia Ports Authority

New York

33 • Albany:
  (a) Cargill, Inc.

Virginia

34 • Chesapeake:
  (a) Perdue Farms, Inc.

4.3.5.2 Pacific Northwest Ports

Port of Portland

The Port of Portland is located at the confluence of the Willamette and Columbia Rivers approximately 160 kilometres up the Columbia River from the Pacific Ocean in the State of Oregon. More that 1,000 deep-drafted vessels load at the Port of Portland's four marine terminals each year.

Portland's Terminal 6 is the region's barging connection from inland producers to Pacific Rim markets and beyond. Container barging connects Terminal 6 to four shallow-draft upriver ports on the Columbia/Snake river system: Boardman and Umatilla, Oregon; Pasco, Washington; and Lewiston, Idaho, which is the country's farthest inland port at 465 miles (744 km) from the Pacific Ocean.

The Columbia and Snake rivers combine to form the second largest river system in the USA. Early on, barge companies serving Portland, Oregon, recognised the market opportunity for container cargo and were the first in the nation to facilitate regular container service on the USA river system. Since container barge service began in 1975, the volume of containers barged through Portland has reached levels as high as 50,000 per year.

Terminal 2 caters for break-bulk cargoes (forest products, steel, aluminium, machinery) and containers. Terminal 4 is a multipurpose, 280-acre facility features seven ship berths capable of handling a variety of cargoes including grain, cars, forest products, steel and dry and liquid bulks. Located on the north edge of the Port's River-gate Industrial District, Terminal 5 and its 185 acres feature a rapid-handling grain elevator operated by Columbia Grain Inc. In the fall of 1997, a $48 million mineral bulk exporting facility began handling potash and other bulk commodities. Terminal 6 is the region's primary ocean container terminal on the Columbia River. Terminal 6 offers the best productivity rates on the West Coast.

Portland is a highly efficient inter-modal port, offering barge transhipment in addition to ship, rail, and air and truck transportation. Portland is served by three transcontinental railroads (Burlington Northern Santa Fe, Union Pacific and Southern Pacific), numerous steam ship carriers, 150 trucking companies and 16 barge, tug and towing services on the Columbia/Snake River system which transport annually around 25,000 container-on barge moves. This inland waterway extends from Portland approximately 590 kilometres to Lewiston, Idaho, a system that hub at the Port of Portland's Terminal 6.

Total port trade for the Port of Portland public terminals is around 12 MT annually, with mineral tonnage being around 4.5 MT and grain 3.9 MT. Major grain terminal operators include United Harvest LCC, Columbia Grain and CLD Pacific Grain LLC (JV between Cargill and Louis Dreyfus).

United Grain

The United Grain facility is located downstream on the Columbia River in the State of Washington. Annual grain exports are around 4.0 MT and with storage capacity restricted to 136,000 tonnes storage turnover and just-in-time cargo accumulation is critical in meeting shipping schedules.

Columbia Grain

Columbia Grain, Inc. was formed in 1978 to create a source of western grain for domestic and export markets. It is located in the State of Oregon. Their goal has been to develop an advanced grain trading organisation, not only in terms of storage and shipping, but also in quality and reliability of information and products.

Columbia Grain expanded and updated their Terminal 5 export facility twice since its construction in 1976. They have also added country facilities near sources of production to enhance their ability to serve export and domestic markets. Their 900,000 MT capacity allows for reliable staging for export and domestic sales. Annual grain exports are around 2.6 MT.

CLD Pacific Grain LLC

CLD Pacific Grain LCC operates the Cargill and Dreyfus Grain terminals at Portland, in the State of Oregon which caters for about 2 MT annually through its 204,000 tonne capacity facility.

4.3.5.3 Gulf Ports

Port of New Orleans

About 90 percent of USA corn exports are shipped out of the New Orleans port in the State of Louisiana. Upwards of 35 million bushels of corn are exported from the USA each week, most going out of the Gulf. Normally, barges move down the river, arriving in New Orleans. At New Orleans, grain is unloaded into a terminal elevator, then into ocean-bound ships. The grain in a barge is also unloaded by using another barge that moves the grain to the ocean-bound ship.

Seventy percent of the nation's waterways drain through the Port of New Orleans.

The Port of New Orleans is located on the Mississippi River approximately 145 kilometres from the Gulf of Mexico and serves the inland cities of the USA by various transport modes, i.e. truck, rail and barge. There are several railroad companies serving the port, as well as a large number of trucking and barge companies. Situated on the Mississippi River, the Port of New Orleans is the focal point of a 23,200 kilometre network of inland waterways. Because barge transportation costs are dramatically lower than other modes, bulk commodities such as grain make up a large share of the movements on the inland waterways. More than half of all the export grain shipped from USA departs through nine elevators on the lower Mississippi River. All types of cargo are handled through the Port of New Orleans, such as containers, break-bulk, neo bulk, bulk, Ro-Ro and heavy lift.

Average exports for the Port of New Orleans are around 17 million tonnes. Grain exports are around 10 million tonnes, representing approximately 59% of total tonnage. It should be noted that only one of the New Orleans grain elevator falls within the Port’s jurisdiction. The remaining eight elevators are located outside its jurisdiction. These include Zen-Noh Grain Corporation and Cargill Inc facilities at Convent and Cenex Harvest States (CHS) at Belle Chasse.

Port of South Louisiana

The Port of South Louisiana is located in the State of Louisiana. The Port of South Louisiana, which stretches 54 miles along the Mississippi River, is the largest tonnage port district (comprised of facilities in St. Charles, St. John the Baptist, and St. James Parishes) in the Western Hemisphere and ranks fourth in the world. It handled over 248 MT of cargo in 2004, brought to its terminals by vessel, barge, rail, and truck.

Over 50,000 barges and 4,000 ocean-going vessels call at the port each year, making it the top ranked in the country for export tonnage and total tonnage.

With exports of 52 MT of cargo a year more than any other port in North America — the Port accounts for 15 percent of total USA exports. The port has eight first-rate Port-owned facilities, ranging from grain elevators to general cargo and bulk docks.

Average exports for the period 2001 to 2005 was 57.8 MT (all commodities), with total port trade being around 248.5 MT. Average grain export through the Port of Louisiana are approximately 48.9 MT with corn at 27.3 MT, soybean at 16.2 MT and wheat at 3.7 MT representing the major grain commodities.

The Port serves primarily as landlord to eight facilities leased to operating companies such as Peavey, Occidental, Archer Daniels Midland and Cargill.

The Port of New Orleans is America's most inter-modal port, enabling shippers to move cargo by ship, rail, truck and barge. Cargo from every area of the world is funnelled through New Orleans to Middle America and the South, particularly iron and steel, coffee, rubber, grain and sugar. The Port of South Louisiana is less than one hour away from New Orleans

Port of Baton Rouge

The Port of Greater Baton Rouge is located on the Mississippi River and is an integral part of the Louisiana maritime industry. The Port of Greater Baton Rouge ranks among the top ten ports in total tonnage.

Located in Port Allen, Louisiana, the Port of Greater Baton Rouge is situated at the convergence of the Mississippi River and the U.S. Gulf Intracoastal Waterway and is linked to major Gulf Ports between north Florida and south Texas and through the Mississippi River inland waterway system.

It handles a variety of bulk and break bulk cargoes for domestic and international markets including asphalt, barite, coal, coffee, coke, grain, forest products, molasses, oats, ores, pipe, rye, steel, talc and sugar.

Bulk cargo storage and transfer at the Port of Greater Baton Rouge takes place at either the Deepwater Complex or Inland Rivers Marine Terminal. Along with facilities for varied agriculture and steel products, the complex includes sugar storage and distribution facility with two 40,000 ton warehouses and a 900 foot conveyer. The public grain elevator at the port, operated by Cargill AgHorizons, serves farmers and ranchers throughout the South.

Port of Houston

The Turning Basin Terminal is located just 10 kilometres down stream Houston city in the State of Texas and serves as the navigation head of the channel. The banks are lined for 4 kilometres downstream with wharves, transit sheds and warehouses. Each year some 3,000 ships and barges tie up at the terminals 37 docks. These docks are equipped to handle just about any type of break bulk, containerised, project or heavy lift cargoes.

The Port of Houston is a massive complex of public and private facilities just a few hours sailing time from the Gulf of Mexico. It is the busiest port in the USA in terms of foreign tonnage, second-busiest in the USA in terms of overall tonnage, and sixth-busiest in the world.

The Port of Houston is made up of the Houston Ship Channel and Galveston Bay. It is made up of the port authority and the 150-plus private industrial companies along the ship channel; many oil companies have built refineries on the channel where they are protected from the Gulf of Mexico. The petrochemical complex associated with the Port of Houston is one of the largest in the world.

The Port of Houston Authority owns and operates the public facilities located on the Houston Ship Channel. These facilities include a large general cargo complex, an ultra-modern inter-modal terminal, a plant for handling dry bulk materials, a public grain elevator, and a deep-water basin with access to private facilities for liquid bulk cargoes, and the site of an automated terminal for boxed and bagged goods, and a modern cold-storage facility.

A total of 6,539 vessel calls were recorded at the Port of Houston during the year 2004, and approximately 200 MT of cargo moved through the Port in 2004. Cereal based products represent around 8.0 MT of annual exports.

There are two major grain terminals located within the region, Houston Public Elevator and Union Equity Co-operative Exchange. Annual grain exports for the Union Equity Co-operative Exchange terminal is approximately 4.0 MT, while the Houston Public Elevator caters for around 2.0 MT annually.

4.3.5.4 Major Grain Trading and Supply Chain Organisations

There are a large number of grain trading and supply chain organisations in the USA corn-belt. Many of the companies own a range of storage facilities and operate transport to move grain to port and also export commodities through their ports.

A profile of two organisations is provided in Appendix 13.7, both being very large entities in their fields:

- Bunge North America – major grain trading and conglomerate
- Burlington Northern Santa Fe Railway - major rail transport group

4.3.6 Costs for each Sector

As outlined above, the USA has a vast and efficient distribution system for virtually all import and export products. The costs of the system are usually low and very competitive. The position is no different for grain. The nature of the grain export distribution system has been outlined in the section above.

Even though most of the grain is grown in the central areas of the continent, the efficient rail and barge transport systems mean that transport costs are no higher than typically faced by Australian grain farmers, where grain is usually grown much closer to the coast.

In general terms rail or barge cost from the main corn States to the gulf terminals are typically less than A$20. Usually barge costs are substantially cheaper than rail. The actual costs vary quite frequently and are summed up by the "basis" difference between the prices set on the hinterland grain trading exchanges (Chicago and others) versus the price at the terminal port loaded onto ship.

An example of the fluctuations can be seen from the results of the recent hurricane damage to the Gulf trade and Gulf ports. The price of the transport function escalated dramatically, in some cases exceeding A$50.

The price of upcountry grain handling and terminal port charges can also vary considerably over time. A common feature of up country systems and terminal port functions is the widespread practice of grain blending. Cheaper grain is blended in to maximise profits while still just meeting US export standards. However, widespread competition in the handling system means that much of the profit is traded away. Terminal handling charges can therefore look quite cheap at times, because blending is a prime profit driver.

As is the case with virtually all grain exports, the actual up country supply chain costs do not have a great net influence on the prices ex the terminal port. These cost variations are substantially borne by the producers of the grain, rather than by overseas buyers of grain.

The price for any corn exports to Australia would follow the normal market dictates, with world supply and demand factors being dominant.

There are two options with the most likely supply chain pathway for corn exports to Australia from the lower disease risk areas being road to a river based sub terminal, then barge to one of the Gulf ports.

Corn in the more western of the main corn-belt areas in Minnesota can also be diverted for export through the Pacific Northwest. However this pathway is too costly for eastern corn-belt States such as Indiana, Iowa and Illinios. The only feasible export pathway for these areas is the Gulf ports, particularly New Orleans.

The proposed pathways and costs of exports of corn to Australia are detailed later in this report.

4.4 Australian Regulations

4.4.1 Overview

Australia's stringent quarantine regulations are science-based and designed to protect Australia's agricultural exports, domestic production and the natural environment. Previous research by the Australian Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) has shown that there are many pathogens that may enter and become established in Australia with the importation of Feed corn (bulk corn). Thus they have argued that Australian quarantine regulations should not be weakened from the current restrictions.

There are two international agreements that relate to plant quarantine and the regulation of grain imports into Australia:

- World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (known as the WTO/SPS Agreement)
- The International Plant Protection Convention (IPPC)

The major obligation on member countries such as Australia under these treaties is not to restrict trade more than is necessary to maintain quarantine security. Thus when Australia develops quarantine regulations and import requirements they must use scientific principles and follow these international standards.

Australia's import risk analysis is thus conducted in a consultative framework that is a scientific process and therefore politically independent. It is a transparent and open process that is also subject to appeal. This ensures that there is a sound scientific basis for the biosecurity policies and that importation is only permitted when the risks posed can be managed in a manner consistent with Australia's highly conservative approach to pest and disease risk.

The Quarantine Act and its subordinate legislation, including the Quarantine Proclamation 1998, are the legislative basis of human, animal and plant biosecurity in Australia.

4.4.2 Import Protocols

Biosecurity Australia is the body under DAFF that is closely involved in developing International Standards for Phytosanitary Measures. Biosecurity Australia is thus closely involved in developing the Australian Government's policy and procedures related to quarantine for commodity imports in the areas of:

- Risk analysis
- Area freedom
- Market access

This essentially occurs through the import risk analysis process for plants and plant products that ensures it is aligned to its international obligations.

Biosecurity Australia produces a Handbook "Guidelines for Import Risk Analysis". These Guidelines provide guidance on the different types of import risk analysis methods used by Biosecurity Australia.

The Guidelines refer to 'document templates' for the various reports that will be required when communicating the methods and results of import risk analyses. These document templates provide a consistent means by which Biosecurity Australia plant import risk analyses are carried out and reported.

There are three document templates for carrying out the import risk analyses:

Technical Issues Paper

- This template provides the structure and generic text required for the Technical Issues Paper.
- It contains a discussion of issues relevant to the commodity for which access has been requested

Draft/Final IRA Report

- This template provides the structure and generic text required for both the Draft IRA Report and Final IRA report
- It contains the results of the risk assessment

Summary Document

- This is generally distributed to stakeholders in place of a full report, with the latter made available on request or as a download from the AFFA Internet site.

4.4.3 Application Process

Biosecurity Australia may initiate development of new biosecurity policy or review an existing policy in one of the following scenarios:

- A proposal to import corn is received or
- An application is received by AQIS for an import permit

Proposals and applications may come from individuals, companies, organisations, government agencies or governments (both in Australia and overseas).

Where it is apparent that the biosecurity risks associated with an import proposal or application are similar to those addressed by an existing policy, an IRA may not be considered necessary.

In the case of corn imported from the USA, previous IRAs have been conducted. Biosecurity Australia would thus be expected to review an application from Meat and Livestock Australia in light of the previous assessment.

In addition, due to the complexity of the assessment, technical experts are used to assist in this assessment. Thus limited resources may be available to conduct the assessment. Requests for IRAs are assessed also on a priority basis, taking into account a range of other factors such as the complexity of the process required.

In summary, steps in the import risk analysis process are:

- Requests for market access may be submitted
- Biosecurity Australia examines proposals to determine which ones require an IRA
- For those requiring an IRA, it will be scheduled
- Consultation with States, Territories and Federal Agencies.
- Scope the approach and IRA team membership
- Consult with registered stakeholders
- Finalise IRA team and scope
- Liaison with the applicant over information required
- Provision of a technical issues paper
- Consultation over the technical issues paper
- Preparation of a draft IRA
- Consultation over the draft IRA
- Notification to the WTO
- Potential peer review
- Drafting final IRA
- Consultation with States and Territories
- Release of final IRA
- Appeal process
- Final notification of policy relating to the application

The entire process may take a short time, or take many months or even take years, depending on the complexity of the task and priority/work commitments. In the current scenario, corn has been assessed previously and a significant amount of information is available. Note however that some of the information would require updating. Therefore, if approved, it is expected that the IRA process for the importation of corn from the USA may take several months.

4.4.4 Compliance Monitoring

AQIS are the Government body responsible for monitoring imports and compliance with the IRA. The nature and extent of their monitoring will be outlined in the final IRA. However the costs associated with that activity will not be known until the IRA has been completed and activities clearly articulated.

Only then can an assessment of the compliance costs required by activity and the monitoring by AQIS be assessed. This review will also highlight the feasibility from an industry perspective of implementing the IRA requirements and ultimately whether it is feasible to import USA corn under conditions as stipulated in the final IRA.

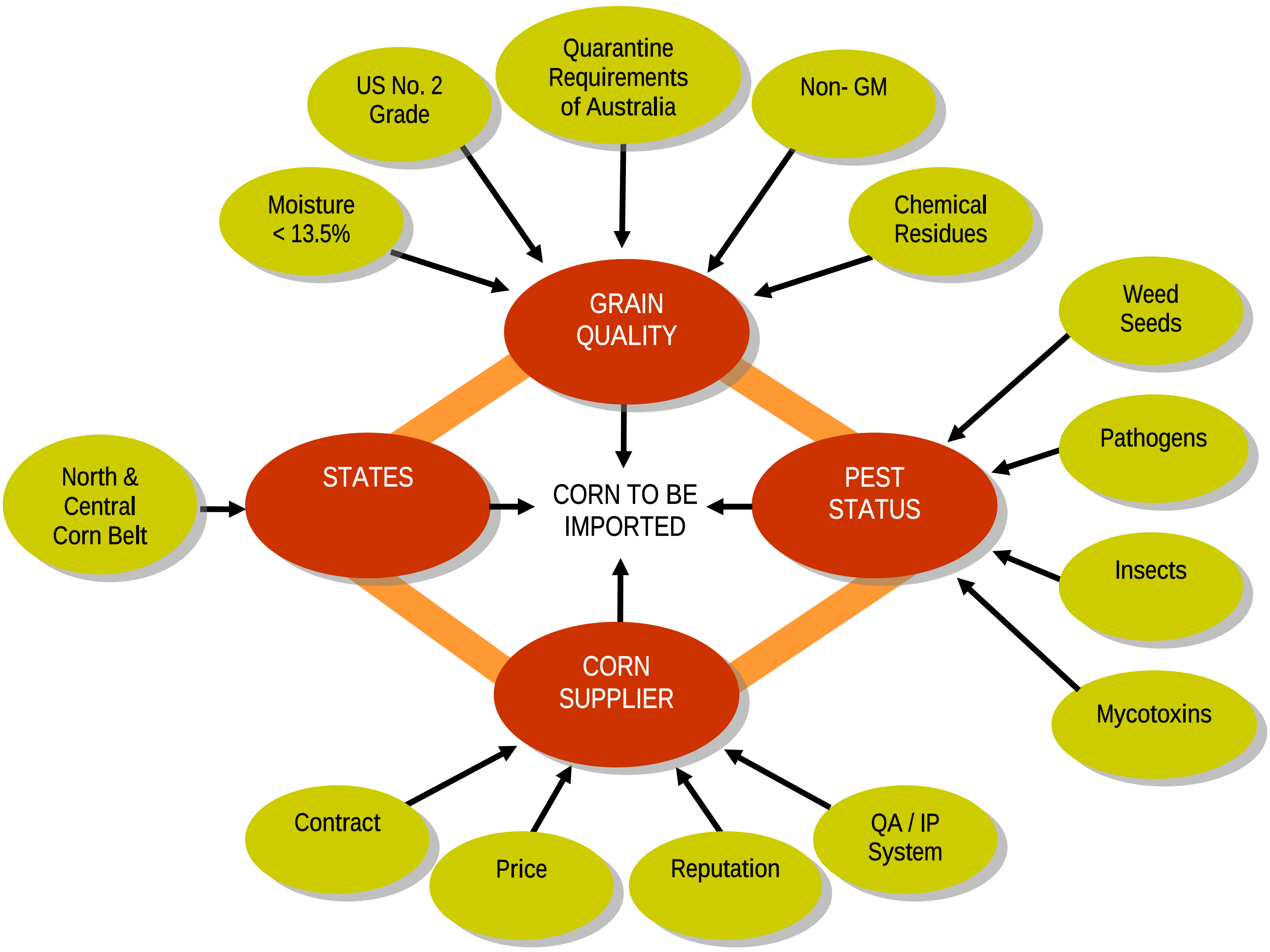
4.5 Grain to be Sourced in the USA

4.5.1 Overview

The following Sections 9 and 10 outlines the proposed supply chain protocol and various issues identified with developing the protocol to minimise the quarantine risk associated with the importation of USA corn into Australia, as discussed throughout this report. The recommended mechanisms to control and reduce those risks are outlined and critical control points are identified.

The following diagram summarises the major quality related aspects of the corn to be sourced from the USA and the mechanisms used to verify specifications are met. These quality attributes are each discussed in further detail on the following pages in this Section.

Grain Source Management



4.5.2 Corn Quality

Cool soils during early season planting favours a high incidence of seedling diseases and a concomitant need for effective and low cost fungicides. Early planting also tends to shift weed populations toward weeds adapted to grow in cooler temperatures such as lambs quarters, mustards and smartweed species. The impact of several insect pests may also increase in earlier plantings.

Planting later in the season may be an effective pest control strategy for many of the pests associated with corn and listed in this document. However this may not be a practical solution for producers who must take advantage of windows of opportunity to till and plant fields of corn.

As outlined earlier in this report, the quality of corn may affect its disease and Pest status. In general, the quality of corn varies by seasonal conditions and corn grown in a particular location is not significantly different from another location, given all things equal. It is not viable to target an area due to particular aspects of corn quality differing across a particular State. The required quality will be sourced post-harvest through seeking quotes from suppliers according to the required contract specifications (as dictated by the stockfeed industry and potentially Biosecurity Australia).

There are other more feasible and economically sound methods to minimise the risks of the presence of Pests in imported corn, as outlined below.

4.5.2.1 Grade

As the major grade available is US No.2, this should be the target grade for importing into Australia, depending on a range of factors at the time, including price and availability. This grade is considered of reasonable quality and price, but able to be economically cleaned to remove much of the Foreign Material and potentially damaged grains, depending on the type of damage.

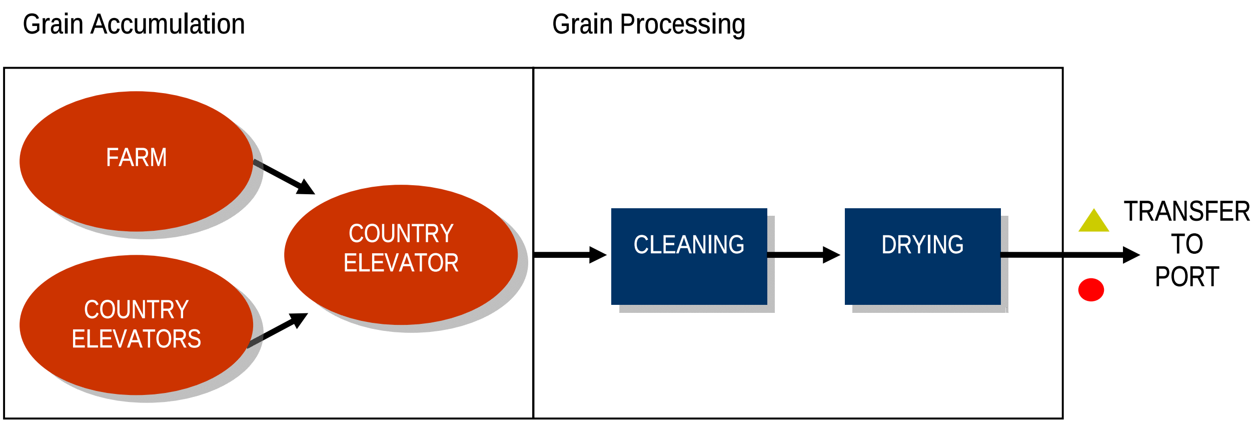
Other grades such a No.3 or No.4 are of a lower quality and price. These grades may be sourced if the Foreign Material and defects present are able to be cleaned at an economic cost and to the level of cleanliness required by Biosecurity Australia. This decision can only be made following commercial discussions on the price of each grade, the cost of cleaning and grade availability in a suitable shipping location.

There is expected to be limited opportunity to select the better quality parcels within a particular grade. This would be managed by the supplier of the corn who is responsible for meeting the contract terms. Thus stock selection is not a risk management tool for use by a buyer to minimise the potential Pest load of the grain unless premiums for quality are negotiated.

When supplying the grain, the buyer will require a certificate from the supplier testifying the grain meets the relevant grade specifications. It is not considered necessary to provide actual results for each quality parameter outlined in the US Grade Standards, only to provide a declaration that the result for each quality parameter is within the US Grade Standard.

Given the quality of the corn obtained from on-farm and country elevators will be altered following the cleaning and drying operation, sampling, testing and subsequent documentation can only be obtained following the cleaning operation. All previous samples and test results that may or may not have been conducted by the owner of the grain for their own internal QA purposes are not directly relevant. This process is depicted below.

Grain Grading Certification



▲ Sampling / Certification to applicable US Grade Standard

☐ Sampling / Certification by seller as preliminary QA processes

● Provision of representative sample to Australian buyer

For reference and to conduct any other tests relevant to the end-use of that grain, a representative sample should be sought of the grain to be loaded for transfer to port. Depending on the outcome of the Biosecurity Australia deliberations, a further sample may be required by that body for quarantine purposes.

As described in Section 10, this certification of the final quality to be loaded may also be provided by an independent inspection agency. The FGIS will provide a Grading Certificate attesting to the quality of the corn exported.

Recommendation 1 USA No.2 corn is the main grade sourced for importing into Australia. The potential use of other grades to be reviewed based on the costs of cleaning to the required level by Quarantine authorities. A representative sample should be obtained prior to supply.

4.5.2.2 Moisture

Where feasible, as low a moisture content grain should also be sourced, although there may be limits on the lowest moisture level available due to access to suitable quality grain. Depending on the supplies available, grain may need to be dried to levels below 13.5%.

Grain should be cleaned prior to reducing the moisture content if required. This will reduce the cost of unnecessarily drying material that is to be removed during the cleaning operation. The cost and feasibility of this operation again, can only be determined at the time of signing the contract or seeking commercial supplies.

As stated previously, low moisture grain is less prone to insect attack, less prone to fungal damage and less prone to moisture migration during transport or storage prior to processing in Australia.

Certification stating the grain moisture content will be required from the buyer (and/or independent inspection agency) as per the certification outlined in 9.2.1 above. In addition, FGIS will provide moisture results on the Grading Certificate.

Recommendation 2 The moisture content of the corn to be as dry as practically and economically possible, with the maximum moisture level of 13.5%. Grain is to be dried if required.

4.5.2.3 GM Content

As outlined previously, initially non-GM corn should be targeted for importation into Australia. This requirement may alter over time.

The pathways and processes outlined in this report will provide confidence the applicable stock will be provided and contamination will be prevented. Note however that there will not be nil risk that some level of GM corn is present in the non-GM corn. Thus an appropriate Adventitious Presence (AP) level should be applied. At present, in most commercial contracts within Australia, this AP level is set at 0.9%.

As with grain quality to be sourced, the supplier of the corn will be required to implement processes to ensure corn supplied meets this AP level. These procedures may include declarations from growers or other elevator operators supplying corn, and sampling and testing as required.

Additionally, FGIS does implement inspection and certification services for some corn varieties to be exported to markets such as Japan (i.e., StarLink). That inspection service covers all aspects required to certify the corn is not contaminated and has been transported according to individual company IP procedures. That service should be considered if there is a requirement for non-GM corn to Australia.

It is not considered necessary for a sample to be supplied with actual GM test results unless this is a commercial requirement.

Recommendation 3 As part of the contractual grade specifications, the corn should be non-GM.

4.5.2.4 Chemical Residues

As with grain quality, specifications for chemical residue content should be outlined in the contract between the supplier and the Australia buyer. There is not a requirement for actual analyses of a range of pre and post-harvest chemicals or for this range of testing to be done.

The supplier of the corn will be required to implement processes to ensure corn supplied meets any regulatory requirements in both the USA and Australia. These procedures may include declarations from growers or other elevator operators supplying corn and sampling and testing of stock received as required. If there are no applicable National MRLs then international Codex Alimentarius Commission limits apply.

Where required by the Australian industry, there may be a need to state a nil residue level for contact insecticides.

It is not considered necessary for a sample to be supplied with actual chemical test results unless this is a commercial requirement. The certification should state the grain meets the maximum residue limits for corn in both the USA and Australia. Again, FGIS offers a pesticide residue analysis service and is able to provide certification if requested.

Recommendation 4 As part of the contractual grade specifications, the corn should be certified as meeting relevant National and International chemical residue limits.

4.5.2.5 Mycotoxins

As with other grain quality parameters, specifications for mycotoxin content should be outlined in the contract between the supplier and the Australia buyer. There is not a requirement for actual analyses of a range of mycotoxins or for this range of testing to be done.

The supplier of the corn will be required to implement processes to ensure corn supplied meets any regulatory requirements in both the USA and Australia. These procedures may include sampling and testing of stock received as required. Note that there are no international Codex Alimentarius Commission limits for mycotoxins on grain, thus National maximum permissible concentrations (MPCs) apply. Where there are no National MPCs, specific limits to apply should be stated in the contract.

It is not deemed necessary for a sample to be supplied with actual mycotoxin results unless this is a commercial requirement or a specific need such as for aflatoxin. The certification should state the grain meets the MPCs for corn in both the USA and Australia. Although not mandatory, FGIS does offer a sampling and testing service for a range of common mycotoxins found on corn. As an added precaution, it is recommended a sampling and certification service for these mycotoxins be conducted on the export corn using either FGIS or an independent inspection agency.

Recommendation 5 As part of the contractual grade specifications, the corn should be certified as meeting relevant National and International mycotoxin limits.

4.5.3 Testing ex Farm

This report highlights there are States in the USA that may contain lower numbers of Quarantine Pests and non-Quarantine Pests than other States. As the areas of the corn-belt are vast, there are many variations within each State boundary. For example, particular Counties may contain lesser numbers or be free of particular Pests and grain may be able to be sourced from these areas. This report was not able to research this data, although some information is available on the world-wide-web. Further discussion would be required to determine the feasibility of this option, although initial USDA and industry reaction indicates this is not an economically viable option.

Elevator operators only conduct limited testing of farm stock prior to receival and thus in general they would not be able to test, source and segregate stock on the basis of all the Quarantine Pests of concern with importing corn into Australia. Testing of grain that is stored on-farm may be an option to source grain from areas that are low in particular Pests for small shipments. However the costs and practicalities of that process for any significant tonnage would be prohibitive and would not make the sourcing of USA corn viable. Costs are not able to be estimated for that service.

As highlighted above, the contract should list the quality and quarantine specifications required and it is the responsibility of the grain supplier to initiate procedures to meet those specifications. This may or may not involve them arranging for testing of grain held on-farm prior to delivery to the country elevator.

Recommendation 6 No testing occur of corn stored on-farm in particular States or Counties within a State.

4.5.4 Testing in Country Storage

Prior to receival into an elevator, representative farm samples may be taken by the buyer of the grain and analysed for the various quality parameters outlined in the Official US Corn Grade Standards. However in general grain is received into the elevator then tested to ensure compliance and outturned within a short timeframe. Grain is not stored for long periods in these country elevators.

Other tests not listed in Official US Corn Standards are done at various stages and to varying degrees along the supply chain, depending on the quality parameter e.g., various mycotoxins. However not all testing is done prior to or at the point of delivery into a country elevator or during the relatively short storage period.

Thus additional testing to include those parameters of importance to Australia may be required in the contract with the seller. The applicable parameters are outlined in this section of the report and summarised in Section 9.10.

Recommendation 7 The contract with the corn supplier should specify all quality requirements that are in addition to the US Corn Grade Standards.

This testing is expected to be done and certificates supplied on corn held in country storages, or in other locations as required. Following this testing, an Identity Preservation system must be implemented as a guarantee by the supplier that corn being moved through the transport network to an export position is as described and does not become contaminated or infested. Further details of this are outlined in the following section of this report.

4.5.5 Grain Sources & Pest Status

The following table highlights the relative presence of Quarantine Pests of concern in corn in the major corn-growing States of the USA corn-belt.

Parameter	IA	IL	NE	MN	IN	SD	OH	MO	KS	WI	MI	TX	KY
No. of weed seeds not known to be present	23	13	23	27	23	26	24	14	21	24	25	23	17
No. of Quarantine pathogens not present in corn	9	9	8	14	13	15	12	12	8	13	12	13	14
Total	**32**	**22**	**31**	**41**	**36**	**41**	**36**	**26**	**29**	**37**	**37**	**36**	**31**
General Ranking based on freedom of Pest	4	8	5	1	3	1	3	7	6	2	2	3	5

The above is a generalised table and reference should be made to the discussion on Quarantine Pests for further information on the relative importance of each Pest and other issues that are of concern.

Using the scoring system, a State with a high total of Pests not present (low ranking number) is potentially more suitable for sourcing corn than those with a high presence of Pests (high ranking number).

As a generalisation, corn from Minnesota (MN) and South Dakota (SD) have the lowest Pest presence, whereas corn from Illinois (IL) has the highest Pest presence. The colder more northern States tend to have a lesser presence of all Pests, especially those in the Northern and Central corn-belt. The mid-Atlantic and South-West areas have a higher Pest presence.

The trend also applies for both Pathogen and Weed Seed presence.

The exception is Texas in the West & South-West area that has a relatively low Pest load. However, these southern States do have some Pests that are more significant than the northern areas.

No analysis was conducted of North Dakota in the Northern and Central corn-belt due to the relatively low tonnage of corn grown, although this is expected to follow the pattern of the other States in that region.

As stated previously, there are many generalisations in the data, as it excludes the level and importance of each Quarantine Pest. These rankings may change as more information of the presence of each Pest alters over time.

Most of the non-GM corn is grown in Ohio and Illinois, with lesser amounts in Indiana, Iowa and Nebraska. That said, given the size of the corn crop, most States do have significant tonnages of non-GM corn that may be available for export to Australia. Based on the above Pest ranking system, large tonnages of non-GM corn would be available from the 3rd to 5th ranked States. This is not considered a major issue and tonnage should be available in most States if non-GM corn is required.

No selection of corn is considered feasible for States where there are low levels of field insects as this is too ad hoc and impractical. Instead, supply of corn for import into Australia should rely on tolerance levels in the Official US Corn Standards. This is expected to keep the presence low and insect levels will be further reduced following cleaning and potentially killing all insects by treatment in the USA before corn is exported.

Similarly, no selection of corn in one State over another is considered warranted for the absence of Stored Product Insects.

While no analysis has been conducted on the pest status of corn grown in California, the potential exists to supply a small tonnage from this area using various supply chain protocols and processes outlined in this report. While container versus bulk is different in terms of price and processes in some regards, many of the expected conditions imposed by Biosecurity Australia could be tested and processes revised based on the outcome. This would assist industry preparing for bulk shipments. As with many of the procedures outlined in this report, this scenario would require a firm commitment to import in order to determine the economics of conducting this exercise.

Minnesota has been selected as the base for supply chain assessment for sourcing of US No. 2 corn. The corn produced in this State has been identified as having a low pest and disease incidence. Annual production of corn in Minnesota is high at an average of 26 million tonnes of grain. Sourcing of No.2 grade corn could therefore be considered to be straight forward. There is an extensive network of country elevators connected to the road and rail systems within this State. In addition, ready access is provided to the barge loading areas on the Mississippi river. This will permit cost effective transport to the export grain ports near New Orleans in the Gulf.

In addition to the above, Minnesota is home to the major grain trading and service facilities associated with the twin cities of Minneapolis and Saint Paul.

There is some restriction in using the northern States as a supply point for corn or other commodities. The waterways freeze over in winter and movements are often not possible between November and March. Rail alone can be used in these periods if continuous supply is required.

Recommendation 8 Corn is sourced primarily from the Northern and Central corn-belt due to the relatively low Pest load in corn. Initially corn is be sourced from Minnesota.

4.5.6 Corn Supplier

As stated above, there are several requirements to be imposed on the supplier of the corn that will ensure the corn quality meets both the buyer contract requirements and any quarantine conditions imposed by Biosecurity Australia.

The protocols and buyers listed in this document will achieve a significant risk reduction in terms of Pest status of the corn. Additional measures as follows may also be implemented as a further means to reduce the risk of unwarranted contamination of the product:

- Contract terms specify all quality and quarantine requirements, detailing responsibilities for all parties should anything untoward be detected in the corn or occur at any stage during the supply of the corn. This could include mandatory communication when any object of quarantine concern be detected prior to or during any stage of the supply.

- Price of the corn will relate to the physical quality and potential for quality related issues with the corn. Economics at the time of sourcing the corn will dictate the available supply, however paying some form of premium other than outlined for the requirements listed may assist in sourcing a quality product.

- The reputation of the seller will also impact on the protocol to be used throughout the supply chain. By using one of the reputable suppliers as listed in this document with expertise and a history in exporting corn, the risks of sourcing product that does not comply with requirements may be reduced. This reputation includes procedures used by that supplier, such as proven and accredited QA and IP systems.

4.5.7 Role of GIPSA Inspection, Testing & Certification

General

The USDA Grain Inspection, Packers and Stockyards Administration (GIPSA) Federal Grain Inspection Service (FGIS) provides inspection services on grains, pulses, oilseeds, and processed and graded commodities. These services facilitate the marketing of USA grain and other commodities from farmers to domestic and international end users.

Inspection

Inspection services are divided into two basic types: "inspection for grade" or "factor analysis" without grade. Inspection for grade involves analysing the sample according to the quality factors listed in the Official U.S. Standards for Grain and certifying the applicable numeric grade designation, the quality factors responsible for the grade assignment and any other quality factors the customer requests. The extent of this other testing required will depend on the contract requirements with the supplier.

Under the United States Grain Standards Act, the following are mandatory FGIS services:

- Official weighing of most grain exported from the USA and of inter-company barge grain received at export port locations
- Official inspection of most grain exported from the USA

- Testing of all corn exported from the USA for aflatoxin prior to shipment, unless the contract stipulates testing is not required

However of relevance to Australia is that mandatory inspection and weighing requirements are waived for grain exporters shipping less than 15,000 metric tons of grain abroad annually and for high-quality specialty grain shipped in containers. These situations may apply for corn imports depending on the tonnage to be imported. As a factor to help to reduce risk and assist in compliance with Australian Quarantine import requirements, as stated previously, the use of FGIS is recommended for any tonnage imported into Australia from the USA.

Stowage

GIPSA provides stowage examinations that ensure that vessels and containers that hold corn are clean, dry and fit for loading. A stowage examination is a service performed by official personnel or licensed co-operators who visually inspect a vessel or container and determine if the stowage areas are clean, dry, free of infestation, rodents, toxic substances and foreign odour, and suitable to store or carry bulk grain.

There have been indications in the past that USA stowage inspections are not as rigorous as those from Australia. This may be the case however independent inspections of a standard similar to Australia could be arranged at a minimal cost.

Certification

Official inspection by GIPSA results in the issuance of official certificates. Certificates report the grade of the grain inspected based on the various quality parameters. Certificates can be issued for corn as this commodity has standards that exist under the U.S. Grain Standards Act. The certificate will document the official procedures followed, the date and location of the inspection or weighing process and provide specific service results factor-by-factor or by the type of service requested. Thus any additional tests required, or additional sampling points along the supply chain other than at export, can be provided by GIPSA.

The cost of this service varies with the sampling locations, testing and certification requested.

Recommendation 9 Use the FGIS for vessel stowage inspection, commodity sampling and testing and certification services.

4.5.8 Pre-Export Inspection by AQIS

On previous occasions for other commodities, AQIS have conducted on-site visits to the USA and other countries to review procedures, facilities and hold discussions with their Government counterparts on issues related to the importation of those commodities. On some occasions, these discussions only related to development of protocols, while on others commodities were inspected.

The option exists for AQIS to pre-clear stocks if suitable stocks can be found, timeframes are suitable and grain can be held and transported under appropriate IP systems to make this system valid. As an initial trial to show compliance with protocols developed by Biosecurity Australia, this option should be considered based on the above stipulations and the cost of this service (which may be prohibitive versus the benefits obtained).

For large tonnages, this system may not be practical, whereas for small tonnage it may be possible to conduct. For small tonnages the cost may be relatively large.

A further consideration should be given for an unofficial visit by AQIS to the facilities to be used for storing transporting and processing (cleaning and/or drying). This inspection would hold no official status however would be beneficial in confirming appropriate practices are in place in the USA to meet Australia's strict import requirements. The outcome of the review of risks and impositions placed on imports by Biosecurity Australia would determine the scope of the visit and premises to be inspected.

While pre-export clearance or at a minimum inspection of facilities and corn to be exported may be conducted, it is expected that AQIS would also require re-inspection of the corn following arrival in Australia. Thus while some confidence can be gained that the inspection in the USA has "cleared" the stock of Quarantinable Pests, the risk of detection of a Quarantine Pest on arrival in Australia may still exist.

Recommendation 10 AQIS pre-export clearance of corn in the USA occurs or at a minimum, AQIS conduct a tour of facilities to be used for corn exports.

4.5.9 Independent Inspection

There are several internationally renowned independent inspection companies that are used on a commercial basis to verify the quality and quantity of grains exported. Additionally, these companies may also be used to verify a process such as IP or other quality systems.

Increasingly companies such as SGS and Bureau Veritas are required to be used as part of a contractual arrangement between the buyer and seller or as a Government requirement in some countries.

While the cost of these services varies extent of the service supplied, it is often considered commercially sound to use these companies as an independent arbitrator where commercial interests may be seen as driving either the buyer or seller in a certain direction.

The range of services offered varies and includes:

- Analytical testing for a range of quality parameters
- Sampling at all stages along the supply chain
- Verification of processes
- Empty vessel inspection
- Grain Fumigation

- IP systems

The latter service, Identity Preservation, will be discussed in greater detail in Section 10 of this report.

Recommendation 11 An Independent Inspection company to be used to certify the quality of corn exported.

4.5.10 Certification Required

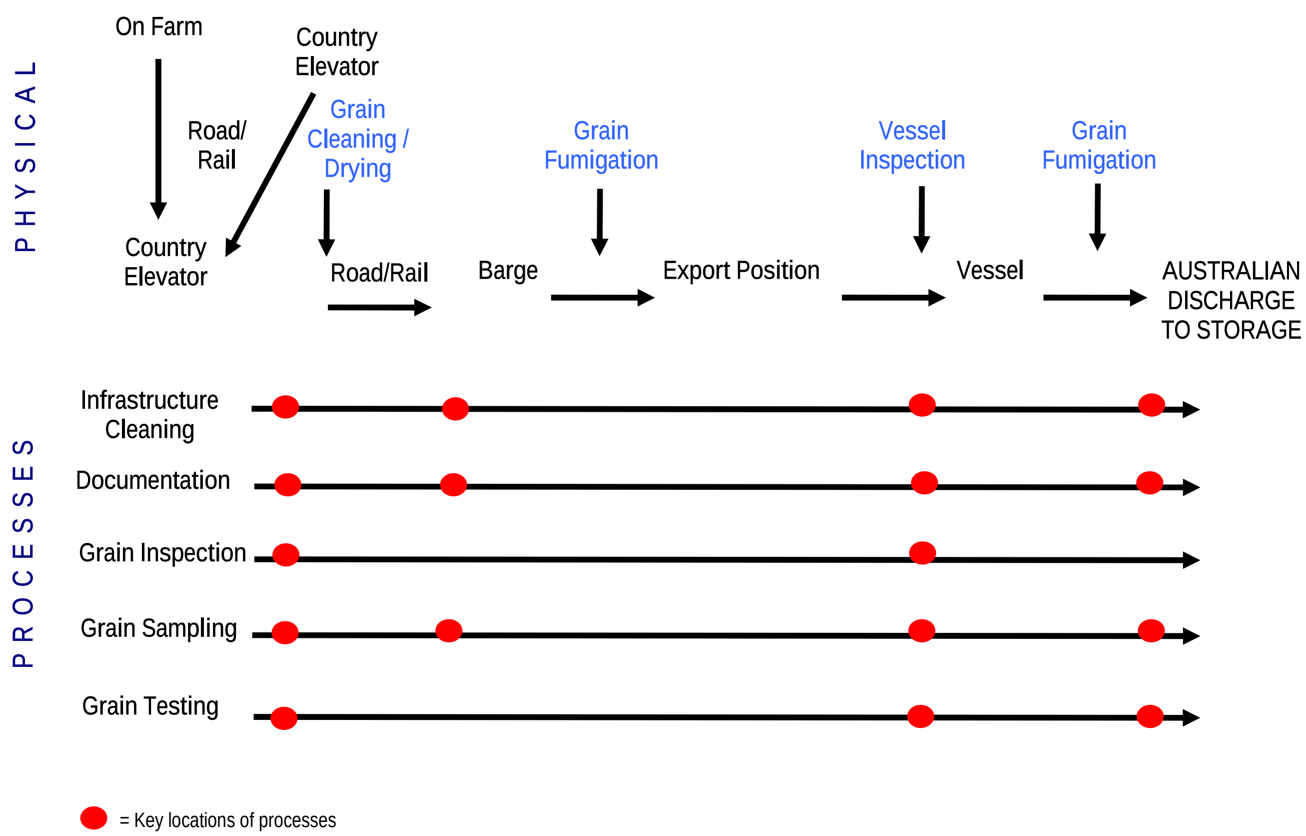
The following is a summary of the quality parameters to be certified on the Certificate of Analysis provided by the buyer, FGIS and/or independent inspection company as required. At present these are thought to include the parameters listed, however these may alter on the basis of the determination by Biosecurity Australia and commercial aspects of corn quality required by the industry importing corn into Australia:

- Corn meets applicable US Grade Standard (each parameter listed as per Appendix 13.4)
- Moisture less than 13.5%
- Is non-GM corn
- Chemical residues within USA and Australian or international MRLs
- Mycotoxins within USA and Australian levels and at levels considered safe by industry
- Freedom from Quarantine Insects
- Freedom from Quarantine Weed seeds
- Freedom from Quarantine Pathogens

Recommendation 12 Certification be sought outlining the full range of quality parameters for the corn specified in the contract.

4.6 Storage and Transport

Transport Mechanism



The above diagrammatically depicts a summarised flow path of grain from the farm to discharge in Australia. Each element is described in further detail either within this section of the report or in the previous Section. While the main pathways are described in detail, alternative supply chain infrastructure such as containers is also described for future reference if required and other variations may exist if rail is used more extensively.

The physical processes that occur to impact on or alter the quality of the grain are simply described as “Physical”. These are generally one off processes occurring at a specific point in the supply chain.

The various QA/IP processes used to ensure the corn sourced and supplied is of the appropriate quality are depicted as “Processes”. As can be seen, the majority of these processes occur at most locations in the supply chain, with the majority being of critical importance.

4.6.1 Overview

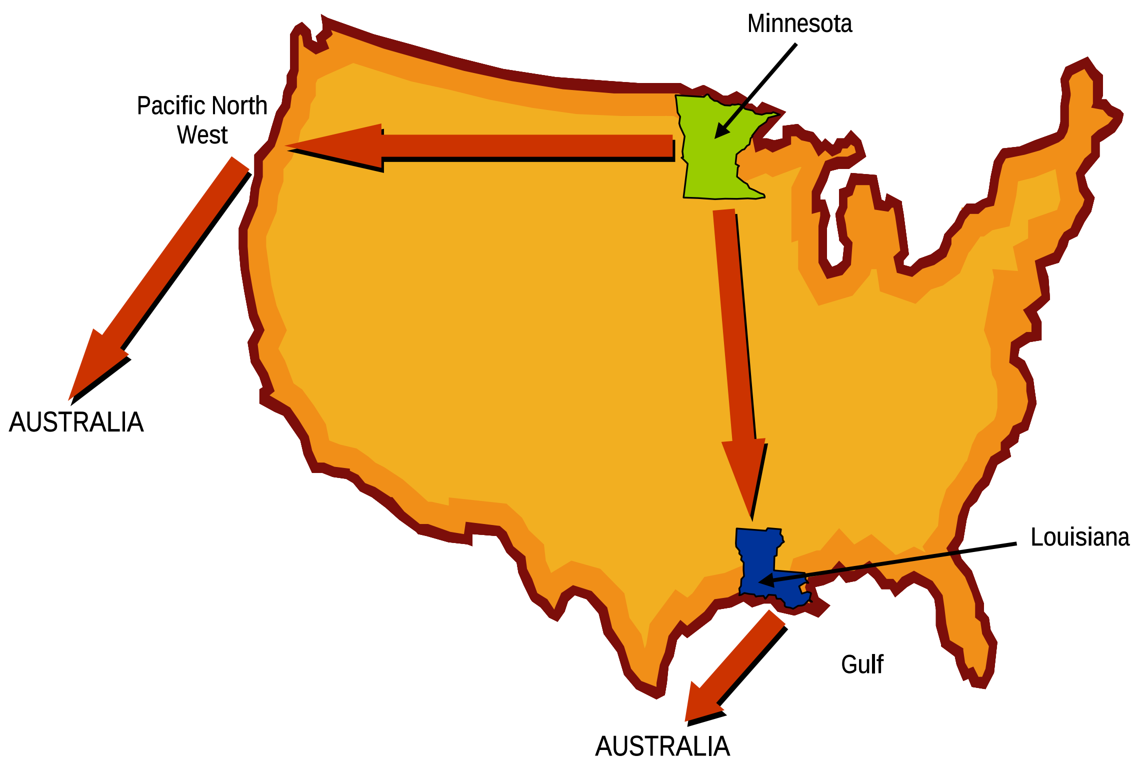
4.6.1.1 Pathway

Three alternative options are provided for moving corn to Australia from the USA:

- Use of ADM facilities to store and clean grain, load to barge and then transfer for export shipment from the Gulf
- Use of CHS facilities for the same movement pathway from the Gulf
- Use of ADM facilities to load to rail, and then move to an ADM linked export terminal in the Pacific North West for loading onto an export shipment to Australia

The two options of barge movement are treated as one in terms of the discussion.

Supply Chain Pathway Summary



The primary supply chain pathways from the corn States of most interest involve road transport to barge loading points on the river systems. These barge loading points usually take the form of a grain sub-terminal on the river system. The barges are then progressively aggregated and moved down the river systems in block formations.

Keeping the barges tighter in one group is an advantage in terms of maintaining traceability of product. For most non-discerning buyers, this pattern can be difficult to achieve as often there is a process of adding and subtracting barges along the journey. Barges serve as mobile storage, and are assembled into particular configurations to suit export terminal loading requirements. In addition, there may be frequent ownership changes to the grain on a barge as different traders take positions on the grain and as various terminal owners position operational stock for rapid shipment.

Barges will then be unloaded direct to ship or to an export facility prior to loading a vessel.

Most export terminals are high throughput, high turnover facilities where stock is rapidly discharged from barge or rail and then positioned for export shipment. The storage capacity of the terminal can be turned over 100 or more times per year.

On arrival in Australia, grain will be discharged and stored in terminals used primarily for that purpose at that period of time.

4.6.1.2 Processes

The use of independent country elevators to accumulate, clean, dry and store No. 2 Grade corn is also outlined in the following section.

Fumigation can be undertaken on route during the barge movement from the Barge Terminal to Export Terminal. Fumigation of the corn is recommended to be done using the other standard US practice – that is, fumigate in the ships hold while on its journey to Australia.

Rail box cars are typically difficult to clean. Only hopper bottom rail cars are designed to be fully self cleaning. Barges typically have some grain residues left at the end of the emptying process but are able to be cleaned adequately to an acceptable standard. Storages are generally not cleaned unless there is a break in the program or a specific requirement from a customer. The level and extent of cleaning will be determined based on the needs of the customer and the shipping program. Industry has advised that Australian requirements can be met and both rail wagons and barges can be adequately cleaned to meet strict quarantine requirements.

During transport from the country elevator to the export position, various samples may be taken by FGIS or other independent parties depending on the location and purpose of sampling:

- Country Elevator
- Barge
- Road truck
- Railcar
- Vessel loading

4.6.2 Grain Storages

The following country storages in Minnesota are recommended to be used to accumulate and supply No. 2 Grade corn:

- ADM Corn Processing – Holland
- ADM Corn Processing - Marshall, (South House)
- CHS Inc. - Herman, dba New Horizons Ag Services
- CHS Inc. – Jasper, dba Eastern Farmers Coop
- CHS Inc. - Madison, dba State Line Farmers Coop
- Farmers Cooperative Elevator Co. – Montevideo, (Monte-West)
- Farmers Cooperative Elevator, Hanley Falls
- Glacial Plains Cooperative – Murdock
- Meadowland Farms Coop – Lamberton
- Minn-Kota Ag Products Inc, Breckenridge
- New Vision Coop – Hills
- Prairie Grain Partners LLC, Clarkefield
- Red River Grain Co., Inc, Breckenridge
- West Central Ag Services - Ulen
- Western Consolidate Cooperative, Holloway

Selection criteria for these country elevators include the following:

- Greater than 15,000 MT (600,000 bushel) storage capacity
- Rail track capacity of greater than 30 wagons. Road is the predominate feeder to the barge terminals at St Paul in Minnesota
- Modern high efficient sites
- If using rail movement to PNW, capacity of 110 wagons to accommodate shuttle trains

The above storages are all capable of sourcing grain, storing grain and maintaining it in good condition for whatever period is required either within their storages or sourcing grain on-farm. Grain is currently supplied from these storages to a range of markets, primarily export orientated. The quality requirements of their customers dictate that IP is conducted where necessary and systems are in place to ensure grain is appropriately segregated.

4.6.3 Pre-shipment Cleaning & Drying

4.6.3.1 Cleaning

It is recommended that cleaning of corn occurs in the country elevators as grain is accumulated ex farm. The typical cost for normal standard cleaning is $1/tonne however this level of cleaning is not adequate for standards required for export to Australia. To achieve a greater degree of freedom from Foreign Material of a Standard that may be suitable for quarantine purposes in Australia, a cost of up to $5 per tonne may be incurred. That cleaning is typically to a standard that removes all noticeable weed seeds, small corn and grain insects.

The effect of cleaning, being the removal of fine material by screening, on many of the more common storage problems is reasonably well known. For example, if imported USA corn must be stored for several weeks in a warehouse, especially under tropical conditions and during the months when heating is most likely, then screening may help minimise the development of hot spots.

In general, cleaning before storage will help reduce the fine material concentration in spout lines (areas in a storage with high concentrations of fines that accumulate due to the method of in-loading) and facilitate the cooling action of aeration where used. If fumigation occurs, pre-storage cleaning would be helpful to minimise the compacted areas where the fumigant gas might not otherwise penetrate.

Cleaning will also remove much of the broken grains, Foreign Material and damaged corn material. As corn is significantly larger than many of the weed seeds potentially present in corn, it should be relatively easy to clean to a very high standard. This will not only potentially remove Quarantine Pests, but reduce the potential for insects to contaminate the corn.

As seeds are of varying sizes, cleaning may not remove all weed seeds, thus some weeds of concern may remain. Further analysis of the corn to be supplied will determine the type of cleaning required, the costs of that activity and the quality of the final product. Aspiration and sieving are often able to be conducted together in the one operation to remove the majority of contaminants. Further treatment upon discharge may also be required to devitalise those seeds remaining in the grain.

A range of country elevators offer the capacity to clean and dry grain.

Recommendation 13 Corn is cleaned prior to export.

4.6.3.2 Drying

As stated, it is best to clean and dry the corn as early as possible in the supply chain. Dedicated movement pathways for IP grain can be very expensive. Only clean low moisture grain should be moved to the export position. In addition cleaning and then drying early in the supply chain will reduce the potential for the presence of insect pests and remove most if present as larvae, pupae and adults. A further major advantage of doing this task in the smaller county elevators is that export terminals are generally very busy. Accumulating and holding corn in these export facilities for subsequent cleaning and drying can be difficult and costly.

Again the cost of drying grain will depend on the initial quality and moisture content of the grain. Indicative costs to dry to 15% are $1.20/tonne per 1% moisture to bring the moisture content to 15%. As corn for Australia would be dried to 13.5% or lower, the cost could average approximately $8/tonne for the average corn harvested. The costs are difficult to determine given that many growers have driers on farm and may initially dry the corn prior to storage.

Temperature of the corn following drying will be reduced to acceptable levels of less than 30^{0}C in order to prevent moisture migration during transport.

Recommendation 14 Corn is dried if required prior to export.

4.6.4 Pre-Shipment Fumigation

Depending on the time of the year that corn is sourced from the USA, there may be a requirement to protect the grain against insect attack. The likelihood is that corn will be sourced from the USA several weeks if not months following harvest. Therefore some form of post-harvest insect control may be required.

Depending on the period since harvest, the corn may have already received some form of insect control treatment. The need for an additional treatment will be influenced by the period since the previous treatment, the condition of the storage, the temperature of the grain and identity preservation techniques able to be provided.

However, to minimise the risks of entry into Australia of Quarantine Pests and other non-Quarantine Insects, fumigation of the corn prior to export is recommended. This should occur at a point in the supply chain as close as possible to the export position and only following cleaning of the grain. Note that if the corn is stored for several months, it may be very cold and thus not suitable for fumigation. The benefit of this scenario is that the grain may also be too cold for insects to breed and/or live.

A further issue to be considered at the time of sourcing the grain is the ability to fumigate the grain immediately after drying and before the grain is cooled. This may be an option to consider.

4.6.4.1 Barge

It must be recognised that many country elevators and all export terminals are throughput facilities and fumigation would generally not occur in these locations. At stated previously, on-farm storage represents the primary location for storing grain. This means that fumigation can only be feasibly undertaken when the grain is in transit on barge or ocean vessel.

The type of fumigant will depend on the timeframe available to fumigate the grain, the storage type, grain condition, grain temperature and other factors such as cost. Phosphine is the most readily available fumigant and is expected to be the product of choice given its usage pattern in the USA.

Care needs to be taken if fumigation occurs during the barge phase to ensure the cargo is free of gas when it arrives at New Orleans. Average transit times from St Paul to New Orleans are around 15 days. The charge for this service varies, but is expected to upwards of $1/tonne.

4.6.4.2 Rail

If grain is transferred to PNW via rail, it will not be fumigated prior to export as there will not be sufficient time for this to occur. Fumigation will not occur during rail transit and as the export terminals are throughput facilities, the only opportunity for fumigation is during the ocean voyage.

Recommendation 15 Grain is fumigated prior to export at the most suitable location prior to vessel loading.

4.6.5 Transfer to Port

There are two mechanisms described to transfer the corn to export terminal for shipment.

4.6.5.1 Barge

The natural draw zone for the barge terminals is commonly 150 kilometres. The normal transport mode to these barge terminals is road transport, given the relatively short transport distance.

Companies such as ADM indicate that suitable protocols are in place to identity preserve corn from the grower and through elevators, through the barge system to the export terminals in Louisiana.

The barges will be held near the barge loading terminal until a full consists (full export shipment quantity) has been assembled. The barges generally move as two consists in the higher river areas and then be assembled into one consist in the lower river.

The CHS Savage Barge Terminals is located near St Paul on the Minnesota River in close proximity to facilities operated by Cargill and Bunge. The conveyor can move 1,100 MT per hour, and load as many as 15 to 16 barges per day (22,500 MT). Grain intake is predominately via road transport. When the navigation channels are operating at peak capacity 500 to 700 trucks will be discharged daily, with each truck taking about five minutes to park, manoeuvre and unload. Grain is distributed and stored temporarily in 15 bins with a total capacity of 15,000 MT. The Barge Terminal is therefore a high throughput facility.

CHS rents barges from various barge suppliers. Barges are loaded to between 1550 and 1650 MT and then towed downriver and assembled in 15 barge tows, growing to as many as 35 once they are through the lock and dam system.

Between Minneapolis and Saint Louis, the Mississippi River drops approximately 350 feet in elevation. A series of 27 locks and dams make it possible for vessels to "stair step" their way up and down the river between these two cities.

ADM River Terminals are based at Ottawa and Havana in the State of Illinois. As ADM do not have River Terminal facilities in Minnesota the most likely grain acquisition regions for ADM are Illinois (for barge transport) and Kansas (for direct shuttle train to either PNW or Gulf Ports). ADM have a higher operational presence in Kansas and Illinois.

Cargill or Bunge provide alternate river barge transport options if Minnesota is identified as the preferred source for corn as both companies have strong operational presence in the State and operate River Barge Terminals on the Minnesota River near St Paul.

Barge and railcar stowage areas must comply with the USDA FGIS standards of fitness prior to loading to assure cleanliness and suitability to load corn. There are costs for this service and additional costs if an “extra degree of cleanliness is required”. Generally, these companies state they are able to IP grain clean barges to a high degree and thoroughly remove all traces of the previous cargo from both the inside and outside of the barge.

Sampling and weighing of corn is undertaken at each intake and outloading point.

Under the IP system, the corn is loaded and the barge lids are secured with seals or other security controls to preserve its identity to the export location. Full documentation is supplied with the barges following loading and unloading.

Recommendation 16 Grain is fumigated prior to export during barge transportation.

4.6.5.2 Rail

Elevators located in the western regions of Minnesota are better suited to railing directly to the PNW export terminals. This includes elevators that are greater than 150 kilometres from St Paul in Minnesota.

For those areas in western Minnesota that are better suited to rail it is recommended that only Shuttle Trains of 100 wagon (10,000MT) capacity be used to move corn to PNW ports.

The box wagons are not considered self cleaning and can be difficult to fully clean. In these instances, the rail wagons would need to be cleaned to an appropriate standard for the IP system. This is not normal practice and a charge is applied for this service. Alternatively hopper bottom wagons may be sourced that are considered fully self cleaning, however as there are limited numbers, a premium may apply.

Recommendation 17 For corn moved to port by rail, grain remains untreated and is fumigated on board the vessel during transit.

4.6.6 Port Operations, Loading & Sampling

At export terminals, the FGIS or Delegated State Agencies are responsible for many of the activities conducted to a similar Standard as that by AQIS:

- Monitoring the cleanliness of the export facility to prevent inadvertent commingling of corn
- Inspecting bins, if applicable, to verify they are empty and ready to receive grain
- Monitoring the facility grain handling system to prevent commingling of corn when grain is transferred from the carrier to bins or directly to vessel

- Assuring the grain handling equipment, weighing equipment, and automatic sampling equipment are clean and ready to handle IP corn as designated by the Standard Operating Procedures of the facility
- Assuring grain spills and other loose grains are not returned to the secured grain handling system

The above processes apply no matter what the export path, either through an export terminal or direct from barge to vessel.

4.6.6.1 Gulf Ports

As stated, these ports could receive the grain via barge.

It is recommended to use a mid steam ship loading system, as a preference, to transfer the grain from the barges to the export ship. Weighing and sampling is automatic in these systems. There is no grain storage so grain identity is automatically preserved.

Associated Terminals operate the “Myrtle Grove Midstream Terminal” (MGMT) to transfer commodities such as corn from river barges to ocean-going ships for export. The MGMT utilizes a Heyl Patterson barge unloader similar to land based elevators but specifically designed for the demands of a midstream operation. The facility is rated at 2,000 tonnes per hour. A computer system coordinates customer load requirements with process controls and information while two FGIS certified scales provide accurate weights. Two FGIS certified samplers are located in a separate sample room where FGIS inspectors monitor loading.

Associated Grain Terminals L.L.C. is located the MGMT at Myrtle Grove, Louisiana, where the company operates three midstream berths on the lower Mississippi River. All barge fleeting, shifting and cleaning services at the location are provided by Turn Services.

ADM has three facilities in South Louisiana, with the one in Ama handling the largest volume. Primarily a barge unloading and Panamax ship loading facility, Ama handles a small amount of rail cargo, but by far the vast amount of volume comes in by barge. The ADM facility at Ama also provides 136,000 MT of storage. The facility can load vessels at a rate of 1,600 tonnes per hour.

ADM/Growmark also operates a 109,000 MT grain terminal at Reserve. Three vessel-loading spouts operate at a rate of 2,300 MT per hour and a marine leg discharges barges at 1,400 MT per hour.

Located downstream from the ADM facilities at Bellevue is the grain elevator and wharf operated by Cenex Harvest State Cooperative (CHS) with a combined loading rate of 1,400 MT per hour. Grain is discharged from rail or barge into their 163,000 MT storage silos where the commodity is accumulated and prepared for export outturn. Non-commingling requirements can be accommodated though the CHS Terminals but are provided at a 50% storage premium.

Recommendation 18 Grain is transferred direct from barge to export vessel when possible.

4.6.6.2 PNW Ports

In the case of grain transported by rail to PNW, transfer through export terminal storage will be required.

Storage capacity at these PNW terminals is fairly tight. Cargill has around 204,000 MT of storage capacity, Columbia Grain about 109,000 MT and United Grain around 136,000 MT. This supports the view that there is limited capacity to conduct any processes at port such as cleaning, drying or fumigating. Thus these must be conducted prior to receival of grain.

IP processes exist through ports to clean down to prevent contamination. Documentation and segregation process also exist. The costs of these services vary depending on the level of control and the availability of the port terminal to conduct those processes when required by the buyer of the grain.

Recommendation 19 Grain is transferred from rail to a terminal and then loaded onto an export vessel in an IP manner.

4.6.7 Vessels

4.6.7.1 General

Panamax and Handymax vessels would form the basis of the bulk corn shipping requirement into Australia. The freight rates for Handymax vessels are higher, but they would often be more suitable for grain discharge in Australia. This is because most port areas in Australia are not set up for bulk discharge of grain. The larger Panamax vessels would be more difficult to handle.

Panamax vessels are the most common type of bulk grain vessel loaded in the Gulf ports, but there is still a reasonable availability of Handymax vessels.

A good standard of vessel is required to meet Australian shipping and port requirements. Vessel hygiene and cleaning requirements are not as stringent in most USA ports compared with Australian bulk export requirements. Some extra protocols are required, incurring additional costs.

Given the high level of complexities involved in the supply chain pathway from USA corn regions to the Australian customer it would appear prudent to trial and validate the feasibility of these logistics. This could be achieved by limiting the initial bulk shipment to a single cargo hatch of around 5,000 to 10,000 tonnes of product. As well as providing greater confidence of the capability of shipping in this manner it also reduces the financial exposure for the importer. Part cargo or parcel shipments, with multiple cargo owners sharing freight on a bulk vessel, is very common and there are a number of traders, shipping agents and freight forwarders willing to assist with the process.

Recommendation 20 A single hatch corn shipment should be utilised to test the bulk import systems and protocols if applicable.

4.6.7.2 Containers

Container shipment of grain to Australia would be a great deal easier to organise as the Australian ports are geared to handle large quantities of container imports and exports. It is worth noting that around 2 MT of bulk grain is exported each year from Australia in containers. The dominant ports in this trade are Melbourne and Sydney. Such grain exports also take grain away for domestic stockfeed availability.

The export rate for containers is often quite economical because of the trade imbalance as more import boxes come into Australia than are required for export. This frequently results in the export of empty boxes. A similar portion would be present in a number of USA ports. It may be possible to obtain some reasonable container rates for corn from the USA to Australia. This has not been analysed in this report.

ADM indicate that they can provide containers that meet customer contract specifications. Trade in container traffic through St Paul is high providing ample capacity to source suitable standard containers for the task.

Corn would need to be cleaned prior to loading into containers with grain inspection also occurring at this point. Containers would be moved to port by rail. However the costs of each stage have not been costed for this pathway.

Recommendation 21 Container lots of corn should be considered as the first export pathway to prove up the import procedures.

4.6.8 Fumigation in-transit

Fumigation on board ship while on the journey to Australia is standard US practice. While this is a standard practice for many shipments of grain from the USA, it is not acceptable practice from Australian ports as the indications are that gas concentrations are not adequately maintained in all areas of the hold for sufficient periods (CT product). Thus insects that are present may survive. Nevertheless, this should be investigated as a potential requirement as an added precaution against the detection of Stored Product Insects on discharge.

Recommendation 22 Fumigation of the corn is recommended to be done via standard US practice – that is, fumigate in the ships hold while on its journey to Australia.

4.6.9 Identity Preservation/QA systems

Identity preservation is quite feasible and is regularly practiced in relation to GM free corn exports. Barge transport appears to provide the best opportunity to identity preserve the grain.

As stated, rail movement in a Shuttle Train consisting of 100 wagons (10,000MT) will be essential in preserving the identity of corn exported from the PNW ports.

GIPSA

To retain their comparative advantage in the global market and address domestic food safety and quality issues, the USA grain producers and handlers are implementing methods to produce, handle and market trait specific grains, including documentation systems that trace raw materials back to the farm. Traceability and documentation are considered core competencies for grain operations (GEAPS 2002).

The demand by customers for process verification has lead to the implementation of auditable certification processes. GIPSA offers a Process Verification Program that conforms to ISO 9001 requirements and provides a USDA Certification label to enhance buyers' confidence in the product that they receive. "The program provides process verification services for grains, rice, pulses and products derived from these products. It is designed for both export and domestic shipments. This process verification designation verifies the process and not the final product."

USA corn producers have successfully implemented traceability programs for seed production outlined by the Association of Official Seed Certifying Agencies' (AOSCA) seed production guidelines and through integrated food supply chains involving a network of producers, grain handlers and processors. AOSCA procedures for corn seed production to prevent adventitious pollen contamination require field separation and limit the amount of off-type corn to 0.5 percent.

Key components of these IP programs include elements including clearly defined value, use of certified seed, field scouting, closed loop contracts, defined marketing plans, producer accountability and product traceability.

Should IP be required, industry will provide this service at a cost to be determined. The system itself should not be overly complex as the task of selecting the grain, cleaning, fumigation and denaturing treatment on discharge should provide a high degree of cleanliness and freedom from Quarantine Pests. The IP system should include traceability documentation such as numbering of transport units etc, but not require sealing of covers on barges unless stipulated. Other practices such as security and integrity of storage facilities, inspection procedures etc should be documented but not a mandatory requirement to be supplied along with the corn as part of the contract. Rather this information should be stated as being complied with by the seller of the grain under an "IP certificate".

Where AQIS pre-clearance is not undertaken, IP programs may not be required. To "preserve" the quality of the grain from the source State, a simpler version of an IP system may be all that is required. This would include documentation specifying the source of the grain and the pathway used for transport to the export position. This system would be cheaper to implement and could be used provided the outcome was suitable to meet any stipulations imposed by Biosecurity Australia. Again, the requirement for IP can only be determined upon review of the requirements for quarantine and access to crop quality data at the time of contractual negotiations.

Independent Inspection Company

Companies such as SGS offer their own IP programs that can be used by industry to provide grain that meets customer requirements. Frequently these are developed for supply of non-GM product, but are able to be adapted to meet any quality requirement. To achieve this goal, the certification programs generally involve audit, inspection, testing, control and analysis of the different stages of the process of production, logistics, storage and shipment.

Depending on customer requirements, these systems may involve any or all of the following:

- Seed testing - Testing on “ready-to-plant seeds” to verify bag label specifications non–GMO status
- Crop Monitoring - Identification of non-GMO fields and any contaminated areas before delivery time by field inspection and laboratory testing of the growing crop
- Transport to and from Elevator - Control on each truck before discharge into silo to verify their non-GMO status and condition
- Country Elevator Control - To minimise and if possible, eliminate contamination risks at receival, processing (cleaning etc) and during storage
- Shipment - Final confirmation of non-GMO status through vessel inspection, grain sampling and inspection during vessel loading

These processes can be used as a back-up to any IP systems already in place or developed specifically as the main IP process for the customer.

The requirements for use and scope of such a system can only be determined following discussion with the supplier of the grain and verification of what systems are able to be used that are already in operation along the supply chain. At that point, a risk assessment can be done to determine the critical control points and the processes available to manage those aspects.

ADM through their Agricultural Services Specialty Grain Program advise that they can provide the following services for speciality grains:

- Grower and elevator certified product sourcing that meets customer contract requirements with subsequent receiving, handling, identity preservation, and shipment via their US Gulf based Export Terminals
- Provision of speciality grains that are certified to be segregated and delivered in an identity preserved manner to barge or rail by a signed certificate from an approved Rail or Barge Terminal Supplier
- Product traceability certified by a pool of signed farmers and elevator supplier certificates
- Provision of containers from Ottawa, Illinois that meet customer contract specifications
- Collection of signed farmer and elevator suppliers certificates warranting
    - Post Harvest Chemical Free
    - Growing, handling, and harvest practices

  - Variety Information
  - Non-commingling

- Trait testing or other tests per customer requirements of outbound specialty grains shipments. Analysis provided by ADM contracted third party laboratory, customer contracted laboratory, and/or State and Federal Agencies

- Origination and shipment of Non-GMO Food Grade Corn. This includes
  - Sourcing of Non-GMO Food Grade corn varieties that provide customer preferred characteristics
  - Handling, storage, segregation and loading of product to prevent commingling with other products that do not have specialty traits
  - Testing and documentation of each outbound shipment as required by customer contract and ADM's internal systems to ensure customer satisfaction

Recommendation 23 The corn contract should specify the requirement for identity preservation of the corn to be exported, subject to review.

4.6.10 Certification

Representative samples are obtained using official USDA Federal Grain Inspection Service sampling procedures. These samples as described in Section 9 are then analysed for the range of quality parameters and certificates produced as required.

For logistics services, the following could be provided either on the one certificate or as a separate certificate as applicable:

- Certificate of Grain Origin (storage premises)
- Cleaning process
- Storage Maintenance and hygiene (country elevator, barge transfer facility, export terminal)
- Road truck, Rail wagon or Barge Cleanliness
- Fumigation (barge, vessel in-transit)
- Ship's Hold Inspection
- Ship Loading
- IP system

4.7 On Arrival in Australia

On arrival in Australia, the cargo will be inspected as per protocols outlined in the Final IRA document developed by Biosecurity Australia. AQIS will be responsible for developing procedures for inspecting the cargo at all stages of the discharge and transport process to ensure the requirements outlined by Biosecurity Australia are met.

These AQIS procedures are not able to be determined at present, but it is expected that the risk reduction procedures used to source the corn from the USA will significantly reduce the scope of requirements needed to be introduced. However, as the risk of contamination of the corn by Quarantine Pests is not removed, upon arrival in Australia, the processes outlined in the following section are recommended to be used to further control the status of the imported corn.

4.7.1 Inspection Pre-Discharge

It is recommended that the cargo be inspected prior to discharge, after berthing, to visually check for any quality issues that may have arisen during the voyage. This would include but not be limited to:

- Moisture ingress
- Insect infestation
- Mould damage due to moisture migration

Detection of any of the above quality problems is not expected given the moisture content specifications of the corn, fumigation prior to and in-transit and sealing of the hatches prior to sailing. Nevertheless, inspection of the grain prior to discharge will enable remedial actions to be undertaken if required or an alternative course of action to be decided between the related parties. These issues may take additional measures to rectify or cause unnecessary quarantine risks if corn is first discharged. Hence in the unexpected event of detection of these or other issues, remedial actions may more readily occur while grain is in the vessel. However for some quality related issues such as moisture migration, treatment may be required during or following discharge.

At this point in time it is unclear, but it is expected that AQIS will physically enter the holds upon berthing of the vessel in Australia and opening of the hatches. The inspection could be in the form of taking surface samples, or taking more representative samples of the entire hatch using a vacuum probe.

If any object of concern was detected by AQIS, the options may be to fumigate or treat the cargo, or reject it outright. This cannot be predicted at this present time.

As an extra precaution, it is recommended that an Independent Inspector also be appointed to review the discharge operation and inspect the corn during transfer to storage.

Recommendation 24 An Independent Inspection agency is appointed to oversee discharge and transport operations in Australia.

4.7.2 Discharge

The importation of USA corn is based around using the GrainCorp Fisherman Islands facility at Brisbane. At this stage GrainCorp have not been contacted to further explore costs and capability due to the commercial in confidence nature of the project. Total capacity of the terminal is likely to include:

- Ship discharge rate 350 MT per hour
- Road Outturn from Silo 350 MT per hour

As the facility does not routinely undertake discharge of vessels, there are no permanent facilities to conduct this task. Imports of grain have occurred previously and temporary infrastructure is used for this purpose.

Discharge will be undertaken via grab into a hopper facility on the wharf with transfer from the wharf to the silo complex occurring via road transport to the intake elevators. As the risk of grain spillage is likely to be quite high, careful monitoring of the discharge and attention to hygiene both on the wharf and during the transfer is essential. As imports have occurred previously according to AQIS protocols, these activities are expected to be able to occur to the required high Standard.

During discharge, receival of other grain commodities for subsequent export cannot occur and a thorough wash-down and cleaning operation both prior to and post-discharge of the vessel and transfer to the storage is required.

Recommendation 25 Use the GrainCorp facilities at Fisherman Islands to unload the vessel.

4.7.3 Storage

The grain is expected to be stored short term only at the Fisherman Islands facility. It is most likely outturn of the corn to feedlots would occur within one to two months of the vessel discharging.

Storage capacity 60,000 MT

The Fisherman Islands facility has a number of silos, with capacity of approximately 10,000 MT per silo. An assumption is that if it is economically feasible to import grain presumably drought conditions will have eliminated any demand for export grain via the Fisherman Islands facility. It follows that it should be possible to dedicate most of the facility to the task. If this is not the case, previous imports of grain have occurred while domestic grain is present in the terminal. Procedures have successfully been employed by GrainCorp to the satisfaction of AQIS to keep the grain segregated.

As stated above, clean-down procedures are essential and all flow pathways can be cleaned down with compressed air between shipments.

Recommendation 26 Use the GrainCorp facilities at Fisherman Islands to store the imported corn from the USA.

4.7.4 Treatment on-shore

4.7.4.1 Use of IP Procedures in the USA

General

To isolate the corn from domestic supplies and other potential carriers of Pests, the corn should be discharged at specific terminals that are dedicated to corn imports and are able to conduct any post-discharge treatment required by Biosecurity Australia. Only specific ports are able to carry out these activities to the specifications required and as advised in the previous section their availability depends on the time of year and availability of storage space.

Naturally, there must be a thorough clean-down of the facilities following discharge of the vessel and after removal of the corn from the terminal.

Denaturing Treatment

With IP processes in the USA, there is expected to be negligible Quarantine Pests associated with the corn that may require any form of treatment in Australia. Treatment with appropriate chemicals upon discharge of the corn in Australia would be an added precaution against the entry of any Quarantine Pests or other Non-Quarantine Pests. It would also potentially render any weed seeds present sterile and incapable of germination. This could severely reduce the risks associated with importing corn and removal of whole grain corn from the port area.

It is understood that such a treatment is being developed and no further comment on its effectiveness or efficacy can be made at present. If it is used, a thorough clean-down of facilities would be required to prevent contamination of other stocks that may be present in the terminal or subsequently received. Strict occupational health and safety procedures would also need to be followed.

As stated, imports of grain in previous seasons have required GrainCorp to developed “Imported Grain Protocols” to the satisfaction of AQIS and it is expected these same protocols, with minor variations as required, would be sufficiently robust for the import of whole corn from the USA.

Treatment for Quarantine Pests

Upon detection in the cargo of any Quarantine Pest or any Non-Quarantine Pest in numbers considered to be unacceptable, chemical treatment is an option as opposed to rejection of the cargo. The exact nature of the contaminant or infestation would need to be determined before a decision could be made. However as stated above, the preventative measures used in the supply chain in the USA should result in a minimal infestation or contamination, if at all. Thus treatment may be an acceptable option.

In these instances, treatment on Australian soil after discharge is preferred over treatment on the vessel. The reasoning being there may be OH&S issues and issues with treatments such as fumigation being able to effectively penetrate the entire cargo at the bottom of the holds. Additionally, a thorough inspection of the cargo can be made during discharge to determine if the treatment is appropriate for the infestation or contamination present.

Following discharge, procedures to clean down the entire terminal should be employed to remove any potential for contamination of other cargo with the imported material. These procedures, including meeting strict AQIS protocols have already been successfully employed in Australian ports including the terminal where the imported corn is expected to be discharged.

Recommendation 27 Suitable additional terminals in Australia for discharge and treatment operations are located prior to negotiation of contracts with corn suppliers from the USA.

4.7.4.2 No IP Procedures in the USA

An alternative option is suggested whereby limited IP or stock selection occurs in the USA and all objects of quarantine concern are dealt with post-arrival in Australia. This option carries a higher degree of risk than the previous option of stock selection to minimise risks of importing objects of quarantine and Quarantine Pests.

The potential exists to handle this cargo as follows:

- Stock is selected in the USA based on price alone
- No quality restriction occur other than normal contract specifications for export corn such as the requirements to meet regulatory levels for US Grade and other regulations for chemicals and mycotoxins
- Grain is fumigated in-transit according to standard practices
- Upon receival of the vessel in Australia, grain could be treated with a denaturing chemical either during discharge from the vessel to the wharf, during transfer to the terminal or within the terminal itself

This option involves a high degree of risk of contamination of the surrounding environment near the wharf but in reality previous imports have created a similar risk of contamination of the immediate environment. Adequate hygiene, cleanup procedures for spillage and clean-down after discharge should significantly reduce much of the risk of contamination being unmanageable.

Grain could be cleaned prior to treatment or post-treatment if required if the quality was not of a standard suited for stockfeed. The screening material could then be treated in some manner such as heat treatment.

As facilities are not set up for cleaning large tonnages or application of chemical, further investigations on the feasibility and costs would be required. However this option enables grain to be purchased at an economic price and the “premium” that would have been used for purchase of IP grain used to treat the grain to an adequate level in Australia based on the sampling and inspection from AQIS.

As no discussions have been held with GrainCorp due to confidentiality of this project, costs have not been explored. Note also that this option relies on development and approval for use of a denaturing agent, as yet fully developed and approved.

Recommendation 28 Corn is to be treated following discharge to ensure all corn is devitalised along with any potential Quarantinable Pests.

4.7.5 Certification

As with the supply chain pathway in the USA, the level of inspection, testing and certification depends on a range of factors including contract terms and requirements of Biosecurity Australia.

The IP procedures in sourcing the corn will create a high degree of satisfaction that the corn meets quality requirements and quarantine restrictions.

A range of testing of the corn could occur following discharge, however denaturing and processing are the final outcomes required. Thus while additional testing of the corn could occur, this is not deemed necessary. Inspection of the cargo prior to discharge, transfer into the storage and denaturing/processing would be closely monitored by AQIS and/or an independent inspection company.

The following certificates or procedures could be supplied during the discharge, storage period and processing operations in Australia and approved by a relevant quarantine authority such as AQIS:

- Hygiene certificate stating cleanliness pre and post discharge
- Protocols for cleaning, storage, discharge and processing
- Certificate of Weight
- Sampling and testing of corn pre and post denaturing and processing to determine success of the procedures

The costs of these certificates and processes are unknown at this stage.

5 Success in Achieving Objectives

5.1 Success in Achieving Objectives

The objective of this desktop study was to investigate the USA corn supply and develop a supply chain protocol for the importation of USA corn into Australia.

This objective has been fully met based on the information available in developing this report.

Based on the information obtained and presented in this report:

- Corn of an appropriate quality is available and can be sourced
- Corn is present and can be sourced from areas with a reduced Quarantine Pest load
- Processes can be implemented to clean and dry the corn, further reducing the risk of contamination with Quarantine Pests and other Non-Quarantine Pests
- Supply chain protocols exist that minimise contamination of the corn selected
- Exports can occur from either the PNW or Gulf ports
- Identity Preservation tools can be implemented to preserve the integrity of the corn
- Certification and testing requirements via contractual obligations can be used as a further guarantee that risk reduction measures have been implemented
- Costs of corn and services indicate the supply of corn and IP processes are realistic in times of short supply of stockfeed in Australia

The report indicates processes and potential supply chain pathways that can be used to source corn for import into Australia. The information obtained can be used by Meat and Livestock Australia to present to Biosecurity Australia as a mechanism to control the Quarantine Pest load of imported corn.

6 Impact on Meat and Livestock Industry

6.1 Impact on Meat and Livestock Industry - Now

The information obtained in this report provides Meat and Livestock Australia with:

- Confidence a pathway for USA corn does exist for supply of corn for stockfeed in times of need such as drought in Australia
- A greater expectation than previously that processes exist in the USA that minimise the presence and contamination of Quarantine Pests in corn supplies
- A higher degree of expectation than previous requests for imports that an approach to Biosecurity Australia for importing USA corn may be met with a greater degree of optimism
- An expectation of receiving agreement without the introduction of costly imposts and measures that would prevent corn imports
- A tool to approach Biosecurity Australia with a process for obtaining supplies of USA corn and importing that corn into Australia with minimal quarantine risk
- A mechanism to further develop a case for the import of whole grains into Australia, as an adjunct to research on denaturing treatments

6.2 Impact on Meat and Livestock Industry in Five Years Time

This report per se will not have an impact on Meat and Livestock Australia in five years time.

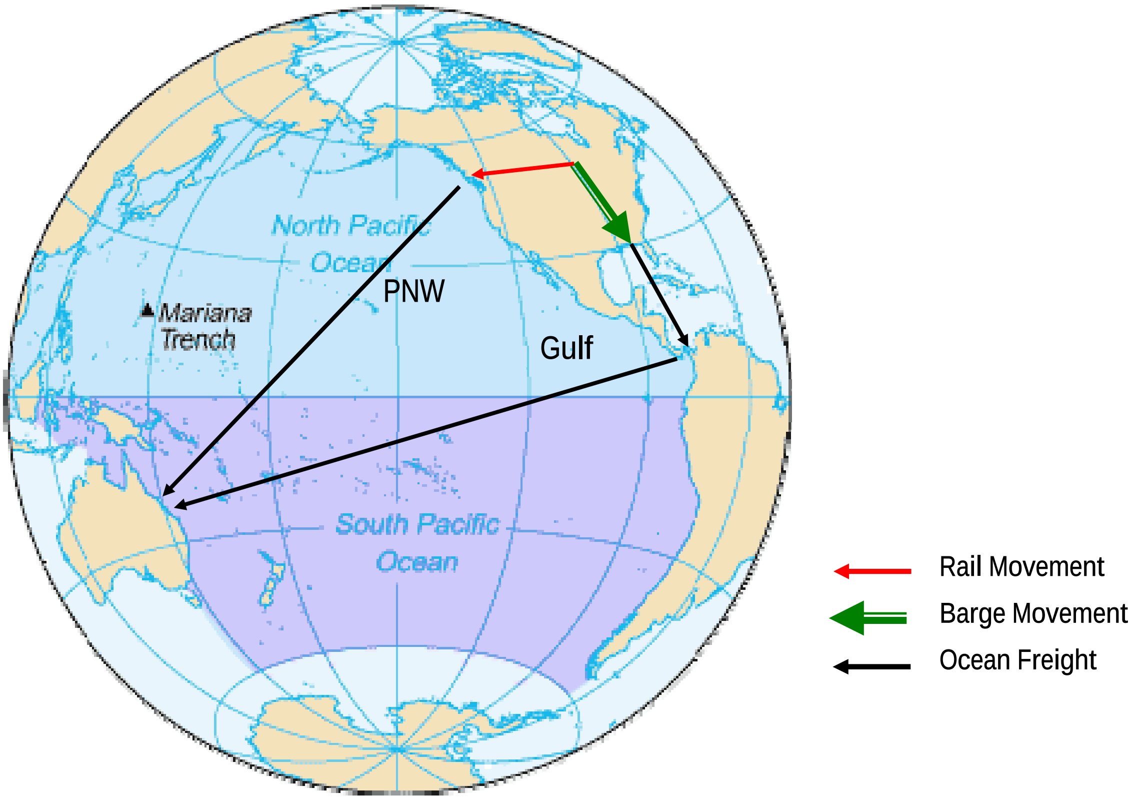
However the report enables Meat and Livestock Australia to further consider approaching Biosecurity Australia to seek approval for the importation of USA corn into Australia. By undertaking the processes outlined in this report, following further discussions with USA corn suppliers on commercial aspects and successfully concluding research into corn denaturing, it is the option of the consultant that approval can be obtained for the importation of whole corn from the USA and that this could be obtained within five years.

Further the consultant considers that the approval process and subsequent commercial negotiations with USA corn suppliers will create new opportunities to control the supply chain processes and potentially lead to reduced costs than those outlined in this report.

7 Conclusions and Recommendations

7.1 Summary of Processes & Indicative Costs

Summary of Movement of Grain

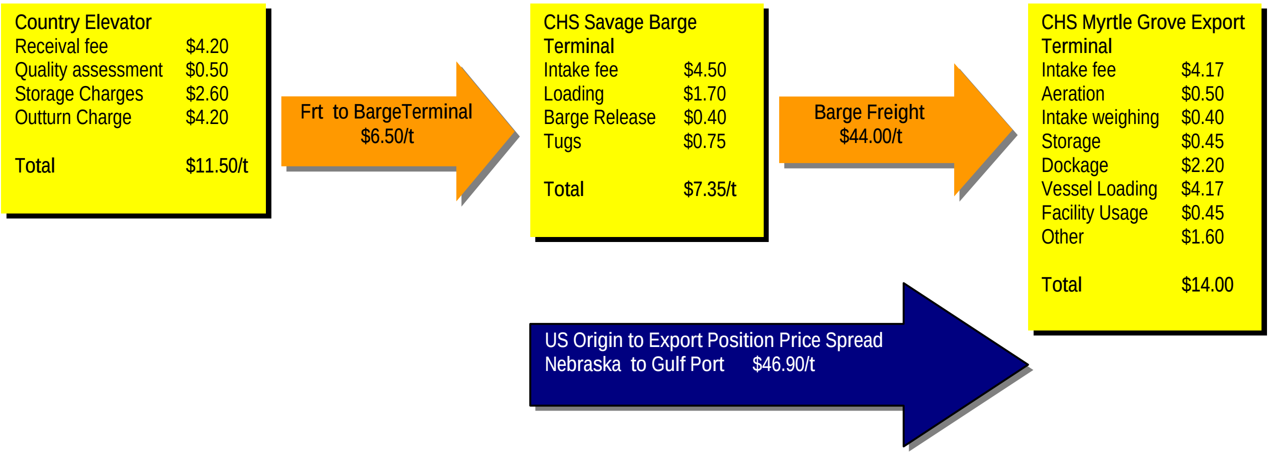


The supply pathway selected includes cleaning, drying and fumigating at Country Elevators with accumulated product being transported to the Barge Facilities on the Mississippi River system for movement to the Export terminals in the US Gulf. It should be noted that this pathway was selected principally to identity preserve the corn.

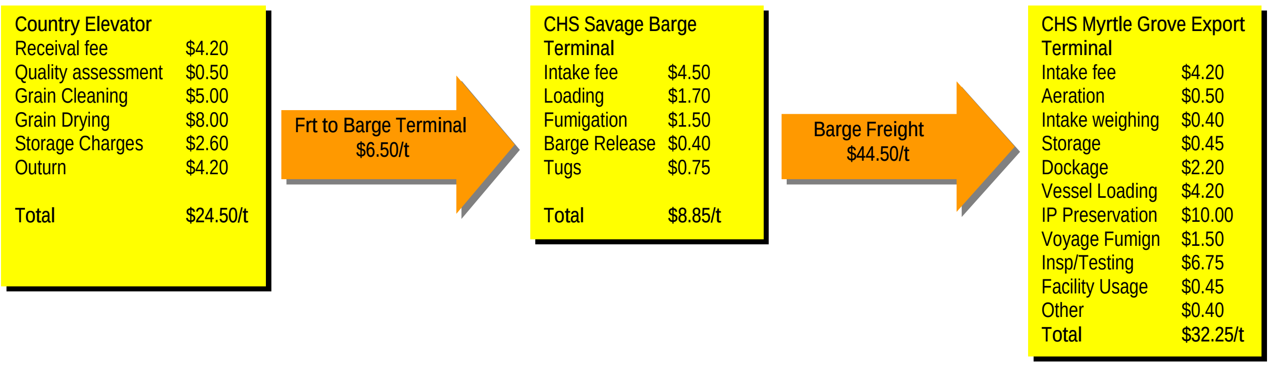
However the PNW represents a much cheaper export pathway to Australia than the Gulf.

Summarised in the following diagram are the export pathway functions and costs that will be required to position Corn in a FOB stowed and trimmed export position via the Gulf.

Standard Grain Pathway Country Elevator, Minnesota via CHS Savage & Barge to CHS Export Terminal, Louisiana (AUD/MT)



IP Control Grain Pathway Country Elevator, Minnesota via CHS Savage & Barge to CHS Export Terminal, Louisiana (AUD/MT)



Standard Pathway

The total US supply chain cost under the above standard pathway is $83.85 / MT.

IP Control Pathway

The total US supply chain cost under the IP pathway is $116.60 / MT. This includes an additional cost to satisfy Biosecurity Australia requirements are $32.75 / MT.

The various costs associated with importing corn into Australia from the USA will vary depending on a range of factors, including requirements imposed by Biosecurity Australia and the availability of appropriate supplies.

In general, the table below highlights the main costs associated with the sourcing of appropriate corn. As advised, these may vary significantly and the costs are an estimate and should only be used as a guide.

Factors to Consider	Approximate Cost A($) per tonne PNW	Approximate Cost A($) per tonne Gulf
Corn supply (ex Minnesota)	94.50	94.50
Non-GMO supply	7.00	7.00
Country Elevator Intake & Outturn	11.50	11.50
Cleaning	5.00	5.00
Drying	8.00	8.00
Freight from Country Elevator to Barge Terminal		6.50
Barge Terminal Charges		6.50
Movement to port	47.50	44.50
Barge & Other fumigation	1.50	1.50
Export Terminal Charges	14.00	14.00
Freight – ocean freight (48kt vessel)	51.00	70.00
In-transit fumigation on vessel	1.50	1.50
FGIS inspection of corn & certification	1.50	1.50
FGIS stowage inspection & certification	1.50	1.50
Testing for all quality parameters specified by BA for Quarantine Pests	1.50	1.50
Identity Preservation	10.00	10.00
Independent Inspection in USA	1.00	1.00
Any other certification required, including AQIS pre-clearance	0.25	0.25
Brisbane Terminal & Storage Charges	16.00	16.00
Sampling and testing of corn discharged, Independent Inspection in Australia	1.00	1.00
Total	**274.25**	**303.25**
Freight in Australia		
Treatment in Australia		

Note:

1. Exchange rate used is 0.75
2. Denaturing costs not included
3. Rail costs do not include potential premium for self-discharging wagons
4. For indication purposes only, a separate charge has been included for certification and inspection. In reality, these charges may be included in the cost of corn supply from a seller and/or the freight charges to position grain at port

5. Independent inspection companies combine service charges into one cost, thus overall costs may be reduced from the above figures in those circumstances

6. The price summarised in the above table represents a current estimate of the AUD price per MT delivered ex-Brisbane Terminal.

7.2 Recommended Actions

The following recommendations are made in this report in order to minimise the quarantine risks of importing USA corn into Australia:

Recommendation 1 — USA No.2 corn is the main grade sourced for importing into Australia. The potential use of other grades to be reviewed based on the costs of cleaning to the required level by Quarantine authorities. A representative sample should be obtained prior to supply.

Recommendation 2 — The moisture content of the corn to be as dry as practically and economically possible, with the maximum moisture level of 13.5%. Grain is to be dried if required.

Recommendation 3 — As part of the contractual grade specifications, the corn should be non-GM.

Recommendation 4 — As part of the contractual grade specifications, the corn should be certified as meeting relevant National and International chemical residue limits.

Recommendation 5 — As part of the contractual grade specifications, the corn should be certified as meeting relevant National and International mycotoxin limits.

Recommendation 6 — No testing occur of corn stored on-farm in particular States or Counties within a State.

Recommendation 7 — The contract with the corn supplier should specify all quality requirements that are in addition to the US Corn Grade Standards.

Recommendation 8 — Corn is sourced primarily from the Northern and Central corn-belt due to the relatively low Pest load in corn. Initially corn is to be sourced from Minnesota.

Recommendation 9 — Use the FGIS for vessel stowage inspection, commodity sampling and testing and certification services.

Recommendation 10 — AQIS pre-export clearance of corn in the USA occurs or at a minimum, AQIS conduct a tour of facilities to be used for corn exports.

Recommendation 11 — An Independent Inspection company to be used to certify the quality of corn exported.

Recommendation 12	Certification be sought outlining the full range of quality parameters for the corn specified in the contract.
Recommendation 13	Corn is cleaned prior to export.
Recommendation 14	Corn is dried if required prior to export.
Recommendation 15	Grain is fumigated prior to export at the most suitable location prior to vessel loading.
Recommendation 16	Grain is fumigated prior to export during barge transportation.
Recommendation 17	For corn moved to port by rail, grain remains untreated and is fumigated on board the vessel during transit.
Recommendation 18	Grain is transferred direct from barge to export vessel when possible.
Recommendation 19	Grain is transferred from rail to a terminal and then loaded onto an export vessel using an IP process.
Recommendation 20	A single hatch corn shipment should be utilised to test the bulk import systems and protocols if applicable.
Recommendation 21	Container lots of corn should be considered as the first export pathway to prove up the import procedures.
Recommendation 22	Fumigation of the corn is recommended to be done via standard US practice – that is, fumigate in the ships hold while on its journey to Australia.
Recommendation 23	The corn contract should specify the requirement for identity preservation of the corn to be exported, subject to review.
Recommendation 24	An Independent Inspection agency is appointed to oversee discharge and transport operations in Australia.
Recommendation 25	Use the GrainCorp discharge facilities at Fisherman Islands to unload the vessel.
Recommendation 26	Use the GrainCorp facilities at Fisherman Islands to store the corn imported from the USA.
Recommendation 27	Suitable additional terminals in Australia for discharge and treatment operations are examined prior to negotiation of contracts with corn suppliers from the USA.
Recommendation 28	Corn is to be treated following discharge to ensure all corn is devitalised along with any potential Quarantinable Pests.

8 Bibliography

8.1 Data Sources

ADM http://www.admworld.com/naen/services/graintrading.asp

ADM terminal – St Paul, Minnesota
http://www.bnsf.com/markets/agricultural/elevator/bin7/ele0437.html

Association of Official Seed Certifying Agencies' (AOSCA) seed production guidelines
http://www.aosca.org

BNSF rail linked elevators in Minnesota
http://www.bnsf.com/markets/agricultural/elevator/menu/mnlist.html

Canadian Pacific rail linked elevators in Minnesota
http://www8.cpr.ca/cms/English/Customers/Existing+Customers/Facilities/US+Grain/Grain+Elevators/default.htm

Cargill Cargill, Inc.

Corn prices, basis http://www.card.iastate.edu/iowa_ag_review/fall_05/article2.aspx

Crop data http://www.fas.usda.gov/psd/psdselection.asp

Crop data www.nass.usda.gov:8080/QuickStats/

Crop Statistics http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp

Data Sheets on Quarantine Pests EPPO quarantine pest Prepared by CABI and EPPO for the EU under Contract 90/399003

Data www.ams.usda.gov

Department: Agricultural Economics http://ianrnews.unl.edu/static/0509080.shtml

Elevator bids – for grain http://www.ams.usda.gov/mnreports/SF_GR110.txt

Elevators in Minneapolis http://www.magicyellow.com/category/Grain_Elevators/-State_MN.html

Elevators within 100 miles of Mankota
http://www.magicyellow.com/listings.cfm?CatID=283035&LocID=USMNCB&CatName=Grain%20Elevators&geo=loc&mode=browse&start=81

Feed grains http://www.ers.usda.gov/data/feedgrains/

FL Feature Creatures, wide range of corn information
http://creatures.ifas.ufl.edu/nematode/awl_nematode.htm

GIPSA (sampling and testing)
http://www.gipsa.usda.gov/GIPSA/webapp?area=home&subject=grpi&topic=landing

GIPSA Corn Quality 2005
http://www.gipsa.usda.gov/GIPSA/webapp?area=newsroom&subject=landing&topic=pub-er05

GM crop tonnage by state http://www.ers.usda.gov/Data/BiotechCrops/

Grain elevator – South Dakota - BNSF railway
http://www.bnsf.com/markets/agricultural/elevator/bin6/ele1326.html

Hard white wheats US breeding http://usda.mannlib.cornell.edu/reports/erssor/field/whs-bb/2004/whs04k01.pdf

HIPSA Standards, elevators
http://www.gipsa.usda.gov/GIPSA/webapp?area=home&subject=landing&topic=landing
http://lincoln.nal.usda.gov/index.php?mode=topic&mode2=&subject=nal_plants&topic=Diseases,%20Pests%20and%20Weeds&d_subject=Plants%20and%20Crops&want_id=Diseases,%20Pests%20and
Weeds&active=Diseases,%20Pests%20and
Weeds&num_to_skip=0&audience=

http://micorn.ncgapremium.com/index.aspx?ascxID=dowJones&category=1&djid=11736

http://www.ams.usda.gov/mnreports/GX_GR112.txt

http://www.chsinc.com/go.asp?Page=205147313&Parent=2&Template=02

http://www.chsinc.com/go.asp?Page=205147313&Parent=2&Template=02

http://www.ctre.iastate.edu/pubs/semisesq/session4/russell/index.htm

http://www.daff.gov.au/content/output.cfm?ObjectID=8C5781F7-B3D1-465C-8887E3DE5F9C964E&contType=outputs

http://www.extension.iastate.edu/agdm/articles/baumel/BaumelNov99.htm

http://www.ipmcenters.org/pmsp/ViewPMSPs.cfm?usdaregion=National%20Site

http://www.tmcnet.com/usubmit/2006/07/31/1755619.htm

Hurricane Katrina http://www.iowafarmer.com/articles/2005/09/13/top_stories/01hurricane.em

IA Department of Agriculture (pests, exporters etc) http://www.agriculture.state.ia.us/

ID (plant viruses) http://image.fs.uidaho.edu/vide/descr464.htm

IL University (pests) http://www.ipm.uiuc.edu/bulletin/index.php

Import Risk Analyses, Technical reports on Pests

Insects in the USA http://www.natureserve.org/explorer/servlet/NatureServe?init=Species

Integrated Pest Management: Corn Diseases, Department of Plant Microbiology and Pathology, University of Missouri-Columbia

Maize Crop Germplasm Committee, Chicago IL 8 December 2004

Maize data general http://maize.agron.iastate.edu/production.html

Maps of the USA http://www-atlas.usgs.gov/printable/reference.html#list

MI Department of Agriculture (pests, industry contacts) http://www.michigan.gov/mda

Mississippi river facilities http://chartmaker.ncd.noaa.gov/NSD/Cp5/CP5-34ed-Ch08_5.pdf#search=%22myrtle%20grove%20grain%20terminals%22

MN Department of Agriculture (pests, industry contacts) http://www.mda.state.mn.us/default.htm

MO University (pests) http://ipm.missouri.edu/pestguidelines/corn/diseasemgmt/corndiseases.htm

National Corn Growers Association (prices, data) www.ncga.com

ND State University (pests) http://www.ag.ndsu.nodak.edu/

NE (plant viruses) http://plantpath.unl.edu/llane/text/plantvirus.html

Nematodes: Management Guidelines for Kansas Crops, Kansas State Research & Extension, Kansas University

OK State University Fact Sheets http://www.osuextra.com

Pathogens by State

Pathogens in the USA http://www.apsnet.org/copyright.asp

Pest Status of USA crops http://www.ipmcenters.org/pmsp/ViewPMSPs.cfm?usdaregion=National%20Site

Pesticides http://www.ipmcenters.org/pesticides.cfm

Pests http://www.aphis.usda.gov/

Pests of USA Crops

Pests of USA States http://ceris.purdue.edu/napis/index.html

Plant Disease / Vol. 84 No. 8 www.sweetcorn.uiuc.edu/stewarts-wilt/PD-84-901-906.pdf

Seaways systems of the USA http://www.greatlakes-seaway.com/en/seawaymap/index.html

SGS Personal communication

South Dakota corn growers association http://www.sdcorn.org/

South Dakota Wheat Growers Assn.

Submission to the Senate Select Committee On the Free Trade Agreement between Australia and the United States Of America (2005)

The Maize Page Iowa State University

Transportation Statistics http://www.bts.gov/publications/freight_in_america/

Tribolium (insects) http://www.entomology.ucr.edu/ebeling/ebeling7.html

U.S. Grains Council (marketing, data, contacts) www.grains.org

US Grains council (weekly corn market report, prices) www.grains.org/page.ww?section=Market+Perspectives&name=Market+Perspectives

US Wheat Associates (prices) www.uswheat.org/priceReports

USDA - The National Agricultural Library (NAL), various reports on weeds and pests

USDA – various sites with tables of information on corn including:

Weed Risk Analysis http://www.daff.gov.au/corporate_docs/publications/word/market_access/biosecurity/plant/twg3.doc

Weed seed data http://www.daff.gov.au/content/output.cfm?ObjectID=DAECE32D-0E91-4DBF-8D9FE613E0B6D2FD

Weeds of the USA http://plants.usda.gov/java/nameSearch

Weeds Regulated by State http://www.nationalplantboard.org

Weeds Society of the USA http://www.wssa.net/

9 Appendices

9.1 Future Contacts

The following outlines contacts (physical and web-based) suitable for updating information provided in this report. The contacts are listed in order of the issues as outlined in the report.

9.1.1 USA Corn Supply

GMO crops
Updated annually, available July 2007, at http://www.ers.usda.gov/Data/BiotechCrops/

Prices
National Corn Growers Association
632 Cepi Drive
Chesterfield, MO 63005 U.S.A.
Phone: (636) 733-9004
Fax: (636) 733-9005
Email: corninfo@ncga.com
Website: www.ncga.com

Weekly corn market report, prices
www.grains.org/page.ww?section=Market+Perspectives&name=Market+Perspectives

USDA – various sites with tables of information on corn production
www.ams.usda.gov/mnreports
http://www.nass.usda.gov/Census_of_Agriculture/index.asp
www.fas.usda.gov/psd/complete_tables/

Prices
US Wheat Associates
www.uswheat.org/priceReports

GIPSA (Corn Quality)
http://www.gipsa.usda.gov/GIPSA/webapp?area=newsroom&subject=landing&topic=pub-er05

9.1.2 USA Corn Exporters

The main exporters of interest are as follows:

Company: Alfred C. Toepher Int. Inc
Address: Normandale Lake Office Park
8300 Norman Centre Drive
Suite 1180
Minneapolis MN 55437
Phone: (612) 835-9100
Fax: (612) 835-6590

Company: Archer Daniels Midland Co.
Address: 4666 Faries Parkway
Decatur, IL 62525
Phone: 217-424-5200
Fax: 217-424-4291
Website: WWW.ADMWORLD.COM

Company: Bunge North America
Address: 750 First St NE
Suite 1070
Washington DC 20002
Phone: 202-216-2000
Fax: 202-216-1785
Web Site: WWW.BUNGENORTHAMERICA.COM

Company: Cargilll, Inc.
Address: P.O. Box 5606, MS 6
Minneapolis, MN 55440
Phone: 1800 227 4455
Web Site: WWW.CARGILL.COM

Company: ConAgra Trade Group Inc.
Address: 11 ConAgra Drive Suite 5022
Omaha, NE 68102
Phone: 402-595-5871
Fax: 402-943-5366
Web Site: WWW.CONAGRA.COM

Company: Louis Dreyfus Corporation
Address: 1350 1 Street NW
Suite 1260
Washington, DC 20005
Phone: 202-842-5114
Fax: 202-842-5099
Web Site: WWW.LOUISDREYFUS.COM

For a comprehensive list of other Industry Contacts:
U.S. Grains Council
1400 K Street NW, Suite 1200, Washington, DC 20005
Phone: 202 789-0789
Fax: (202) 898-0522
Website: www.grains.org

Or more specifically, at
http://www.grains.org/page.ww?section=About+Buying+U.S.+Grains&name=Commercial+Grain+Exporters

Another list of Storage operators registered to Export Grain under the United States Grain Standard Act during Calender year 2005 can be accessed via the following linkage
http://www.gipsa.usda.gov/GIPSA/search?source=INTERNAL&navid=SEARCH&mode=simple&q=registered+exporters

9.1.3 USA Corn Pest Status

State by State through universities have fact sheets on grain pests as they become aware of the pests.

Link to all State Departments of Agriculture for pests, statistics, exporters
http://agri.nv.gov/AGRI_USMap.htm

9.1.4 USA Storage, Infrastructure & Service Suppliers

SGS Memphis (GM Laboratory, inspection and certification) Fraser Gilbert, Fraser.Gilbert@sgs.com

Company	Contact	Address	Phone/Fax/Email
Farmers Cooperative Elevator Co.	Merchandise Mgr. John Brandts	P. O. Box 59 Hanley Falls , MN 56245	Phone (507) 768-3448 Fax (507) 768-3675 Email fce@mvtvwireless.com
Prairie Grain Partners LLC	Facility Mgr. Scott Mauch	P. O. Box 68 Clarkfield , MN 56223	Phone (320) 669-7501 Fax (320) 669-4682 E smauch@prairiegrainpartners.com
Western Consolidate Cooperative	Merchandise Mgr. Paul Mattson	P. O. Box 78 Holloway , MN 56249-0078	Phone (320) 394-2171 Fax (320) 394-2180 Email paulm@west-con.com
Minn-Kota Ag Products Inc,	Facility Mgr. Brian Arnhalt	P. O. Box 175 Breckenridge , MN 56520	Phone (218) 643-8464 Fax (218) 643-4252 Email brian@mkap.com
Red River Grain Co., Inc	Facility Mgr. Chad Friese	3549 200th Ave Breckenridge , MN 56520	Phone (218) 643-3738 Fax (218) 643-5755 Email chad@redrivergrain.com
CHS Inc- New Horizons Ag Services	Facility Mgr. Kelly Longtin	P. O. Box 230 Herman , MN 56248-0230	Phone (320) 677-2251 Fax (320) 677-2718 Email kelly.longtin@chsinc.com
New Vision Coop	Merchandise Mgr. Dan Uttech	521 41st Street Hills , MN 56138	Phone (507) 962-3243 Fax (507) 962-3332
ADM Corn Processing	Merchandise Mgr. Matt Kauffman	901 North Highway 59 Marshall , MN 56258	Phone (507) 347-3131 Fax (507) 347-3134
CHS Inc.- Eastern Farmers Coop	Facility Mgr. Kevin Paulson	P. O. Box 266 Jasper , MN 56144-0266	Phone (507) 348-3911 Fax (507) 348-8835 Email kevin.paulson@chsinc.com
Meadowland Farms Coop	Merchandise Mgr. Pete Valentine	101 1st Ave E Lamberton , MN 56152	Phone (507) 752-7352 Fax (507) 752-7106
CHS Inc- State Line Farmers Coop	Merchandise Mgr. Howard Bragg	P. O. Box 146 Madison , MN 56256-0146	Phone (320) 598-7351 Fax (320) 598-7631 Email howard.bragg@chsinc.com
ADM Corn Processing	Merchandise Mgr. John Wall	701 N. Seventh Street Marshall , MN 56258-0663	Phone (507) 532-5404 Fax (507) 532-5425 Email john_wall@admworld.com
Farmers Cooperative Elevator Co	Merchandise Mgr. M D Zimmer	P. O. Box 432 Montevideo , MN 56265	Phone (320) 269-6531 Fax (320) 269-8279 E fcemonte@mvtvwireless.com
Glacial Plains Cooperative	Merchandise Mgr. Keith Bebler	P. O. Box 47 Murdock , MN 56271-0047	Phone (320) 875-2811 Fax (320) 875-2813 Email kbebler@glacialplains.com
West Central Ag Services	Facility Mgr. Jesse McCollum	P. O. Box 368 Ulen , MN 56585-0368	Phone (218) 596-8821 Fax (218) 596-8366

9.1.5 Australian Regulations & Industry

APVMA (chemicals) http://www.apvma.gov.au/residues/mrl_standard.shtml

AQIS (importing commodities)
http://www.affa.gov.au/content/output.cfm?ObjectID=3E48F86-AA1A-11A1-B6300060B0AA00014&contType=outputs&subdisplay=7

AQIS, PHYTO database of importing country quarantine requirements
http://www.aqis.gov.au/phyto/asp/ex_home.asp

FSANZ (Food Standards Code) http://www.foodstandards.gov.au/foodstandardscode/

Import Risk Analysis Handbook, Biosecurity Australia
http://www.daff.gov.au/content/publications.cfm?ObjectID=D667DCE6-A412-4673-A6B49B7579CF4AD7

Registration as a Stakeholder with Biosecurity Australia
http://www.daff.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060B0A03927&contType=outputs

9.1.6 Rail Freight

BNSF Rail Freight Prices can be determined from the following links:

Price Lookup

BNSF market-based prices are the most up-to-date, accurate prices for BNSF rail service. With prices that are market based instead of mileage based, you can make the best modal choice for your shipment.

Price Publications

Locate pricing for any product from grain to coal or from lumber to steel—as well as information on national tariffs, demurrage and storage charges, fuel surcharges, and finance charges.

Pricing Updates

Pricing Updates notify BNSF customers of changes to rates or price structures.

Demurrage and Private Car Storage

Demurrage is a penalty charge assessed for the detention of cars by shippers or receivers of freight beyond a specified free time.

Finance Charges

Find information regarding potential finance charges.

Fuel Surcharges

Find information regarding BNSF's Fuel Surcharge program.

Industrial Products Price Calendar

Better predict when prices will be renewed for various industrial products.

Industrial Products Price Groups

ValueTrax Boxcar

Each week, BNSF will offer discounted rates for carload service on select commodities in select lanes.

ValueTrax Intermodal

Each week, BNSF will offer discounted rates for inter-modal service in select lanes.
The site is assessed through the following linkage:

http://www.bnsf.com/tools/prices/

9.2 Definitions

Quarantine Terms

APHIS	Animal and Plant Health Inspection Service, USA
AQIS	Australian Quarantine and Inspection Service, DAFF
Biosecurity Australia	An agency within the Commonwealth Department of Agriculture, Fisheries and Forestry, Australia, responsible for protecting consumers and animal and plant health and providing quarantine policy
Control (of a pest)	Suppression, containment or eradication of a Pest
DAFF	Department of Agriculture, Fisheries and Forestry, Australia
Entry (of a pest)	Movement of a Pest into an Area where it is not yet present, or present but not widely distributed and being officially controlled
Entry potential	Likelihood of the Entry of a Pest
Establishment	The perpetuation, for the foreseeable future, of a Pest within an Area after Entry
FAO	Food and Agriculture Organisation of the United Nations
FGIS	Federal Grain Inspection Service, USA
GIPSA	Grain Inspection, Packers, and Stockyards Administration, USA
Introduction potential	Likelihood of the Introduction of a Pest
Introduction	Entry of a Pest resulting in its Establishment
IPPC	International Plant Protection Convention
IRA	Import risk analysis
National Plant Protection Organisation	Official service established by a government to discharge the functions specified by IPPC

Non-quarantine pest	Pest that is not a Quarantine Pest for an Area
Official Control	The active enforcement and application of mandatory phytosanitary regulations and procedures with the objective of eradication or containment of Quarantine Pests or for the management of regulated Non-quarantine pests
Pathway	Any means that allows the Entry or Spread of a Pest
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products
Pest categorisation	The process for determining whether a Pest has or has not the characteristics of a Quarantine Pest or those of a regulated Non-quarantine pest
Pest free area	An area in which a specific Pest does not occur as demonstrated by scientific evidence and where appropriate, this condition is being officially maintained
Pest risk analysis (PRA)	Is the process of evaluating biological or other scientific evidence to determine whether a Pest should be regulated and the strength of any Phytosanitary measures to be taken against it
Pest risk assessment	Determination of whether a Pest is a Quarantine Pest and evaluation of its Introduction Potential
Pest risk assessment (for quarantine pests)	Evaluation of the probability of the Introduction and Spread of a Pest and of the associated potential economic consequences
Pest risk management	The decision-making process of reducing the risk of Introduction of a Quarantine Pest
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of Introduction and Spread of a pest
Phytosanitary measure	Any legislation, regulation or official procedure having the purpose to prevent the Introduction and/or Spread of Quarantine pests

Phytosanitary regulation	Official rule to prevent the Introduction and/or Spread of Quarantine pests, by regulating the production, movement or existence of commodities or other articles, or the normal activity of persons, and by establishing schemes for phytosanitary certification
PRA area	Area in relation to which a PRA is conducted
Quarantine pest	A Pest of potential economic importance to the Area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled
Regulated non-quarantine pest	A Non-quarantine pest whose presence in plants for planting the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party
Spread	Expansion of the geographical distribution of a Pest within an Area
Spread potential	Likelihood of the Spread of a Pest
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
USA	United States of America
USDA	United States Department of Agriculture
WTO	World Trade Organisation

Grain Quality Parameters

Broken	All matter that passes readily through a 12/64 round-hole sieve and over a 6/64 round-hole sieve according to procedures prescribed in FGIS instructions
Chemical	Refers to those chemicals not permitted to be used on corn
Damaged Grain	Kernels and pieces of corn kernels that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mould-damaged, sprout-damaged, or otherwise materially damaged
Field Insects	Are insect contaminants that do not cause damage to stored corn

Foreign Material	A particular quality parameter referring to all material other than corn
Heat Damaged	Kernels and pieces of corn kernels that are materially discoloured and damaged by heat
Moisture	The amount of water measured in a sample of corn
Mouldy Grain	Mouldy grains are those that are decomposed or decayed because of bacteria or fungi. The mould is usually indicated by blackening, discolouration and softening of all or part of the kernel
Objectionable Material	Refers to objectionable foreign matter that may or may not be otherwise stated in the Standards, that has the ability to degrade the hygiene of the corn, become a food safety issue or has a commercially unacceptable odour
Physical Characteristics	A general description of corn, usually describing the physical characteristics such as general appearance and overall condition, relative to a particular variety of corn
Predominating Class	Is used in reference to the major class of corn such as yellow, white or mixed corn
Screenings	The total material passing through a screen of a nominated size and into a catch pan
Soil	Is generally regarded as unconsolidated mineral or organic material and comprises clumps of earth and grains of sand
Stored Product Insects	Are insect contaminants that generally cause damage to the stored corn
Taint	Arises from contaminants imparting a smell or taint to the corn, including plant parts and seeds

Other Terminology

Basis (Price)	The difference between the current cash price and the futures price of the same commodity. Unless otherwise specified, the price of the nearby futures contract month is generally used to calculate the basis
Bulk Vessel	A sea going vessel used to transport corn. Corn is stored loosely in holds without being constrained within a receptacle such as a container or bags. Vessels usually have a number of separate holds or compartments
Carrying Charge	For physical commodities such as grains and metals, is the cost of storage space, insurance, and finance charges incurred by holding a physical commodity. In interest rate futures markets, it refers to the differential between the yield on a cash instrument and the cost of

	funds necessary to buy the instrument. Also referred to as the cost of carry or carry
Carryover	Corn not consumed during the marketing year and remaining in storage at year's end. These stocks are "carried over" into the next marketing year and added to the stocks produced during that crop year
CFR (Cost and Freight)	A Term of Sale where the seller pays the costs and freight necessary to bring the goods to the named port of destination, Terms of Sale but the risk of loss of or damage to the goods, as (continued) well as any additional costs due to events occurring after the time the goods have been delivered on board the vessel, is transferred from the seller to the buyer when the goods pass the ship's rail in the port of shipment. The CFR term requires the seller to clear the goods for export
Charter Party	A written contract between the owner of a vessel and the person desiring to employ the vessel (charterer); sets forth the terms of the arrangement such as duration of agreement, freight rate and ports involved in the trip
Classification Procedures	Refers to procedures used to assess the quality of corn tendered for delivery or presented for outturn
Container	A box like receptacle that stores corn in a sealed environment for transport. Are usually approximately 20 or 40t capacity
Export Standard	Refers to the Export Standards outlined in this document. Are Standards that are applied to corn when sold and transported to overseas markets such as Australia
Farmer Dressed	Refers to corn that has been harvested and has not subsequently undergone any major cleaning or mechanical screening process to affect the quality. Corn generally contains some unmillable, foreign material and damaged corn
FOB (Free On Board)	An International Term of Sale that means the seller fulfils his or her obligation to deliver when the goods have passed over the ship's rail at the named port of shipment. This means that the buyer has to bear all costs and risks to loss of or damage to the goods from that point. The FOB term requires the seller to clear the goods for export
Futures Contract	A legally binding agreement, made on the trading floor of a futures exchange, to buy or sell a commodity or financial instrument sometime in the future. Futures contracts are standardised according to the quality, quantity, and delivery time and location for each commodity. The only variable is price, which is discovered on an exchange trading floor

Futures Exchange	A central marketplace with established rules and regulations where buyers and sellers meet to trade futures and options on futures contracts
Grower Load Composite	A sample representing the entire load tendered for delivery. Compiled by obtaining individual probe samples of the individual load (container, truck etc) based on the tonnage each represents and combining these samples to form one sample
Hedging	Is the practice of offsetting the price risk inherent in any cash market position by taking an equal but opposite position in the futures market. Hedgers use the futures markets to protect their business from adverse price changes
Hold Sample	A sample obtained from the hatch of a ship that represents the quality of the corn loaded within that hatch
Load	A road bulk unit tendered for delivery
Machine Dressed	Refers to corn that has undergone a significant quality transition via a mechanical operation such as cleaning to remove foreign material, foreign seeds or damaged corn
Nil	Means a level of zero in a sample representative of the entire load and/or not detected in the load or in/on the transport unit at any stage of the receival or outloading process
Outturn	Process of loading grain from a storage unit into a transport unit, for eventual delivery to a domestic or international customer
Receival Standard	Are Standards that apply to the purchase of corn from a grower or through the trade
Representative Sample	A sub-sample of a parcel of grain used for assessment purposes, which is representative of the entire grain parcel
Speculator	A market participant who tries to profit from buying and selling futures and options contracts by anticipating future price movements. Speculators assume market price risk and add liquidity and capital to the futures markets
State	One of the 50 States of the USA

9.3 USA Corn Standards

USA Grades and Grade Requirements for Corn				
Grade	Test Weight (lb/bu) Minimum	Damaged Kernels		Broken and Foreign Material %) Maximum
		Heat Damaged (%) Maximum	Total Damaged (%) Maximum	
U.S. No.1	56.0	0.1	3.0	2.0
U.S. No.2	54.0	0.2	5.0	3.0
U.S. No.3	52.0	0.5	7.0	4.0
U.S.No.4	49.0	1.0	10.0	5.0
U.S. No.5	46.0	3.0	15.0	7.0

U.S. Sample Grade

U.S. Sample grade is corn that:

(a) Does not meet the requirements for the grades U.S. Nos. 1,2,3,4, or 5; or

(b) Contains stones with an aggregate weight in excess of 0.1 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria spp*), 2 or more castor beans (*Ricinus communis*), 4 or more particles of an unknown foreign substance(s) or a commonly recognised harmful or toxic substance(s), or more cockleburs (*Xanthium spp*), or similar seeds singly or in combination, or animal filth in excess of 0.20 percent in 1,000 grams; or

(c) Has a musty, sour, or commercially objectionable foreign odour; or

(d) Is heating or otherwise of distinctly low quality.

Special Grades and Special Grade Requirements

Flint corn	Corn that consists of 95 percent or more of flint corn
Flint and dent corn	Corn that consists of a mixture of flint and dent corn containing more than 5.0 percent but less than 95 percent of flint corn
Waxy corn	Corn that consists of 95 percent or more waxy corn, according to Procedures prescribed in FGIS instructions

Definition of Corn

Grain that consists of 50 percent or more of whole kernels of shelled dent corn and/or shelled flint corn (*Zea mays* L.) and not more than 10.0 percent of other grains for which Standards have been established under the United States Grain Standards Act.

Definition of Other Terms

(a) Broken Corn
All matter that passes readily through a 12/64 round-hole sieve and over a 6/64 round-hole sieve according to procedures prescribed in FGIS instructions.

(b) Broken Corn and Foreign Material
All matter that passes readily through a 12/64 round-hole sieve and all matter other than corn that remains in the sieved sample after sieving according to procedures prescribed in FGIS instructions.

(c) Classes
There are three classes for corn: Yellow corn, White corn, and Mixed corn.

(1) *Yellow Corn*
Is corn that is yellow-kernelled and contains not more than 5.0 percent of corn of other colours. Yellow kernels of corn with a slight tinge of red are considered Yellow corn.

(2) *White Corn*
Is corn that is white-kernelled and contains not more than 2.0 percent of corn of other colours. White kernels of corn with a slight tinge of light straw or pink colour are considered White corn.

(3) *Mixed Corn*
Is corn that does not meet the colour requirements for either of the classes Yellow corn or White corn and includes white-capped Yellow corn.

(d) Damaged Kernels
Are kernels and pieces of corn kernels that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mould-damaged, sprout-damaged or otherwise materially damaged.

(e) Foreign Material
All matter that passes readily through a 6/64 round-hole sieve and all matter other than corn that remains on top of the 12/64 round-hole sieve according to procedures prescribed in FGIS instructions.

(f) Heat-damaged Kernels
Are kernels and pieces of corn kernels that are materially discoloured and damaged by heat.

(g) Sieves

(1) 12/64 round-hole sieve. A metal sieve 0.032 inch thick with round perforations 0.1875 (12/64) inch in diameter which are 1/4 inch from centre to centre. The perforations of each row shall be staggered in relation to the adjacent row.

(2) 6/64 round-hole sieve. Is a metal sieve 0.032 inch thick with round perforations 0.0937 (6/64) inch in diameter which are 5/32 inch from centre to centre. The perforations of each row shall be staggered in relation to the adjacent row.

Principles Governing the Application of Standards

Basis of determination:

Each determination of class, damaged kernels, heat-damaged kernels, waxy corn, flint corn, and flint and dent corn is made on the basis of the grain after the removal of the broken corn and foreign material. Other determinations not specifically provided for under the general provisions are made on the basis of the grain as a whole, except the determination of odour is made on either the basis of the grain as a whole or the grain when free from broken corn and foreign material.

9.4 Common Weeds of Corn

The common types of weeds that are found in corn are described below.

Annual Species

Annual species comprise the majority of the weeds found in corn production. Many of the primary weed species are introduced rather than native. Native and non-native plants become weeds because they are adapted to the two crop rotation system primarily used throughout the Midwest, germinate at or near the same time as the crop and are able to produce seed before the crop is removed by harvest. Increases in conservation tillage practices in recent years have resulted in a greater prevalence of these weeds.

Weed species that have developed resistance to herbicides have in many cases become more prevalent (shattercane, giant foxtail, cocklebur, kochia and lambs quarters) in recent years. The most significant resistant weeds in recent years are the tall and common waterhemp species.

Annual grasses infest approximately 98% of all corn acres. Many of these are controlled with pre-emergence herbicide applications and tillage. While usually not as competitive as broadleaf weed species, annual grasses can reduce crop yields when significant populations are present. This is particularly true in dry years, where competition for moisture early in the season can be critical for corn development.

Woolly cupgrass *(Eriochloa villosa)* is a relatively new and potentially serious weed problem in the States of Iowa, Illinois, Wisconsin and Minnesota. Its spread has increased rapidly in the last 10 to 15 years. This annual grass weed demonstrates biological, biochemical and morphological characteristics that make it economically damaging and adds to the difficulty in developing effective management strategies. Woolly cupgrass is a prolific seed producer. This seed tends to germinate earlier and at higher populations than many other annual grass weeds. Woolly cupgrass has demonstrated tolerance to most herbicides commonly used for control of annual grasses in corn.

Perennial Grasses and Grass-like Weeds

Johnson grass (*Sorghum halepense*) produces large rhizomes that can be spread throughout the field making it difficult to contain and control. Johnson grass is more common in the southern portions of the Corn Belt.

Yellow Nutsedge (*Cyperus esculentus*) causes the most severe perennial weed infestations and is quite serious across the region. It reproduces from tubers as the seed does not survive over-wintering and tubers can adapt to almost any soil type and conditions. Tubers germinate at depths of up to 30cm and may remain viable for up to three years in many soils.

Pre-emergence herbicide control of perennial grasses is generally with the use of EPTC or butylate. In addition, nutsedge can be suppressed by the acetamide herbicides, especially acetochlor. Roundup can also be used if the grasses are present in the field and growing prior to planting or if the grasses are actively growing after the crop is removed. For quackgrass, nutsedge and Johnson grass, tillage is also useful. Post-emergence control of shattercane, nutsedge and perennial grasses is generally achieved by the use of various commonly available chemicals.

Annual Broadleaf Weeds

These weeds produce prolific numbers of seeds which may lie dormant for very brief (2 weeks) or very long (30-50 years) periods before germination. Weed seeds are distributed by wind, rain, birds, and mechanical harvesting equipment.

An example is Giant Ragweed (*Ambrosia trifida*). Wet weather favours giant ragweed and this summer annual may be a severe problem in isolated fields. The seeds of giant ragweed may remain viable in the soil for several years. However, small seedlings can be controlled with row cultivation and tillage.

Jimsonweed (*Datura stramonium*) produces several hundred hard-coated seeds per plant that may remain viable in the soil for years. This summer annual grows best under warm temperatures and moist soils. Jimsonweed also contains the alkaloids, atropine, hyoscyamine, and hyoscine, which are toxic. Even small amounts of jimsonweed can cause harvest problems.

Perennial Broadleaf Weeds

While perennial weeds do produce seeds, the majority of plants propagate through vegetative means. Most perennial weeds begin growth early in the season before crops are planted and may also have a very active period of growth after the crop has been harvested. Tillage can be effective for controlling many perennial weeds but it may also distribute viable rhizomes, roots and tubers throughout the field if done improperly.

The occurrence of perennial broadleaf weeds is highly dependent on the tillage regime used in corn production. Since most perennial broadleaf weeds do not tolerate tillage, these weeds are more of a problem in reduced tillage and no-till operations.

While much of the effort to control perennial weeds takes place before the crop is planted or after it has been harvested, effective control of perennial weeds often necessitates control efforts during the cropping season as well. Other perennial broadleaf weeds, such as pokeweed, hedge bindweed, and Jerusalem artichoke may also be present in some fields, but are less common. It is generally agreed that multiple treatments in a season, which include a combination of herbicides and mechanical means of control, are necessary to reduce perennial weed populations and obtain what is otherwise termed “Good” control.

Winter Annual Weeds and Cover Crops

Winter annual weeds start their growth in the Fall and complete their life cycle in the spring, often bearing seed in May or June. While discing, ploughing or field cultivation tillage is effective for all winter annuals, no-till and conservation tillage fields must rely on herbicides for control. Heavy populations of winter annual weeds can sap the moisture from the soil and slow or reduce germination of the crop.

A number of winter annual weeds can be present in fields throughout the Midwest with the most common of these being henbit and chickweed. Some winter annuals are more prevalent across the northern portion of the corn-belt, while others such as bluegrass and brome grass tend to be more of a problem across the southern section of Missouri, Illinois, Indiana and Ohio. Weeds present in the field early in the season may attract damaging insects and provide an environment for egg laying.

Brome grasses include downy brome, Japanese brome and cheat. If left uncontrolled, these grasses will continue to pose a competitive threat to the crop. Thus herbicides are frequently used to control these weeds.

Herbicide Resistant Weeds

A number of weed biotype populations have been identified as having resistance to one or more herbicide classes. Those most commonly found are waterhemp, lambs quarters, kochia and pigweeds. In addition, resistant biotypes of common ragweed, cocklebur, shattercane, velvetleaf and giant foxtail have been found in some areas. The herbicide modes of action that have resulted in the most rapid development of resistant populations include those that have been used with the greatest frequency for weed control in corn and soybeans. This would include the triazines and the ALS inhibitors.

There is considerable concern about the potential development of resistance to glyphosate as it also has become widely used within the last 5 years. The difficulty in dealing with herbicide resistant weeds is often that the presence of such weeds necessitates the use of a more robust and more expensive approach to weed control. Since whole groups of compounds are no longer effective many individual products within those groups will no longer be efficacious. Control often rests on a strategy of crop rotation (to permit rotation of herbicides) and herbicide combinations.

9.5 Common Diseases of Corn

A short précis of the more common corn diseases in the USA is outlined below:

- *Aureobasidium zeae*, Eyespot, was previously known as *Kabatiella zeae*. This fungus overwinters in corn residue and in wet conditions produces conidia that are spread by splashing water and wind. The disease is much more common when corn follows corn. Eyespot is more prevalent in the northern part of the corn-belt. Early maturing hybrids seem to be more susceptible. Field corn is seldom treated with foliar fungicides for this disease.

- *Bipolaris zeicola*, Northern Corn Leaf Spot, was previously known as *Cochiobolis carbonum*. There are five known races of this fungus with different virulence characteristics and symptoms. Race 0 is nearly avirulent to corn, and race 1 is virulent on only a few genotypes. Races 2 and 3 are the most common races in the Midwest. Race 2 is not specific for corn genotypes, while race 3 is only a problem on certain susceptible lines. A fifth race has been reported recently. This fungus overwinters as mycelium and spores in corn residue, and the spores are dispersed by wind and splashing water. This disease rarely occurs in modern hybrids and is not treated with fungicides.

- *Colletotrichum graminicola*, Anthracnose Leaf Blight is caused by the same fungus that causes Anthracnose Stalk Rot. It overwinters as mycelium or sclerotia in corn residue or seed. Spores are spread primarily by splashing water. Anthracnose is much more common where corn follows corn. Anthracnose is usually more severe in the eastern corn states, but its importance in the Midwestern states is increasing. Problems are usually localised but can be severe. It is not economical to treat for as it is normally too late to treat once symptoms are seen.

- *Exserohilum turcicum*, Northern Corn Leaf Blight, has at least seven races. The fungus overwinters as mycelium and spores in corn residue. Spores are dispersed by wind and splashing water. This has traditionally been the most consistently damaging leaf disease of field corn in the northern corn-belt, but its severity has decreased due to improvements in resistance. It occurs throughout the eastern half of the USA, as far west as eastern Nebraska. This disease is important to corn production but corn is rarely treated.

- *Puccinia sorghi*, Common rust, begins as small, circular, light green to yellow pustules in the leaf tissue and when the rust is severe, leaves and leaf sheaths may yellow and die prematurely. This rust does not survive on infested residues left in the field.

- *Ustilago zeae*, Common Smut, was previously known as *Ustilago maydi*. This fungus overwinters in corn residue or soil. This fungus produces black teliospores that survive well in soil. Sporidia are spread by wind and water. All above ground plant parts are susceptible, especially the actively growing meristematic tissue. Sporidia can infect through unwounded cells, but wounds caused by insects, detasseling, cultivation, hail or blowing soil are important infection sites as well. This disease is of low importance to corn production. Smut is not a health issue to livestock when it contaminates feed. This disease does not receive chemical treatment. Some hybrids are less susceptible than others.

9.6 Supply Chain Operator Examples

9.6.1 Bunge North America

Size and Focus

Bunge North America is a major North American agribusiness and food ingredient manufacturer. From their corporate and business unit headquarters located in St. Louis, Missouri, they operate throughout the United States, Canada and Mexico as a wholly owned operating company of Bunge Limited, which is based in White Plains, New York.

Bunge are organized into four distinct, but interrelated businesses: Grain Division, Soybean Processing Division, Bunge Milling and Bunge Foods. They operate seven soybean processing plants, four corn dry milling plants, five edible oil processing and packaging facilities, seven food processing plants and over 70 grain elevators, located primarily along the Mississippi River and its tributaries.

A key element of its strength is its ability to leverage synergies between each of their businesses along the food supply chain.

Bunge are a major exporter of food and feed ingredients, the world's largest corn dry miller and the third largest soybean processor in the United States.

History

Early Roots: 1818 - 1923
The parent company–Bunge Limited–was founded in Amsterdam in 1818 as Bunge & Co. by Johann Peter Bunge, and soon became a leader in world commodity trading. In 1884, Ernest Bunge, one of the founder's grandsons, emigrated to Argentina where he founded an associated company, Bunge y Born. By 1903, the new company had expanded into Brazil. Geographic expansion continued throughout the early 1900s, and in 1923, the Bunge Group established Bunge North American Grain Corporation (today known as Bunge North America, Inc.) in New York City as a privately held company trading in raw agricultural commodities.

First Steps: 1923 – 1959
In 1935, Bunge North American Grain Corporation purchased its first sizable grain facility, located in Midway, Minnesota, and in 1943 shortened its name to Bunge Corporation. During the 1940s and '50s, they pursued an acquisition strategy that began our transformation from an operation focused solely on trading into a full-service grain company.

Major Investment and Expansion: 1959 - 1982
By the early 1960s, Bunge began to focus our grain origination capabilities along the Mississippi River system to better support their export activities. They constructed our own grain-handling facilities at strategic locations and, in 1961 they opened the largest export elevator at that time in the U.S. at Destrehan, Louisiana.

Bunge began to diversify into value added processing in the late 1960s, and built the first soybean processing plant in 1967, adjacent to the Destrehan, Louisiana export elevator.

Throughout the 1970s and early ‘80s Bunge built or acquired additional grain elevators and soybean processing plants. The purchase of Lauhoff Grain Company in 1979, elevated Bunge to a status of the largest corn dry miller in the world and creating the base for Bunge Milling’s operations. In 1980, they acquired three edible oil refineries, which marked their entry into value-added food processing and packaging.

Diversification and Consolidation: 1982 - 2000

During the 1980s and ‘90s, Bunge added bakery mixes and frozen bakery products to our downstream businesses and it divested interior elevators to concentrate its superior facilities along the Mississippi River system. In 1990, Bunge moved its headquarters from New York City to St. Louis, Missouri to more efficiently manage these operations from a central location.

Some key developments during this period are highlighted below.

- 1985 Bunge Foods begins to provide sales, marketing and technical support to Sysco Corporation, a leading distributor to the foodservice industry in the U.S.
- 1987 Bunge Foods acquires Carlin Foods Corporation, expanding our range of products sold to retail and wholesale bakeries, foodservice operators and a wide range of food processors.
- 1990 The Grain Division purchases 10 elevators in Louisiana, continuing its focus on grain origination assets along the lower Mississippi River system.
- 1992 Bunge Milling expands outside the U.S. by acquiring a corn dry milling operation in Chatham, Ontario.
- 1996 Bunge Foods opens a new bakery mix plant and automated warehouse in Bradley, Illinois.
- 1997 Bunge Corporation acquires an interest in the third largest wheat mill in Mexico, called "La Espiga."
- 1998 Bunge Milling enters Mexico by acquiring a corn dry milling facility in Queretaro, Mexico. Bunge Foods expands into frozen bakery products by acquiring Au Bon Pain’s Mexico, Missouri frozen dough plant and Dansk Specialty Foods’ frozen bakery plant in Tustin, California.

  The Grain Division enters into an agreement with Zen-Noh Grain Corporation to jointly operate both companies’ export grain elevators at the New Orleans Gulf.
- 1999 The Soybean Processing Division opens one of the largest U.S. crusher/refiners at Council Bluffs, Iowa and an integrated refinery at its soybean crushing facility in Decatur, Alabama. The latest technology is employed to sample each load of grain and analyse it for test weight, moisture, cracking and foreign material according to strict industry standards – a procedure that takes just minutes per truckload.

Growth: 2000 and Beyond

Today, Bunge North America is vertically integrated and positioned for strong growth at key points along the food supply chain in the U.S, Canada and Mexico.

Bunge Global Markets, a sister company established to merchandise agricultural commodities to destination customers globally, provides our grain and soybean businesses with direct access to world markets. To leverage this expanded access, it continues to build our network of elevators along the Mississippi River system.

In 2000, their Grain Division made a significant investment in the Destrehan, Louisiana export elevator to modernize its grain handling systems and increase its throughput capacity. In 2001, they changed their name from Bunge Corporation to Bunge North America, Inc. – a change that reflects its North American experience and geographic focus, as well as the central role it play in Bunge Limited's global strategy.

Facilities Network

The Grain Division's 63 river and inland elevators facilitate the efficient handling of grain and soybeans from growers' fields to the Company's export elevator in Destrehan, Louisiana. Compared to its competitors, the Grain Division has the largest storage capacity along the Mississippi River system, representing about 30 percent of the industry's total storage in the region.

The Grain Division operates a fleet of 450 barges on the Mississippi River and its tributaries to transport grain and soybeans between the conditions that change each year with each new crop. To assure its ability to deliver quality grains and oilseeds that meet customer requirements, it has developed innovative aeration systems and quality control protocols.

The Grain Division offers growers and end-buyers over 75 years of experience – a history that began with the founding of Bunge North American Grain Corporation in New York in 1923. Since then, the Grain Division has focused on its ability to enhance the value of the food and feed grains and oilseed crops American growers harvest. With storage capacity of about 120 million bushels (3 million metric tons), the Grain Division is challenged to maintain consistent grain quality under Company's river facilities, its export elevator and outside buyers. The barge fleet also moves soybeans from the Grain Division to the Soybean Processing Division's facilities located on the river system and carries soybean meal to the New Orleans Gulf for export.

In 1998, the Grain Division entered into an agreement to jointly manage its Destrehan, Louisiana export elevator with Zen-Noh Grain Corporation's export elevator at Convent, Louisiana. In addition, the agreement provides both companies with the opportunity to participate in each other's export sales, expanding access to global markets for each company's grower-customers while minimizing market risk at the same time. To further enhance the Grain Division's ability to compete in export markets, the unloading and handling capacity of the Destrehan, Louisiana facility has been increased by nearly 50 percent, and its ability to physically handle corn has been improved by investment in new technology that minimizes kernel breakage.

In addition to storage capacity, the Grain Division's competitive advantage is largely derived from the strategic location of its facilities along the lower Mississippi River system. These locations are not subject to river ice during the winter months and are located close to the export market in the New Orleans Gulf.

Export Capacity

With major export elevators located at Destrehan, Louisiana and Quebec City, Quebec, the Grain Division can export more than 500 million bushels (13million metric tons) of grain and oilseeds annually. In collaboration with our sister company, Bunge Global Markets, the Grain Division is a leading exporter of U.S. soft red winter wheat, corn, soybeans and sorghum sold in bulk.

Approximately 75 percent of the grain and oilseeds originated by the Grain Division is sold into export channels, with prices determined by global supply and demand. The balance is sold domestically, either to Bunge Milling, the Soybean Processing Division or to other grain and food processing companies.

Expertise in effective risk management is a fundamental strength of the Grain Division's business. Substantial management experience in the use of sophisticated trading strategies, financial instruments and forecasting methods enables it to anticipate market developments and optimize the timing and execution of purchases, sales and hedging – all of which maximize stakeholder returns.

Soybean Processing

The Soybean Processing Division sells bulk soybean meal, oil and hulls to some of the largest feed and food processors in the U.S. It also sells into export markets through its sister company, Bunge Global Markets. The Soybean Processing Division operates seven crushing facilities in the United States, two of which include integrated edible oil refineries.

In 1999, the Soybean Processing Division opened a state-of-the art soybean crusher/refiner facility with the largest oil extractor in North America at Council Bluffs, Iowa, and added an integrated refinery to its Decatur, Alabama crushing plant. The Council Bluffs facility offers area growers the fast unloading time (approximately 10 minutes per truckload, even during peak harvest time) and processes approximately 165,000 bushels (4,500 metric tons or 50 railcars) of soybeans daily.

With the largest average crushing capacity per facility in the United States and combined crushing and refining capabilities at its two largest facilities, the Soybean Processing Division is one of the most efficient operators in the industry.

Processing Expertise

Soybeans are processed into meal, hulls and crude and refined oil for use in the feed and food industries. Soybeans are "crushed" into their constituent parts, yielding approximately 73 percent meal, 19 percent crude oil, and 7 percent hulls (with a 1 percent loss). Graded for quality at delivery, soybeans are cleaned and conditioned with heat and steam prior to passing through a dehuller that loosens and separates the outer, protective layer from the bean. The hulls are sold either in

In 1967, the Soybean Processing Division built its first soybean processing facility at our export elevator in Destrehan, Louisiana (the only soybean processing facility in the U.S. located at a Gulf export facility).

Today, the Division is the third largest soybean crusher in the United States, processing approximately 300 million bushels (8 million metric tons) of soybeans annually. It also is one of the United States' largest exporters of soybean meal and crude, degummed soybean oil. The Soybean Processing Division purchases soybeans from growers, dealers and the Grain Division. In addition to Destrehan, Louisiana, its facilities are located in Council Bluffs, Iowa; Decatur, Alabama; Cairo and Danville, Illinois; Emporia, Kansas, and Marks, Mississippi.

The Soybean Processing Division's competitive advantages include the strategic locations of its plants, economies of scale associated with the size of its facilities, combined crushing and refining capabilities at its two largest facilities, and its ability to leverage synergies with the Grain Division in soybean origination and with Bunge Foods in downstream value added processing and packaging. These capabilities, combined with its expertise in risk management, provide the Soybean Processing Division with a strong base for future expansion.

The dehulled bean is then mashed into thin flakes, which exposes the oil contained in the bean's cell walls. The flakes are passed through a large extractor that separates the crude oil from the flakes using a chemical process. The flakes are dried, toasted, cooled and sold as soybean meal. Soybean meal is high in protein (48 percent), easily digestible and typically formulated with corn and other nutrients to provide balanced animal nutrition.

The crude soybean oil is refined, bleached and deodorized to remove impurities that can shorten its shelf life. If the refined oil is to be used by the Soybean Processing Division's customers to produce shortening or margarine, it is hydrogenated – a process that converts the substance into a semi-solid to facilitate storage and end-use applications.

Approximately 20 percent of the soybean oil produced by the Soybean Processing Division is exported from the U.S. as crude, degummed oil. The majority is sold domestically as refined edible oil either to Bunge Foods, other food processors or foodservice operators.

Milling

Bunge Milling is the largest corn dry miller in the world and operates corn dry mills at Danville, Illinois (the world's largest) and Crete, Nebraska; Chatham, Ontario (King Milling), and Queretaro, Mexico (Molinos Bunge). With these four facilities, Bunge Milling maintains an annual processing capability of approximately 56 million bushels (1.5 million metric tons) of yellow and white corn and hard wheat (which is milled into bulgur wheat) and storage capacity of approximately 15 million bushels (400,000 metric tons), ensuring timely access to quality raw materials.

Bunge Milling prides itself on producing the highest quality products – the result of its resolve to purchase only premium corn and adhere to strict dry milling standards. As a result, it has attracted and continues to satisfy the corn product needs of major customers such as Kellogg Company, Frito-Lay, General Mills and Anheuser-Busch. Bunge Milling also is a major supplier of blended and fortified famine relief products distributed by private volunteer organizations through the United States Department of Agriculture's 416(b) and the United States Agency for International Development's P.L. 480 programs.

Corn Dry Milling Expertise

Bunge Milling purchases yellow and white corn and various classes of hard wheat directly from growers and dealers. Each truckload of corn delivered to its facilities is sampled and tested to determine test weight, moisture, stress cracks, foreign material content, kernel size and uniformity – all in a matter of minutes. It accepts only high test weight, low stress crack corn for its dry milling process.

The corn dry milling process removes the bran coat and germ from the corn kernel, keeping the endosperm portion largely intact. This process yields "prime products" which are high in starch, low in oil and essentially free of bran and germ. "Prime products" include degermed corn grits, corn meal, corn flour and corn bran, which are used in a variety of foods, including snack foods, ready-to-eat breakfast cereals, baked goods, brewed beverages and premium pet foods. The co-products derived from the milling process are corn oil and hominy. Corn oil is used in salad dressings, margarines and syrups, while hominy is used primarily as a source of starch and fibre in animal feed. Bunge Milling's milled corn products are also used in a wide range of non-food items, including building materials, ceramics, pharmaceuticals, explosives, industrial alcohols, paints, paper goods and textiles.

An industry leader, Bunge Milling has achieved a number of breakthroughs in modern milling technology through its research and development activities and it regularly publishes its findings, which it shares with universities and government agencies. It also conducts a "Good Manufacturing Practices" course attended by many U.S. corn and wheat millers and major food processors.

9.6.2 Burlington Northern Railroad

The BNSF Railway is the product of some 390 different railroad lines that merged or were acquired during more than 150 years of operation.

Key Facts

- Route Miles: 32,000
- Number of Employees: 40,000
- Locomotives: 6,300
- Average Freight Cars on System: 220,000
- More than 10 percent of the electricity produced in the USA, enough to power one out of every ten homes in the nation, is now generated from coal hauled by BNSF
- BNSF serves more of the nation's major grain-producing regions than any other railroad
- BNSF is one of the largest grain-hauling railroads in the USA
- In 2005, BNSF transported more than 900,000 carloads of agricultural commodities, nearly half of which were corn and wheat movements

- Approximately 50 percent of the agricultural commodities traffic BNSF hauls is transported to export points in the Pacific Northwest, Gulf of Mexico, Mexico and the Great Lakes
- In 2005, more than 5 million inter-modal shipments (truck trailers or containers) were transported on BNSF's rail lines
- The average BNSF inter-modal train moves the equivalent of what 220 trucks could move
- BNSF moves more inter-modal traffic than any other rail system in the world
- Major products moved in the trailers and containers BNSF transports include such items as mail, small packaged goods, paper products, clothes, appliances, electronic products and auto parts

9.7 General Corn Information

Maize, or corn, is a gigantic domesticated grass (*Zea mays ssp. Mays*) of tropical Mexican origin.

The variable feature of corn that relates most closely with its food uses is endosperm composition, a trait usually controlled by one or a few genes. Corn may be classified based on endosperm characteristics into the following types:

- Pop (reventador) - the original domesticated type, consisting of a small spherical grain with floury (soft) starch core and a flinty (hard) endosperm shell. Moisture trapped in the floury starch expands upon heating and bursts through the hard shell, creating the confection popcorn. This accounts for less than 1% of commercial corn production.
- Flint (duro) - similar to Pop corn but is a larger grain. Flint corn is thought to have been developed from Pop types by selection for grain size and greater yield. This type is produced in areas where cold tolerance is required or where storage and germination conditions are poor. Currently accounts for approximately 15% of commercial corn production.
- Flour (blando) - discovery and selection of this trait was a key step in the widespread development and adoption of a number of corn-based food staples. Flour corn remains the preferred form for direct human consumption, as it consists of soft starch that is easily ground to produce meal that can be consumed directly (pinole), or as a flat bread (tortilla), dumpling (tamal) or beverage (atole). Currently accounts for approximately 10% of commercial corn production.
- Dent (dentado) - consists of a floury starch core with lateral inclusions of flinty starch. Because the crown of the kernel consists of floury starch, moisture loss from this area upon kernel maturation causes a slight collapse in volume that produces a characteristic dent. This is the most produced type of corn on a global basis, accounting for approximately 75% of commercial production, and is used as livestock feed and for industrial manufactures such as starch, syrup, oil and alcohol.
- Sweet (dulce) - the endosperm consists primarily of soluble sugar, with little starch, and an intermediate form of sugar polymer called phytoglycogen. Commercial production is less than 1%, though the crop has high cash value as a processed vegetable in industrial economies.

Currently, major corn production areas are located in temperate regions of the globe, and primarily produce animal feed and industrial materials. However, in Mexico the culture of corn remains predominantly a subsistence enterprise.

Corn is used to produce grain and fodder that are the basis of a number of food, feed, pharmaceutical and industrial manufactures. Corn is currently produced in most countries of the world and is the third most planted field crop after wheat and rice.

Industrial corn varieties are hybrids that tend toward uniformity due to the requirements of mechanised production and their common ancestry. These were mainly developed in the corn belt of the north central USA.

Depending on the State, corn is generally sown in the March-June period, and harvested in the August-November period.

9.8 States in the USA

The individual States are represented by the following abbreviations in tables throughout this report:

CA – California
CO – Carolina
IA – Iowa
IL – Illinois
IN – Indiana
KS – Kansas
KY – Kentucky
MI – Michigan
MN – Minnesota
MO – Missouri
ND – Nth Dakota
NE – Nebraska
OH – Ohio
PA – Pennsylvania
SD – Sth Dakota
TX – Texas
WI – Wisconsin

These States can be seen on the following map:

Only those States with significant corn production have been reviewed in this report.