Manitoba's Seed Industry: Value Added Economic Impacts

A study prepared for the Manitoba Seed Growers Association

by
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Agri-Food Research & Development Initiative (ARDI)

Manitoba Agri-Ventures Initiatives (MAVI)

Foundation Level
Monsanto Canada

Registered Level
Canadian Seed Growers Association
Cargill Seed
Cyanamid
Warburton's

Certified Level
Agricore
Aventis CropScience
Canadian Wheat Board
Royal Bank

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Manitoba Seed Industry: Value Added Economic Impacts Study, Grower Questionnaire

Manitoba Seed Industry: Value Added Economic Impacts Study, Marketing and Input Industry Questionnaire

[1]Companion documents are available by contacting the Department of Agricultural Economics and Farm Management, University of Manitoba.

List of Acronyms Used

AAFC	Agriculture and Agri-Food Canada
ARDI	Agriculture Research and Development Initiative
CFIA	Canadian Food Inspection Agency
CGC	Canadian Grains Commission
CIGI	Canadian International Grains Institute
CPS wheat	Canadian Prairie Spring wheat
CPSR wheat	Canadian Prairie Spring Red wheat
CPSW wheat	Canadian Prairie Spring White wheat
CSAAC	Canadian Seed Analysts Association of Canada
CSGA	Canadian Seed Growers Association
CSI	Canadian Seed Institute
CSTA	Canadian Seed Trade Association
CWAD wheat	Canadian Western Amber Durum
CWB	Canadian Wheat Board
CWES wheat	Canadian Western Extra Strong wheat
CWRS wheat	Canadian Western Red Spring wheat
CWSWS wheat	Canadian Western Soft White Spring wheat
EU	European Union
FGS	Farm Gate Sales
FTE	Full Time Equivalents
GDP	Gross Domestic Product
GMO	Genetically Modified Organism
HEAR	High Erucic Acid Rapeseed
IP	Identity Preserved
KVD	Kernel Visual Distinguishability
MCIC	Manitoba Crop Insurance Corporation
MCVET	Manitoba Crop Variety Evaluation Team
MSGA	Manitoba Seed Growers Association

OECD	Organization for Economic Cooperation and Development
PBR	Plant Breeder's Rights
PNT	Plants with Novel Traits
PRRCG	Prairie Registration Recommending Committee for Grain
SWOT	Strengths, Weaknesses, Opportunities and Threats
TRIPs	Trade Related Intellectual Property Rights
TUA	Technology Use Agreement
UNEP	United Nations Environment Programme
WTO	World Trade Organization
WCC/RRC	Western Canadian Canola/Rapeseed Recommending Committee

Common Terms of Biotechnology

There are numerous new terms being used regarding biotechnology in plant breeding, and, at times, there appears to be some confusion over the distinction between these terms. As stated in *Biotechnology and the Canadian Seed Grower, A quick reference guide* (CSGA, 2000), "the language of biotechnology is evolving." For this reason, the most common terms used are presented below, as defined in *Biotechnology and the Canadian Seed Grower*:

Biotechnology
: The application of science and engineering in the direct or indirect use of living organisms, or parts or products of living organisms, in their natural or modified forms.

Plants with Novel Traits (PNTs)
: Any variety of plant that contains characteristics that have never been typical of that species before, regardless of the method employed to induce the change.

Recombinant DNA Technology
: Genes from one species has been introduced into a non-related organism

Genetically Modified Organism (GMO)
: Includes organisms produced both by mutation and other more traditional plant breeding methods.

Genetically Engineered Organism (GEO)
: Or transgenics, are GMO's that are developed through recombinant DNA technology.

1 Executive Summary - MSGA Study Highlights

1.1 Introduction

A profile of Manitoba's 1997 seed industry activities has been carried out for the Manitoba Seed Growers Association (MSGA) to assist the industry in identifying its significance in Manitoba's economy and in planning its future strategies and goals. Knowledge of Manitoba's seed industry value added impacts on the provincial economy provides valuable information to the MSGA, the producers themselves, and the industries involved in seed related activities. The profile is based on the results of surveys of seed growers and companies involved in the seed industry.

This chapter highlights the overall results of the study. Detailed discussions of the study results are presented in further chapters organized under the following topics: Chapter 2 summarizes the grower and industry survey results, including sales and research expenditures; Chapter 3 looks at the economic impacts of the seed industry on the Manitoba economy; Chapter 4 outlines and discusses the industry strengths, weaknesses, opportunities and threats (SWOT).[1]

1.2 Survey Highlights

The survey results are presented in detail in Chapter 2. These results are summarized here and presented in a series of figures (Figures 1.1 to 1.8)[2]. Crops grown on acreage registered for pedigreed seed production are dispersed as pedigreed seed, or commercial grain, or screenings, or kept as inventory. One goal of the study was to estimate the value of 1997 production from pedigreed acreage, and thus farm gate sales values, unless they specifically refer to seed sales, represent sales of all of the above. Reference to seed sales hereafter, therefore, refers to that portion of the crop sold as seed for sowing. Producers may sell crops grown as pedigreed in the commercial crop market because the crop does not meet quality requirements for pedigreed seed, or because they cannot find a market for the pedigreed seed.

Some seed producers also have seed processing facilities and can earn extra revenue from these facilities, and thus revenue/cost information was collected from these producers/processors. Seed company sales value is the increase in the value of the seed after purchase from the producer (i.e. company sales value net of seed costs).

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[1]Several appendices are also provided. Appendix 1 gives profiles and flow charts for each of the crop types used in this report. Appendix 2 gives discussion and a graphical demonstration of acreage and export trends for commercial crop production. Appendix 3 details the survey methodology and responses.

[2]Because of the number of figures given for the Executive Summary, they are given at the end of the chapter.

Survey results are summarized below and in Figures 1.1 to 1.8:

- Total seed grower and seed company sales value for 1997 is estimated at $182.23 million, including $92.4 million of farm gate sales by growers (royalty payments included) from production and processing, and $89.83 million from company sales net of seed cost (Figure 1.1).
- The $92.4 million of growers' farm gate sales includes $77.15 million from sales of crops produced on pedigreed registered acreage, $6.5 million from producer owned processing facilities, and $8.71 million from farm gate sales of common forage seed. The $89.83 million from seed companies includes sales of pedigreed seed and common forage seed purchased mainly from Manitoba growers and net of seed costs (also includes some canola seed imported and processed by Manitoba seed companies).
- Wheat and forage seed accounted for the largest proportion of farm gate sales (Figure 1.2), whereas canola accounted for the majority of seed company sales. Canola, in fact, accounted for the largest proportion of the $182.23 million of final sales (47.8 percent; Figure 1.3), followed by all wheats (16.8 percent) and forages (15.3 percent).
- The amount of farm gate sales that were as seed sales was $55.35 million, or 69.5 percent, and the amount as commercial grain sales was $14 million, or 17.6 percent (Figure 1.4).
- Certified forages and canola had the largest percent of their farm gate sales as seed sales, and the wheats and dry peas were the lowest (Figure 1.5).
- Growers sold the highest proportion of their crop that was sold as seed to seed or marketing companies (53.4 percent; Figure 1.6) and then to commercial producers (35.1 percent).
- Forage and canola growers, which had the highest proportion of their crop sold as seed, also sold a high proportion of their seed sales to seed companies (Figures 1.5 and 1.7). In contrast, wheat had the lowest proportion of the crop sold as seed, and producers also sold a lower proportion of that seed to seed companies.
- The largest value added per acre for production was generated by canola ($244/acre) and then oats ($189/acre; Figure 1.8). Canada Western Red Spring (CWRS) wheat and other wheats had the lowest value added per acre ($76/acre and $68/acre, respectively).

1.3 Economic Impacts of the Pedigreed Seed Industry on the Manitoba Economy

This section summarizes the total economic impacts given in Chapter 3. Canada's pedigreed seed system impacts the Manitoba economy in a number of ways. The farm gate sales of seed and industry sales by seed companies contributes direct added value to the economy. The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of inputs purchased for the production of those commodities. Indirect value added is contributed through input purchases from supplier companies, which in turn produces value added from these companies. In addition, Canada's reputation as a producer of high quality commercial crops is the result of seed developmental research, breeding and multiplication activities, which in turn generates economic activity. Survey results were used to estimate economic impacts for the province (i.e. all

Table 1.1: Seed Industry Total Impacts on Manitoba Economy, 1997

	Certified Seed Growers	Common Forage Growers	Seed Companies	Total Impact
Value Added Impacts ($ million)				
Direct Value Added (GDP)	$36.91	$2.67	$28.15	$67.73
Indirect Value Added	$17.42	$2.25	$22.97	$42.64
Total Value Added Impact	$54.33	$4.92	$51.12	$110.37
Direct Employment				
Wages & Salaries ($million)	$9.41	n/a	$7.27	$16.68
Full-time Paid Employees	251	n/a	155	406
Part-time and Seasonal Employees	899	n/a	n/a	899
Unpaid FTE	1026	n/a	0	1026
Direct Investment ($million)				
Current Investment	$337.65	n/a	n/a	$337.65
Planned Investment (1998 - 2002)	$69.68	n/a	n/a	$69.68
Research				
Public and Private Research				$19.37
Royalties/Levies				$3.53

Sources: Tables 3.2 and 3.54; numbers may not all add due to rounding
n/a - not available

pedigreed seed growers and seed companies). Total economic impacts are given in Table 1.1 and are summarized below:

- The total value added impact from the seed industry in 1997 was $110.37 million, including $54.33 million from pedigreed seed growers, $4.92 million from common forage growers and $51.12 million from seed companies.

- Total direct value added was estimated at $67.73 million, including $36.91 million from pedigreed seed growers and growers/processors, $2.67 million from common forage growers, and $28.15 million from seed companies.[3]
- Total indirect value added was estimated at $42.64 million, including $17.42 million from pedigreed seed growers, $2.25 million from common forage growers and $22.97 million from seed companies.
- Wages and salaries for direct employment was $16.68 million, with 406 full-time paid employees (251 employed by seed growers and 155 by seed companies) and 899 part-time and seasonal employees (employed by the pedigreed seed growers). No wage or salary information was available for common forage seed growers.
- Unpaid full-time equivalents for the pedigreed seed growers was 1,026 in 1997.[4]
- Investment in land, machinery and equipment by seed growers for pedigreed seed production and/or processing was estimated as $337.65 million for 1997. No investment information was available for common forage growers or seed companies.
- Planned investment for the same categories by seed growers for 1998 to 2002 was estimated as $69.68 million.
- Research expenditures were calculated as $19.37 million, plus another $3.53 million from pedigreed producers for royalty and levy payments (total of $22.9 million).

1.4 Strategic Analysis of Manitoba's Seed Industry

A strategic analysis of Manitoba's seed industry is given in Chapter 4. Such an analysis takes into consideration the changes and challenges facing the seed industry to summarize development strategies for the seed industry. Five main topics were examined:

- major players and their roles,
- quality assurance, value added and investment,
- advances in biotechnology and other seed research,
- market demands and trends for certified seed, and
- seed industry development and investment opportunities and challenges.

Within each of these topics the seed industry was examined with regards to it strengths and weaknesses, and the opportunities and threats facing the industry. The SWOTs is then summarized to give the key points for each of the four attributes. The SWOTs summary is given below and in Figure 1.9, full discussion is provided in chapter 4.

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[3]Although common forage seed was not part of the survey process, due to the importance of the forage seed industry in Manitoba it was considered desirable to make some estimates regarding production and sales, as is done for Chapter 2 and as described in Appendix 1. Thus, an estimate of value added from common forage seed is also made here.

[4]Of the 861 seed growers producing seed in 1997, some are accounted for as full time paid employees and the remainder as unpaid full-time equivalent.

1.4.1 Strengths

Quality Assurance/Regulatory Strengths

- Canada's pedigreed seed system, and the strength of Canada's institutional arrangements for assuring the pedigreed status, has recognized importance. Canada's quality assurance program (Figure 1.10) has two essential control points: variety registration and seed certification.
- The Variety Registration Office of the Canadian Food Inspection Agency (CFIA), is responsible for registering crop varieties, based on the recommendations of the Prairie Registration Recommending Committees for Grain (PRRCG) and the Western Canadian Canola/Rapeseed Recommending Committee (WCC/RRC). Variety registration maintains a quality standard for the applicable commercial crops, such that only varieties meeting certain quality specifications may be registered. In contrast, commercial crop producers in the United States face a "buyer beware" situation in purchasing specific seed varieties.
- The pedigreeing of seed ensures genetic purity, which is especially important for such factors as yield, quality, disease resistance and morphological characteristics. Seed certification is administered by the Canadian Seed Growers Association (CSGA), which prescribes standards and issues crop certificates for pedigreed seed crops. The Seed Section of the CFIA oversees the administration of the Seeds Act; accredits the Canadian Seed Institute (CSI); establishes germination and mechanical purity (weed) standards; and enforces the Seeds Act and Regulations. The Canadian Seed Institute is responsible for seed quality assurance in Canada. The CSI is responsible for: evaluating seed establishments and seed laboratories against CSI quality systems standards; assessing graders' and operators' knowledge and competency; regularly reviewing industry performance; co-ordinating the training and accreditation of quality systems experts; and recommending to CFIA the accreditation of seed establishments, new seed processing facilities, seed laboratories, and operators and graders.
- The new Canadian Food Safety and Inspection Act will clarify the role of Health Canada in setting health, safety and nutritional standards while the CFIA is to enforce rules and regulate agriculture inputs and plant and animal health.
- The quality assurance system that exists in Manitoba provides a major competitive advantage over the U.S., which does not have variety registration required under a Seeds Act, nor a national association of growers responsible for prescribing standards and issuing certificates.
- In order to keep apace of changes in the agricultural industry, the Seeds Act and variety registration system have been amended over the plus-75 years they have been in existence in Canada. A review of the variety registration system was completed in March 1999, prompted by developments in biotechnology and the need to keep Canadian agri-business competitive at home and abroad.
- International recognition is given Canada's regulatory system for seed. The Plant Health and Production Division of the Canadian Food Inspection Agency (CFIA) is the Designated Authority in Canada responsible for expediting the international movement of pedigreed seed. Canada's participation in the Organization for Economic Cooperation and Development (OECD) Seed Certification Schemes expedites the international movement of pedigreed seed.

Biotechnology and Other Seed Research Strengths

- Public and private sector seed research in Manitoba and other parts of Canada has maintained Canada's competitive position in international markets.
- The considerable multinational corporate research on hybrid vigor and novel trait production characteristics such as herbicide tolerance, pesticide resistance and disease resistance gives production benefits to seed growers and commercial producers. Canola is the western Canadian crop most affected by private research funding to date, with considerable resources currently being channeled into wheat research.
- Multinational seed companies have advantages relative to public sector agencies associated with economies of size. Joint arrangements, such as the Monsanto/federal government/provincial government $10 million Crop Development Center at the University of Manitoba, will provide public agencies access to privately held gene patents.
- Manitoba's highly experienced seed growers and seed companies transfer new seed technology from plant breeders to commercial producers.
- Advances in genetic engineering and traditional breeding methods by plant breeders in western Canada has made phenomenal progress with respect to canola production traits and variety characteristics. Industry sources indicate that about seventy percent of the canola crop planted in western Canada in 1999 had novel trait characteristics.
- Transgenic, as well as hybrid wheats, are in the pipeline, with Roundup ready wheat expected to be available by 2003 to 2005.
- Survey responses from 17 companies and public institutions with research expenditures indicated most have plans to expand research operations in Manitoba.
- The Agriculture Research and Development Initiative (ARDI) and the St. Boniface General Hospital Research Center are planning to spend a total of $6 million to establish a center of excellence that will provide medical based research into the linkages between agriculture and food products and health.
- The University of Manitoba Faculty of Agriculture has proposed a $23 million nutraceutical and functional foods research center.
- Manitoba's attributes for attracting research resources include agro-Manitoba's favorable growing climate, Manitoba's seed growers expertise (average of 15 to 20 years of experience), the expertise in the public research facilities located in Manitoba, and a low Canadian dollar.

Branding, Identity Preserved (IP) and Other Market Characteristics Strengths

- Seed companies estimate that commercial end use cereal, oilseed and forage IP sales ranged from 0 to 25 percent in 1997 and that IP sales in the year 2007 will range from 20 to 50 percent.
- The CSGA pedigreed seed system, an IP system, has been refined and revised over a number of years, placing Manitoba seed growers in a good position for understanding the requirements of an efficient, fully functional and accountable IP system.
- With the 1997 provincial farm gate value of crop production at $1.6 billion and exports at $1.7 billion, the pedigreed seed system is an essential element contributing to the high quality, and thus value of Manitoba's commercial crop.

- CWB wheat and barley are sold by class designations which have a recognized brand value associated with high quality and service in international markets.
- Canola varieties are branded by seed companies as a means of differentiating seed production traits as well as oil product quality characteristics in end use markets.
- Forage seed companies promote specific varieties and seed certification in domestic and international markets.
- Manitoba's seed growers are experienced and resourceful, adapting to the rapid changes that are occurring in the seed and agriculture industry with such endeavors as formation of grower-owned seed companies, developing contracts or alliances with companies, and taking advantage of industry trends, such as increased usage of seed treatments.
- Many growers, grower/processors and seed companies are investing in expansion and capital replacement.

1.4.2 Weaknesses

Quality Assurance/Regulatory Weaknesses

- Canada's ability to take advantage of IP markets is dependent on the ability of its transportation and handling system to maintain the level of segregation required to assure identity preservation. This will present challenges to a system which is currently geared to deliver bulk commodities and is in a process of rationalization. A system will be required for assigning accountability for mix-ups at various stages of the transportation chain.

Biotechnology and Other Seed Research Weaknesses

- Manitoba's GMO canola does not have market access in European Union (EU) countries which ban GMO products, such as Germany and France. Irregular purchases of canola from Manitoba have been made previously by Germany ($16.22 million in 1996) and France ($1.89 million in 1996).

Branding, Identity Preserved and Other Market Characteristics Weaknesses

- The present Kernel Visual Distinguishability (KVD) system for wheat, which requires that all varieties of a wheat class have specific visual characteristics, places constraints on breeders and companies in developing varieties and brands geared to specific end use requirements.
- There is a high usage of common seed on the prairies, with some estimates indicating as high as 85 - 90 percent of commercial cereal crop acreage sown with common seed. This takes away from the market share for certified seed. A consideration that should be of concern to the seed growers is that there seems to be no real firm knowledge of just how much of the commercial crop in Manitoba is grown with certified seed versus common seed; seed growers need full market information in planning development strategies.
- There is a lack of information on amounts and value of interprovincial trade of seed, and to a lesser degree international trade. This is particularly true for Manitoba's forage seed trade, with significant imports from other provinces and the majority of the market for forage seed as international exports, mainly the United States.

- Capital constraints are the major bottleneck for development of market opportunities in Manitoba to benefit the agriculture industry, including the seed growers.

1.4.3 Opportunities

Quality Assurance/Regulatory Opportunities

- Branding, seed certification, electrophoresis variety testing, contracting and food labeling in product markets provide a mechanism for ensuring market incentives for commercial producers to purchase certified seed.
- There is an opportunity for Manitoba to be the world initiator of GMO cereal varieties and gain an enormous international competitive advantage in the seed industry and related sector value added activities if markets for GMO cereals (e.g. Roundup ready wheat) can be developed.
- The review of the variety registration system could result in a system which further increases the seed variety quality standards of the current system relative to the U.S., depending upon the outcome of the review and which crops, if any, remain subject to variety registration with merit.
- Labeling and Biosafety Protocols being developed for international trade in GMOs provide an opportunity for promoting variety branding of Manitoba crops produced with certified seed.
- Bilateral analysis between Canada's Department of Foreign Affairs and International Trade and the EU on common approaches to trade in GMOs, if successful, could provide expanded trade opportunities.

Biotechnology and Other Seed Research Opportunities

- The Manitoba Crop Variety Evaluation Team (MCVET) could be strengthened and expanded to include GMO canola production traits, to provide seed growers and commercial producers with an unbiased third party analysis of canola varieties.
- Improve seed growers' and commercial producers' productivity and profitability with economic analysis of canola cost and returns information comparing herbicide tolerant seed options, seed treatments or hybrid versus conventional varieties.

Branding, Identity Preserved and Other Market Characteristics Opportunities

- Growth of the IP system presents many opportunities to the seed industry, providing the IP system is based on use of certified seed.
- The trend towards branding of seed varieties for specific product markets provides potential value added benefits including reduced use of common seed and increased returns to variety development research.
- Canada's well structured certified seed system and its ability to ensure the purity of the variety being planted can be used as a selling feature to customers for IP products.
- The potential of the wheat industry to change from marketing high volume bulk commodities to identity preserved specific varieties will provide seed growers an opportunity for greater certified seed sales of wheat.

- Improved information on market trends will assist seed growers in making better decisions regarding selection of varieties to produce.
- There are considerable market opportunities for development in such areas as nutraceuticals and functional foods, livestock feed, HEAR oil, pasta processing, noodle processing, and frozen dough. Developments in these areas would be enhanced by an Identity Preserved system. Specifically, IP products have potential, both for export and for developing the processing industry for these products here in Manitoba. This in turn presents opportunities for the seed growers for providing certified seed for the specific varieties required for these IP markets. It is expected that IP markets based on certified seed can be developed for specific pasta and noodle wheat varieties, as well as barley, oat and edible bean varieties.
- Seed growers can enter into many different types of contracts with seed companies or can grow and market their seed on an independent basis. Analysis of contract options with seed companies and the importance of quality specifications relative to seed company end use markets would assist growers in making their marketing and growing decisions. As well, with the development of IP markets, increasing knowledge of contract options is important for seed growers.
- Considering the high proportion of Manitoba's commercial crop acreage that is planted with common seed, there is a large potential market for seed growers to pursue. In particular, once transgenic wheat varieties are available, and if they become as popular as for canola, seed growers will be able to increase their market share substantially. Manitoba seed growers will face competition from seed produced in other provinces, particularly with respect to hybrid seed production.
- There are a number of market opportunities for certified seed outlined above. To take full advantage of these opportunities seed growers need complete knowledge of their customer base, both current and potential. An area which has been identified as lacking in information is the proportion of the commercial crop that is planted with certified seed. Further research should be done in this area to move beyond the current industry estimates, which range considerably depending on the source. Seed growers could approach such agencies as Manitoba Crop Insurance Corporation or Statistics Canada, that collect seeding information on an annual basis, to incorporate questions on use of certified seed.

1.4.4 Threats

Quality Assurance/Regulatory Threats

- According to the Canadian Seed Trade Association (CSTA), the substantial increase in submissions and field trials of genetically engineered plant material proceeding under the Seed Act is creating a bottleneck in the regulatory process. This has an impact in terms of how quickly new varieties are available to seed growers for multiplication purposes.
- The review of the variety registration system could result in a system which, in effect, reduces the seed variety quality standards of the current system if Canada moves towards

the US system, where commercial crop producers face a "buyer beware" situation in purchasing specific seed varieties.

- The Biosafety Protocols could lead to a continuation of the effective ban on EU trade of Manitoba's commercial GMO crops.

Biotechnology and Other Seed Research Threats

- Large scale multinational patented research on hybridization and production traits could displace public sector seed technology research in Manitoba and reduce competition in the seed industry.

Branding, Identity Preserved and Other Market Characteristics Threats

- If certified seed does not become a basic requirement for commercial crops destined for an IP market then the seed industry will not fully benefit from IP market development. IP market developers need to recognize the benefits of variety branding and seed certification.
- Manitoba seed growers lose market share when seed varieties developed and/or owned and multiplied outside of the province become popular with Manitoba commercial growers, such as with imports of canola seed from Alberta and Saskatchewan .
- Spread of GMO market access problems for canola to other trading partners could have major implications on western Canada's canola industry.

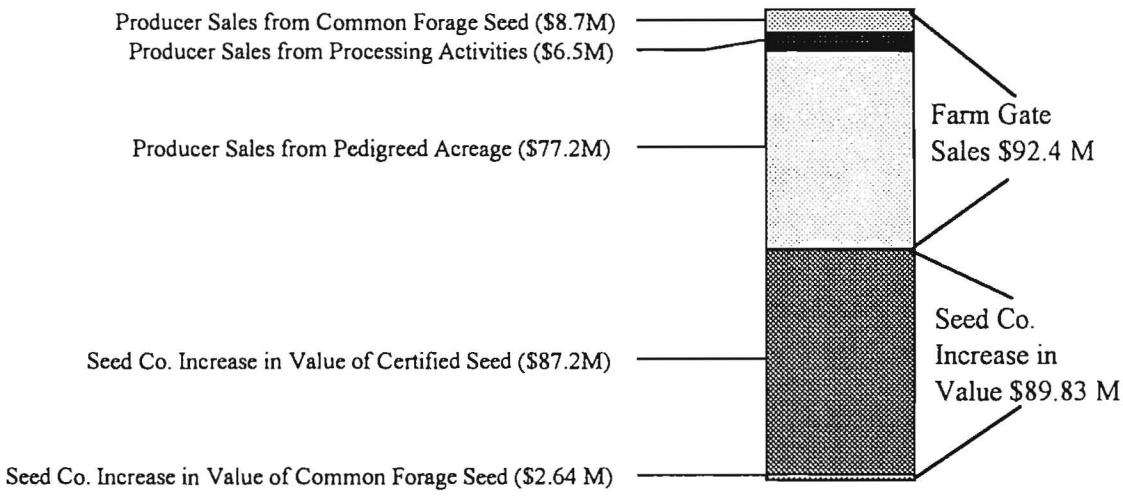

Figure 1.1: Distribution of $182.23 Million of Manitoba Seed Industry Farm Gate and Seed Company Sales, 1997

(Source: Table 2.1)

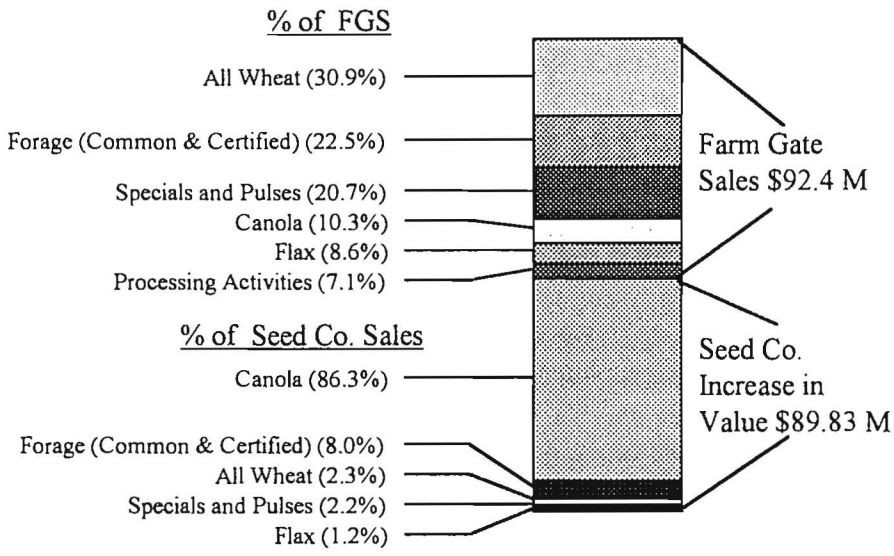

Figure 1.2: Distribution of $182.23 Million of Manitoba Seed Industry Sales by Crop, for Farm Gate Sales and Seed Company Sales, 1997

(Source Table 2.1)

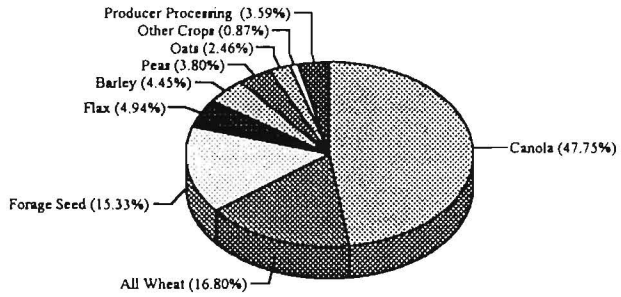

Figure 1.3: Distribution of $182.23 Million of Farm Gate and Company Seed Sales, by Crop, Manitoba, 1997

(Source: Table 2.1. Forage seed includes certified and common seed; Other crops include other special crops and other pulses.)

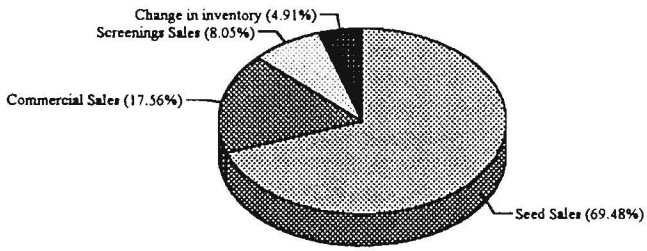

Figure 1.4: Dispersal of $77.15 Million of Farm Gate Sales from Pedigreed Acreage, Manitoba, 1997

(Percentages in chart based on $79.66 million of farm gate sales from which $2.48 million from seed purchased for resale is then deducted to give the net value of $77.15 million from farm gate sales from Table 2.2)
(Source Table 2.2)

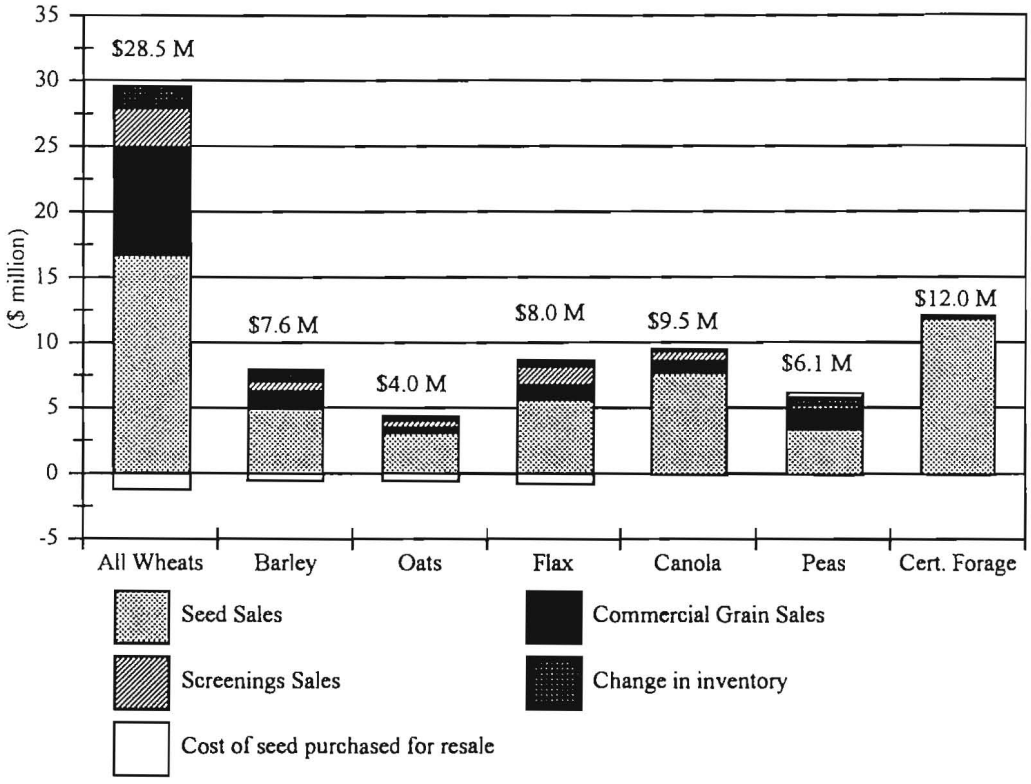

Figure 1.5: Dispersal of $77.15 Million of Farm Gate Sales from Manitoba Seed Acreage, 1997, by Crop

(Source: Table 2.2)

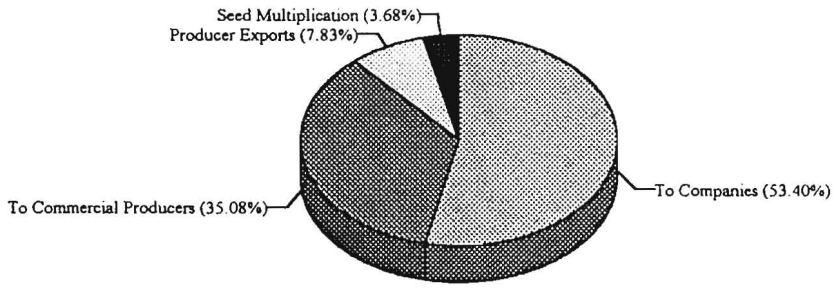

Figure 1.6: Distribution of $55.35 Million Farm Gate Sales of Certified Seed, by Market, Manitoba, 1997

(Source: Table 2.2)

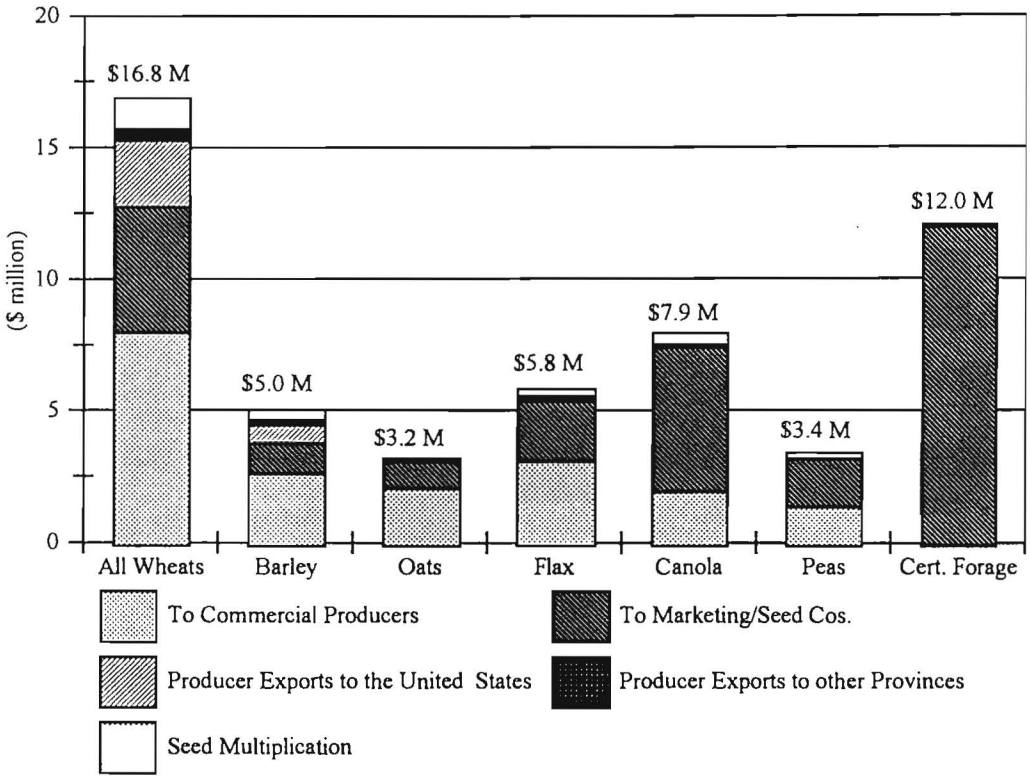

Figure 1.7: Distribution of $55.35 Million of Manitoba Farm Gate Sales of Certified Seed, by Crop, 1997

(Source: Table 2.2)

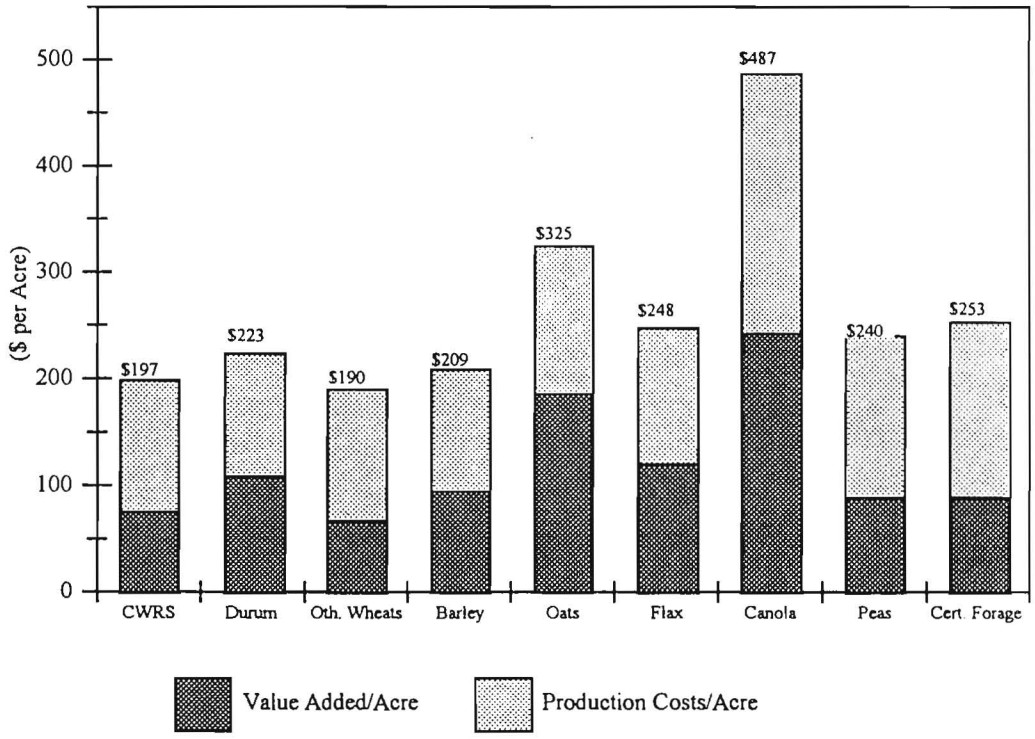

Figure 1.8: Manitoba Seed Acreage Farm Gate Sales per Acre, by Crop, 1997 (Showing Production Costs and Value Added per Acre)

(Source Table 2.3)

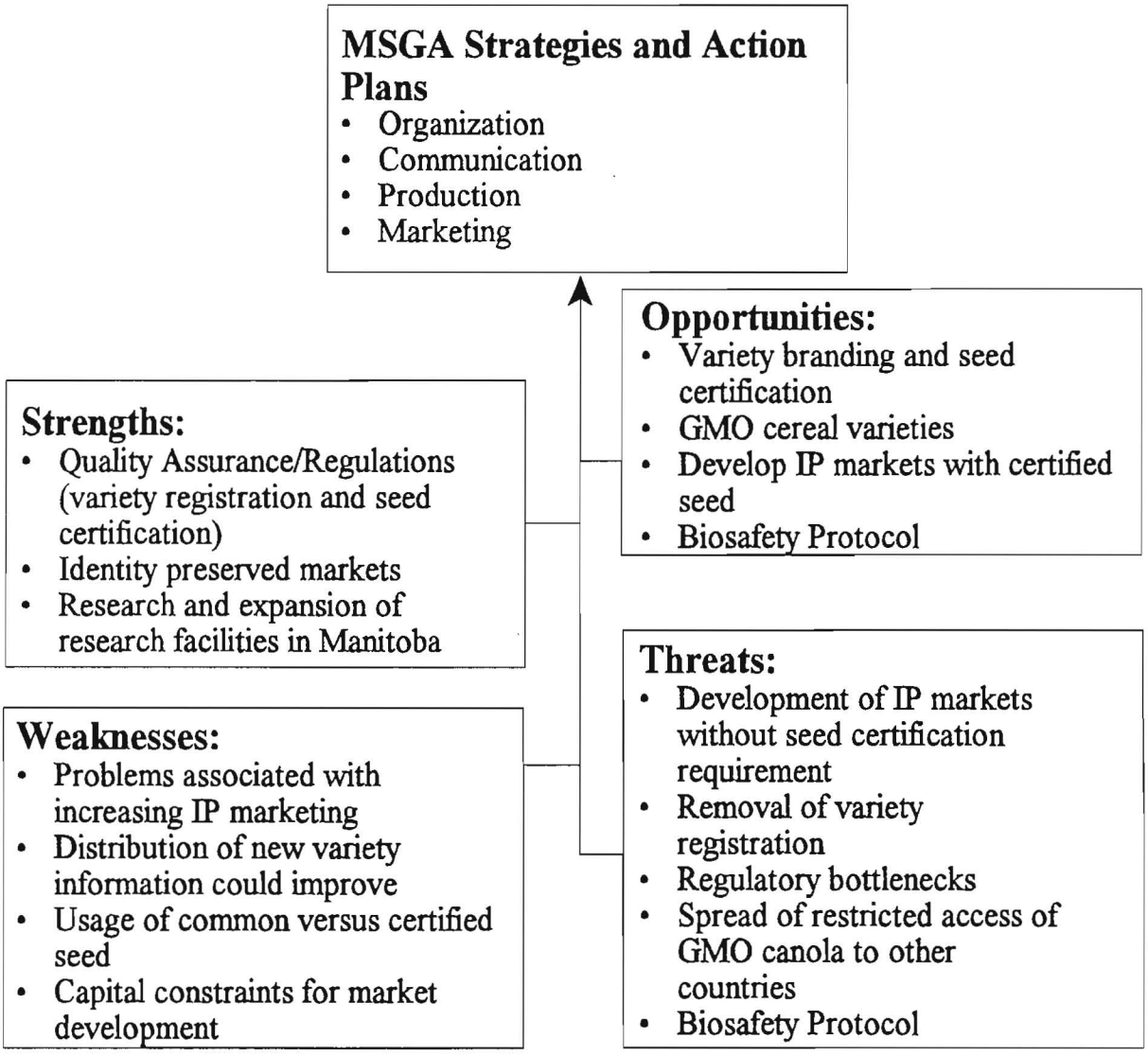

Figure 1.9: Manitoba Seed Industry - Strengths, Weaknesses, Opportunities and Threats

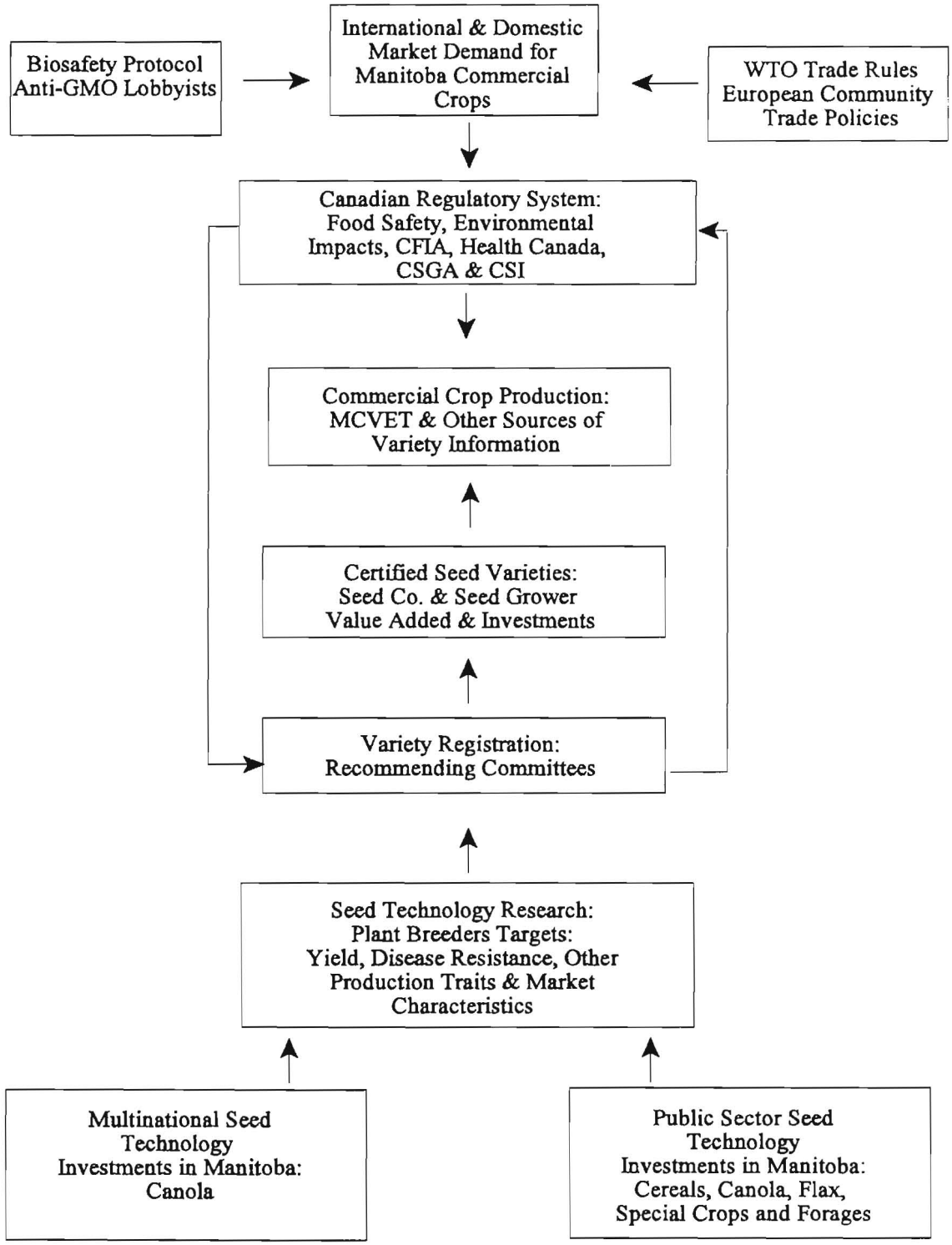

Figure 1.10: Manitoba Seed Industry, Quality Assurance, Value Added & Investment

2 Grower and Industry Survey Results

This chapter estimates the value of sales by seed growers and seed companies. The value of seed grower farm gate sales are based on the results of the grower survey estimates. These results were given in the tables of the *Manitoba Seed Industry: Value Added Economic Impacts Grower Survey Results*, and are hereafter referred to as the Grower Survey Results. Tables 2.1 to 2.2 in this section (as well as Figures 1.1 to 1.8 in the Executive Summary) summarize grower and company 1997/98 sales for the various crop types used in the survey, including Canadian Western Hard Red Spring (CWRS) wheat, durum wheat, other wheats, barley, special crops, flax, canola, peas, and forage seed.[5] Each of these crop types are profiled in Appendix 1 giving estimates of seed growers' production and supply, disposition and farm gate sales, market distribution of certified seed, total sales, and value added or gross domestic product (GDP) from the seed industry.

The farm gate sales values given in Tables 2.1 to 2.3 represent gross sales value from all production from acreage registered for certified seed production. This production was dispersed as either sales as certified seed, or commercial grain, or screenings, or was kept as inventory. Because one of the goals of the study was to estimate the value of certified producers' 1997 production on their certified acreage, the value of each of these is included in determining farm gate sales value. This is the case even if a portion or all of the crop grown on land intended for certified sales generates revenue through commercial crop sales or screenings. Producers may sell crops grown as pedigreed into the commercial crop market because the crop does not meet quality requirements for pedigreed seed, or because they cannot find a market for the pedigreed seed. Reference to seed sales hereafter, therefore, refers to that portion of the crop actually sold as seed for sowing. Sales values for grain used specifically for seed, therefore, represents only a portion of the total sales values in Table 2.1 and as will be shown in Table 2.2. The sales values used throughout this report are only for that acreage on which the producer intended to grow certified seed, and do not include any of the producer's commercial grain acreage. Producers were not asked to give any sales information on their commercial grain acreage.

Some seed producers also have seed processing facilities and can earn extra revenue from these facilities. Producers were asked to give the sales values and production costs for their seed processing facilities and these are given in the report as producer/processors, and refer only to the revenue/costs of the processing facilities. From the survey results, an estimated 22.4 percent of seed growers also have seed processing facilities.

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[5] Other wheats include Winter Wheat, Canada Prairie Spring (CPS) and Canada Western Extra Strong (CWES). Although winter wheat was given separately in the Grower Survey results, it has been combined with other wheats in this section. For special crops, oats are given separately, and canary seed and rye are given together as other special crops. For pulse crops, peas are given separately. The remaining special and pulse crops are combined together as other crops, because the information was not as detailed for these crops.

Table 2.1: Manitoba Seed Industry 1997/98 Sales

Crop Type	Farm Gate Sales from Pedigreed Acreage[1]	Seed Co. Sales Net of Seed Costs[2]	Total Sales
	----------$ Million ----------		
CWRS Wheat	22.62	1.36	23.98
Durum Wheat	1.35	0.11	1.46
Other Wheat (Winter, CPS, CWES)	4.56	0.62	5.18
Barley	7.58	0.53	8.11
Oats	4.03	0.46	4.49
Other Specials (Canary Seed & Rye)	0.61	0.2	0.81
Flax	7.97	1.04	9.01
Canola	9.48	77.54	87.02
Peas	6.13	0.79	6.92
Forage Seed - pedigreed	12.04	4.54	16.58
Other Crops[3]	0.78	n/a	0.78
Subtotal	$77.15	$87.19	$164.34
Forage Seed - common	8.71	2.64	11.35
Producer Seed Processing Activities	6.54	--	6.54
Total Sales	**$92.40**	**$89.83**	**$182.23**

[1]Includes all sales from pedigreed acreage including seed that was sold as seed, or screenings or that had to be sold as commercial grain, as well as value of inventory change.
[2]Seed company sales values are net of seed costs to avoid double counting of seed; company sales values were estimated using a mark-up over farm gate sales by crop type based on company survey results; value for canola includes a sales value of $19.8 million for imported seed (net of seed cost), plus the value of technology use agreements.
[3]Other crops include other specials and pulses (mustard, lentils, buckwheat, triticale and beans).

Sources: Grower Survey Results and Industry Survey Results; numbers may not all add due to rounding.

Table 2.2: Manitoba Seed Producers 1997 Sales, Market Distribution from Seed Acreage and Final Sales Value

	CWRS	Durum Wheat	Other[1] Wheats	Barley	Oats	Other[2] Specials	Flax	Canola[3]	Peas	Cert. Forage	Other[4] Crops	Total
Acres of Seed Planted	114,698	6,053	24,032	36,341	12,415	2,773	32,194	19,476	25,524	47,502	4,354	325,362
						million dollars						
Seed Sales	$13.54	$0.69	$2.61	$5.00	$3.16	$0.47	$5.79	$7.94	$3.41	$12.04	0.7	55.35
Commercial Grain Sales	6.4	0.66	1.19	1.39	0.5	0.015	1.24	0.91	1.68	0	0	13.99
Screenings Sales	2.36	0.08	0.51	0.73	0.44	0.07	1.24	0.64	0.26	0	0.08	6.41
Change in inventory	1.37	-0.05	0.27	0.83	0.24	0.06	0.4	0	0.78	0	<0.01	3.91
Cost of seed purchased for resale	-1.05	-0.03	-0.02	-0.38	-0.31	0	-0.69	0	0	0	0	(2.48)
(1) Farm Gate Sales (FGS)	**22.62**	**1.35**	**4.56**	**7.58**	**4.03**	**0.61**	7.97	**9.48**	**6.13**	**12.04**	**0.78**	**77.15**
% of FGS's value from Seed Sales	59.9%	51.1%	57.2%	66.0%	78.4%	77.0%	72.6%	83.8%	55.6%	100.0%	n/a	71.7%
Distribution of Farm Gate Sales of Certified Seed												
Seed Multiplication	1.00	0.00	0.04	0.26	0.03	0.01	0.20	0.30	0.18	0.00	n/a	2.01
To Commercial Producers	6.53	0.31	1.16	2.62	2.06	0.02	3.08	1.98	1.41	0.00	n/a	19.17
Producer Exports to other Provinces	0.44	0.05	0.00	0.26	0.03	0.00	0.15	0.00	0.00	0.00	n/a	0.93
Producer Exports to the United States	2.48	0.09	0.00	0.65	0.00	0.00	0.00	0.13	0.00	0.00	n/a	3.35
To Marketing/Seed Cos.	3.10	0.24	1.42	1.21	1.04	0.45	2.36	5.52	1.81	12.04	n/a	29.18
Total Seed Sales	13.54	0.69	2.61	5	3.16	0.47	5.79	7.94	3.41	12.04	0.7	55.35
(2) Seed Co. Increase in Value of Seed	**1.36**	**0.11**	**0.62**	**0.53**	**0.46**	**0.20**	**1.04**	77.54	**0.80**	**4.54**	**n/a**	**87.20**
Subtotal Final Sales (1)+(2)	**$23.98**	**$1.46**	**$5.18**	**$8.11**	**$4.49**	**$0.81**	**$9.01**	**$87.02**	**$6.93**	**$16.58**	**$0.78**	**$164.35**
Producer Seed Proc.												**$6.54**
Sales of Common Forage												**$11.35**
Total Final Sales												**$182.23**

[1]Other wheats includes winter wheat, CPS, and CWES wheats
[2]Includes Canary Seed and Rye
[3]Canola seed company increase in value of seed includes $19.8 million sales value net of seed costs for seed imported and processed by seed companies
[4]Other crops include, from Table 2.1, FGS of mustard seed, lentils, buckwheat, triticale and beans.
Sources: Grower Survey Results and Industry Survey Results; numbers may not all add due to rounding.

Table 2.3: Manitoba Seed Producers 1997 Farm Gate Sales, Costs of Production and Value Added from Pedigreed Seed Acreage

	CWRS	Durum Wheat	Other[1] Wheats	Barley	Oats	Other[2] Specials	Flax	Canola	Peas	Cert. Forage	Other[3] Crops	Total
Acres of Seed Planted	114,698	6,053	24,032	36,341	12,415	2,773	32,194	19,476	25,524	47,502	4,354	**325,362**
	---------- million dollars ----------											
Farm Gate Production Sales	**22.62**	**1.35**	**4.56**	**7.58**	**4.03**	**0.61**	**7.97**	**9.48**	**6.13**	**12.04**	**0.78**	**77.15**
Production Costs	13.96	0.67	2.93	4.08	1.68	0.31	4.04	4.73	3.77	7.67	0.55	**44.39**
Prod. Value Added[4]	**8.66**	**0.68**	**1.63**	**3.50**	**2.35**	**0.30**	**3.93**	**4.75**	**2.36**	**4.37**	**0.23**	**32.76**
Producer Processing												6.54
Proc. Costs												2.38
Proc. Value Added[4]												**4.15**
Total Value Added[4]												**36.91**
Production Farm Gate Sales/Acre	---------- dollars per acre ----------											
Sales/Acre	197	223	190	209	325	220	248	487	240	253	179	**237**
Production Costs/Acre	122	111	122	112	135	112	125	243	148	161	126	**136**
Value Added/Acre[4]	**$76**	**$112**	**$68**	**$96**	**$189**	**$108**	**$122**	**$244**	**$92**	**$92**	**$53**	**$101**

[1]Other wheats includes winter wheat, CPS and CWES wheats
[2]Includes Canary Seed and Rye
[3]Other crops include, from Table 2.1, mustard, lentils, buckwheat, triticale and beans
[4]From this value added, producers must pay wages and salaries, municipal taxes, and noncash costs, including opportunity costs and returns to management.

Sources: Grower Survey Results and Industry Survey Results; numbers may not all add due to rounding.

Seed company activities include processing and sales of Manitoba produced seed, as well as, for canola, the value of technology use agreements (TUAs) and the processing and sales of any imported canola seed. Grower farm gate sales values are gross values with no costs deducted; industry values are sales values net of seed cost only, to avoid double counting of the seed.

Other than for forages, these sales estimates pertain only to seed produced from pedigreed seed acreage, and, as such, do not reflect the value of common seed production for the other crops. Common forage seed is an important component of the forage seed industry and is given separately in Table 2.2 and 2.3. Common forage seed production was not estimated through the survey results but by forage seed area estimates from the Manitoba Forage Seed Association.

2.1 Overall 1997 Farm Gate and Company Sales

From Table 2.1, the estimate of total grower and seed company sales value for 1997 is $182.23 million (also see Figures 1.1 and 1.2). This $182.23 million includes $92.4 million of farm gate sales by growers and $89.83 million from seed companies. The $92.4 million of farm gate sales includes $77.15 million from production from growers' certified seed acreage, $6.54 million from processing done on-farm by producers with processing facilities, and $8.71 million of common forage seed sales. The $89.83 million of seed company sales (net of seed costs) includes $87.19 million from certified seed and $2.64 million from common forage seed. Other than for forage seed, Manitoba produced seed is used primarily within Manitoba, whereas only a small amount of forage seed is used domestically, with the bulk exported to the US and foreign markets as well as some exports to other provinces.

Farm gate sales were highest for CWRS wheat, $22.62 million, accounting for 24.5 percent of the $92.4 million total farm gate sales, followed by forage seed, $20.75 million for certified and common seed, accounting for 22.5 percent of total farm gate sales. All wheat combined accounted for $28.53 million, or 30.9 percent of total farm gate sales.

Seed company sales were highest for canola, an estimated $77.5 million, accounting for approximately 86.3 percent of the sales value for seed companies ($89.83 million), followed by forage seed, $7.18 million for certified and common seed, accounting for 8 percent of sales. Of the $77.5 million of company canola sales, an estimated $57.74 million is from Manitoba produced seed and $19.8 million from imported seed (net of seed costs in both cases). Together, canola and forage seeds accounted for 94.2 percent of company seed sales value. Company sales of forage seed (certified and common) are for Manitoba produced seed only, and, therefore is an underestimate of company forage seed sales. An unknown amount of forage seed is imported from other provinces and processed by Manitoba companies, mainly for export out of country.

The aggregate measure of the 1997 economic value of $182.23 million from the Manitoba seed industry was obtained by adding the estimates of seed growers farm gate sales revenues, as well as the sales revenues of seed companies. The largest contributions to this total sales value were made by canola, ($87 million or 47.7 percent of the total), followed by pedigreed and

common forage seed ($27.93 million, or 15.3 percent) and then CWRS wheat ($24.0 million, or 13 percent). These three crops together accounted for close to 76 percent of the sales value (also see Figure 1.3). Contributions to total sales by CWRS wheat was primarily through farm gates sales ($22.6 million of the $24.0 million total sales), while close to a quarter of the contributions by forage seeds were through seed company sales of $7.18 million, and 89.1 percent of the contributions by canola seed were through company sales of $77.54 million. Canola seed company sales revenue includes seed treatment costs and the value of technology use agreements, as well as the value of imported seed.

2.2 Farm Gate Sales and Disposition of Supply

There were 325,362 acres planted to pedigreed seed crops in Manitoba in 1997. As discussed above, the crops grown on acreage registered for certified seed production are dispersed as either sales as certified seed, or commercial grain, or screenings, or kept as inventory. The value of inventory is determined as the value of inventory change between the end of 1997 and end of 1996. This, in effect, will subtract out any inventory from previous years' production and include the value of inventory left from 1997, to take full account of only 1997 production. Ending inventory consists of seed kept by producers for their own use, as well as seed not used in 1998.

Table 2.2 summarizes, for each of the crop types, as well as in total, the value of the above four crop dispersals which together give farm gate sales from pedigreed acreage. Table 2.2 also gives the market distribution of farm gate sales for the portion of the crop sold as seed (also see Figure 1.7). Only the aggregate values are discussed here, each of the crops are discussed individually in Appendix 1. The 47,502 acres of forage seed are for acres registered as certified seed; crop dispersal for common seed was not available.

Total farm gate sales from the 325,362 acres, as given in the previous section, was $77.15 million. Some producers bought and resold seed. To avoid double counting the value of this seed, the cost of these purchases ($2.48 million) was subtracted from farm gate sales, to include only the increase in value. Of the remainder, the amount of the crop that was actually sold as seed was $55.35 million, or 69.5 percent of the value of total production. Sales to commercial grain markets were $14 million, or 17.6 percent of the value of total production. The remainder were screenings sales and the value of change in inventory. Of the crops reported here, forages and canola had the largest percent of their farm gate sales as seed sales (100 percent and 83.8 percent respectively); the wheats and peas had the lowest percent of the available crop sold as seed, all being in the 50 to 60 percent range (see Table 2.2 and Figure 1.5). CWRS wheat for example had $6.4 million of farm gate sales (or 28.3 percent) sold as commercial grain.

Of the $55.35 million in farm gate sales as seed, growers sold $19.17 million (35 percent) to commercial producers for commercial crop production, exported $0.93 million to other provinces and $3.35 million to the US (7.7 percent exported by producers in total), and sold $29.18 million (52.7 percent) to seed or marketing companies. Another $2 million was used for

seed multiplication purposes (see Figure 1.6). Producers sold the largest percentage of their wheat seed to commercial producers (48.2 percent) and then to marketing and seed companies (22.9 percent; see Figure 1.7). All of the certified forage seed was sold to seed or marketing companies (through contract agreements), as was the majority of canola seed (69.5 percent).

2.3 Total Sales Summary

To summarize total sales as given in the previous sections, total farm gate sales from certified seed acreage was $77.15 million, and of this, $55.35 million was sold as seed, of which $29.18 million was purchased by seed or marketing companies. There was another $8.71 million of farm gate sales of common forage seed.

Further processing of the Manitoba produced seed by seed companies (certified seed and common forage seed), as well as an estimated 0.09 million bushels of imported canola seed, gave a sales value to the companies of an estimated $89.83 million, net of costs of seed and including value of TUAs.

In addition, some producers own processing facilities and earn revenue from these facilities. Estimated sales from producer owned processing facilities was $6.54 million.

Total 1997 sales from all these activities was an estimated $182.23 million. This $182.23 million reflects the total sales value from seed acreage and producer processing, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers. The various sales activities which contribute to the $182.23 million of final sales, and which are detailed by crop in Tables 2.1 and 2.2 and have been described in the previous sections are summarized in Figure 2.1.

2.4 Value Added by Crop

The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. The direct value added of the seed growers, for example, would be the value of the sales from the production from seed acreage minus the inputs purchased by the producers. Included with this is the value added by processing facilities owned by growers. In turn, seed companies produce value added when they purchase, process and sell certified seed. Value added then, eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry.

In addition to this direct value added there is also indirect value added by the supplier industries from which the seed growers and seed companies purchase their inputs. Production of these inputs by the supplier industries generates additional value added to the Manitoba and Canadian economy.

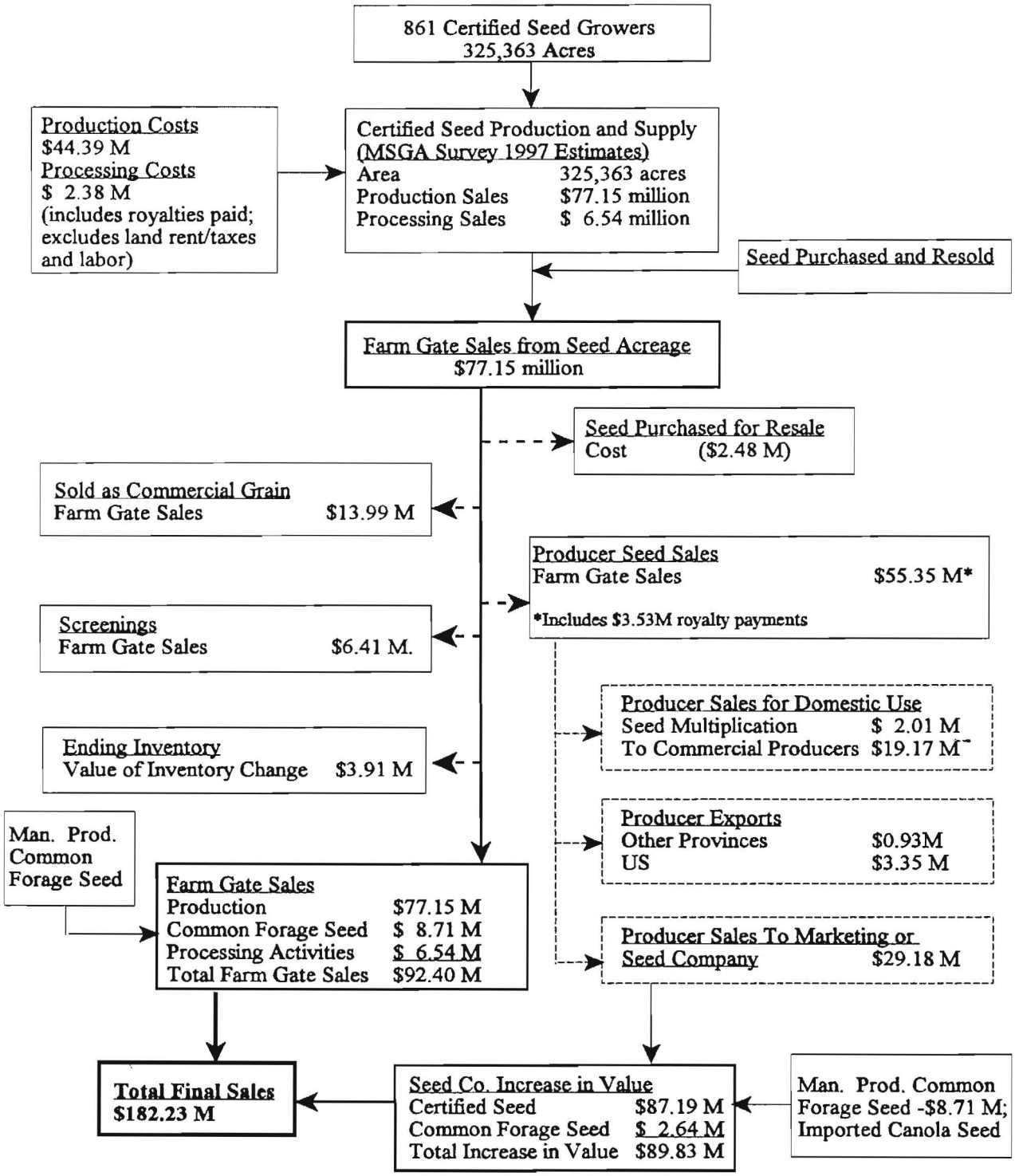

Figure 2.1: Summary of Manitoba Seed Industry - Farm Gate Sales, Company Sales and Total Sales, 1997

The aggregate direct value added by the seed growers is summarized briefly here, and discussed in more detail in Chapter 3 along with other aggregate economic impacts. Discussion is given here and summarized in Table 2.3 on production costs and direct value added (or GDP) for each of the crop types at the farm gate level for pedigreed crop acreage only (also see Figure 1.8). To obtain the value added at the farm gate level, the costs for commodity purchases are subtracted from the sales value. These costs do not include cash costs which growers must pay such as municipal taxes, wages, land rent, interest on debt and non cash costs such as depreciation but do include royalty payments (as was done in Summary 1 and Summary 2 of the Grower Survey Results). Table 2.3 does not include the value added by crop for seed companies; value added by seed companies is given on an aggregate basis only in the next chapter. Table 2.3 also does not include value added for common forage seed. This can be calculated, however, from the information given in Figure A1.9 in Appendix 1. Production costs per acre are apparently very similar for common and pedigreed forage seed. Applying the $161 per acre of production costs to the estimated 37,498 acres of common forage seed gives production costs of $6.04 million and an estimated value added of $2.67 million ($8.71 million minus $6.04 million), or $71 of value added per acre.

Total production costs for seed producers were estimated at $44.39 million for the 325,362 acres, or $136 per acre. Chemicals, fertilizer, seed, custom processing and royalties are major production costs (see Table 3.5). With farm gate sales of $77.15 million, this gives a production value added of $32.76 million, or $ 101 per acre. *From this $32.76 million of value added, producers must pay cash costs such as municipal taxes, wages and salaries and non cash costs including opportunity costs and returns to management.* Total producer/processing costs were estimated at $2.38 million, and with producer/processing sales of $6.54 million, this gives a value added of $4.15 million from producer processing, and a total value added for producers of $36.91 million (see Table 2.3).

The seed growers production input expenditures of $44.39 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

The largest contributions to the total production value added of $32.76 million were made by CWRS wheat ($8.66 million), followed by canola ($4.75 million), and forage seed ($4.37 million). The highest per acre production costs were found in canola ($243/acre), followed by forage seed ($161/acre; see Figure 1.8). The largest value added per acre was generated by canola ($244/acre), followed by oats ($189/acre), and then flax ($122/acre). With the exception of durum wheat (value added of $112/acre), the wheats generated the lowest value added per acre in 1997; CWRS wheat had a value added of $76/acre and the other wheats a value added of $68/acre.

3 Economic Impacts of the Pedigreed Seed Industry on the Manitoba Economy

The purpose of this chapter is to provide estimates of the economic impacts of the pedigreed seed industry on the Manitoba economy. Canada's pedigreed seed industry impacts the Manitoba economy in a number of ways. The farm gate sales of producers and producer/processors and the industry sales by seed companies that have been presented in the previous chapter on survey results give an indication of the importance of the industry and the contribution it makes to the provincial economy.

The estimated direct value added impacts were given in the previous chapter on a per crop basis. The aggregate value added impacts are examined in more detail in this chapter. This includes looking at the components of this direct value added, as well as estimation and discussion of the indirect value added impacts. Direct and indirect value added together give total impacts.

3.1 Total Economic Impacts of Manitoba's Pedigreed Seed Industry

This section summarizes total impacts of the pedigreed seed industry, as given in Table 3.1. This includes the direct and indirect value added impacts, as well as employment, research investment, and producers' current and planned investment. Each of these are discussed in the following sections.

The direct value added economic impacts of an industry, or its GDP, is the value of the commodities produced by that industry minus the value of commodities purchased for production. From this value added the industry must then pay wages and salaries, business income and any indirect taxes. Estimated direct value added from growers and seed companies is $67.73 million.

The value added produced from purchases from supplier industries by seed growers and seed companies is considered the indirect economic impact. Indirect economic impacts were an estimated $42.64 million.

Direct and indirect value added together gave an estimated total impact of $110.37 million.

A component of direct value added is salaries and wages. Producers and seed companies paid an estimated $16.68 million in salaries and wages. This was for an estimated 406 full-time paid employees of producers and seed companies and, for growers and grower/processors, 899 part-time and seasonal employees.

Table 3.1: Seed Industry Total Impacts on Manitoba Economy, 1997

	Certified Seed Growers	Common Forage Growers	Seed Companies	Total Impact
Value Added Impacts ($ million)				
Direct Value Added	$36.91	$2.67	$28.15	$67.73
Indirect Value Added	$17.42	$2.25	$22.97	$42.64
Total Value Added Impact	$54.33	$4.92	$51.12	$110.37
Direct Employment				
Wages & Salaries ($million)	$9.41	n/a	$7.27	$16.68
Full-time Paid Employees	251	n/a	155	406
Part-time and Seasonal Employees	899	n/a	n/a	899
Direct Investment ($million)				
Current Investment	$337.65	n/a	n/a	$337.65
Planned Investment (1998 - 2002)	$69.68	n/a	n/a	$69.68
Research				
Public and Private Research				$22.90

Sources: Tables 3.2 and 3.4; numbers may not add due to rounding.
n/a - not available

The strength of an industry at any point in time can be indicated by the investments and outlook of the stakeholders involved. Seed growers currently have an estimated $337.65 million invested in land, machinery and equipment exclusively for their seed growing and processing operation. Seed growers were also planning on investing an estimated $69.68 million for expansions or replacements over the five years from1998 to 2002.

Value added impacts are estimated from a seed sales or revenue perspective. Part of seed company revenues are allocated on an annual basis to investments in seed research in Manitoba. Research expenditures by seed companies are expected to generate future sales revenues. In addition, a large percentage of the annual Manitoba research expenditures are by public institutions which reflects the public value placed on the Manitoba seed industry. Research expenditures for 1997 were an estimated $22.90 million.

Figure 3.1 summarizes the value added economic impact of the seed industry to Manitoba. Variety development and breeding research expenditures creates employment directly and indirectly, in addition to contributing to the maintenance and development of high quality seed varieties. Seed growers, in turn, play an important role in maintaining and reproducing high quality seed for commercial production, and in the process produce seed growers' direct and indirect value added. Seed companies add further value added to seed produced by growers and make additional expenditures. Variety development and breeding research and seed production all contribute to Manitoba's commercial crop production of $1.62 billion farm gate value for grains, oilseeds, forage and specialty crops in 1997 and the $1.66 billion of exports of these commodities in both processed and unprocessed form.

3.2 Direct Economic Impacts

The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of inputs purchased for the production of those commodities. The direct value added of the seed growers then would be the value of the sales from the production from seed acreage minus the inputs purchased by the producers. Included with this is the value added by processing facilities owned by growers. Value added then, eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by the seed growing industry.

Table 3.2 gives the estimated direct economic impacts of the seed industry on the Manitoba economy. Direct impacts are estimated using the results from the grower and industry surveys; with the sales and GDP (or value added) figures as were given in Tables 2.1 to 2.3. Direct economic impact values for seed growers are given for certified seed growers as well as for common forage seed. Although no cost of production information was collected for common forage seed through the survey, value added was calculated as described in Section 2.4. Seed company sales include their sales of Manitoba produced certified and common forage seed, but do not include resale value of imported forage seed, as the trade of forage seed between provinces is unknown. This lack of knowledge on the movement of forage seed between provinces has been identified as a weakness of the seed industry (Huebner, G., personal communication).

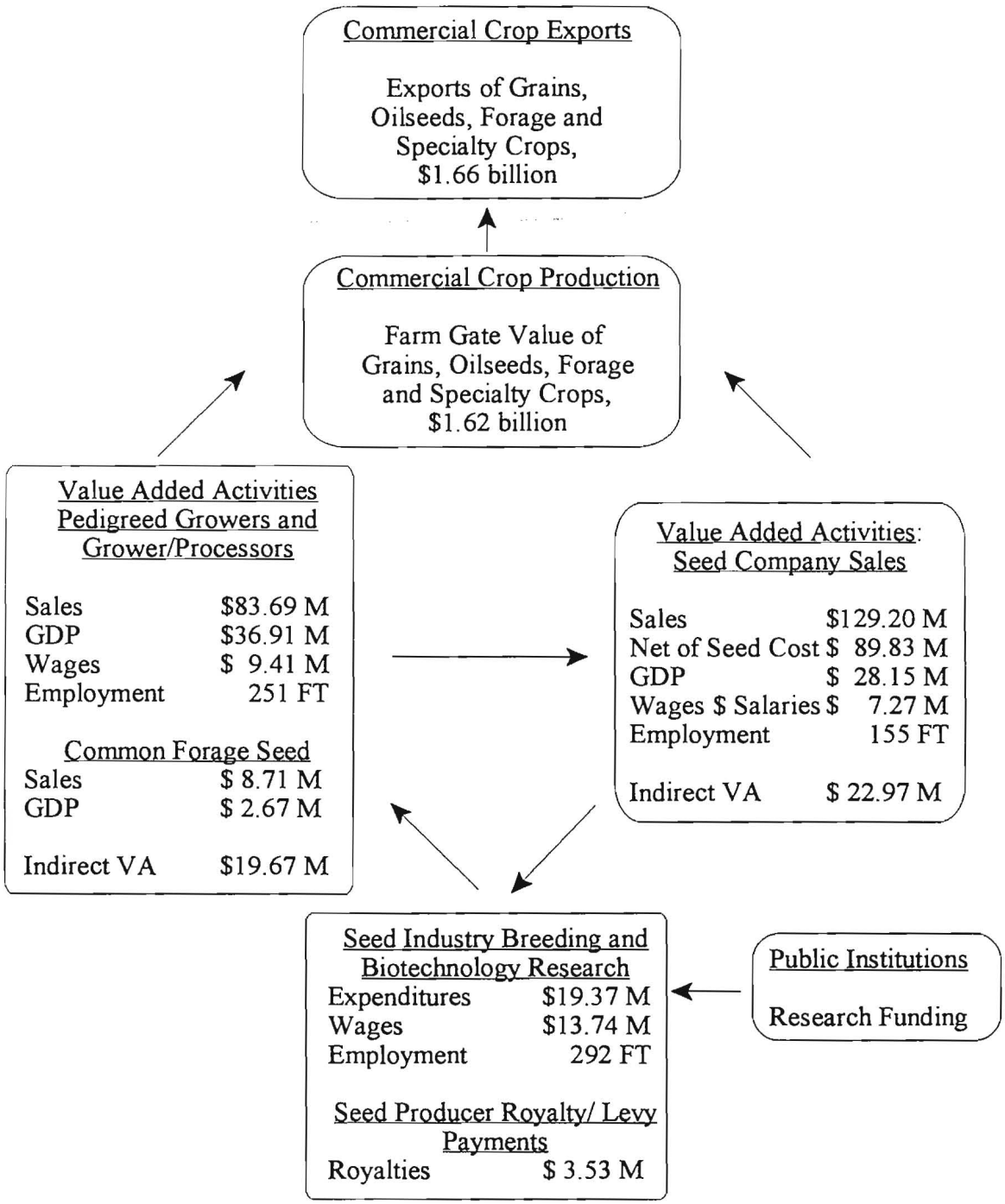

Figure 3.1: Value Added Economic Impact of the Seed Industry to Manitoba, 1997

Sources: Tables 3.2 and A2.1.

Table 3.2: Seed Industry Total Direct Economic Impacts on the Manitoba Economy, 1997

	Certified Growers		Common Forage Production	Seed Company	Total
	Production	Processing			
	$ million				
Sales	$77.15	$6.54	$8.71	$89.83[1]	$182.23
Purchases	$44.39	$2.39	$6.04	$61.68	$114.50
Direct VA (GDP)	$32.76	$4.15	$2.67	$28.15[2]	$67.73
Wages/salaries	$6.82	$2.59	n/a	$7.27[3]	$16.68
Employment:	persons				
Paid Full-time	186	65	n/a	155[4]	406
Paid Part-time	226	45	n/a	n/a	271
Paid Seasonal	546	82	n/a	n/a	628
Unpaid FTE	1026		n/a	n/a	1026
Seed Industry Research (17 companies and public institutions):[5]					
Expenditures ($ million)					$19.37
Employment (persons)					292
Wages ($ million)					$13.74
Grower Royalties/Levies ($ million)					$3.53

[1]Seed company sales are net of seed costs. Seed costs were an estimated $39.37 million ($29.18 million from Manitoba certified seed growers, $8.71 million common forage and the remainder imported canola seed). Adding $39.37 million seed costs to $89.83 million from Table 2.1 gives $129.2 million total sales with seed costs.
[2]Seed company value added (GDP) was estimated by multiplying seed company sales, including seed purchases, by the ratio of company value added to sales ($129.20 x 0.2179). The company value added to sales ratio (0.2179) was obtained from the seed industry survey. Financial information from eight seed companies was used to estimate the ratio. Seed company purchases were calculated as Sales minus Direct VA.
[3]Seed company wages were estimated by multiplying average wages and salaries (including benefits) by the number employed ($46,912 x 155).
[4]Seed Company employment was estimated by dividing total seed company sales by the sales to employment ratio, as obtained from the seed industry survey ($129.20/$0.835). Sales and employment data were given by 13 seed companies.
[5]Seed industry research is a summary of the information obtained from the industry survey and which includes information from 13 seed companies and 4 public institutions. Research impacts cannot be added to grower and seed company impacts to comprise part of total impacts; some of research expenditures are accounted for in seed company purchases and some of research wages and employment are also accounted for in company wages and employment.
Sources: Tables 2.1,2.3, Grower Survey Results and Industry Survey Results; numbers may not add due to rounding.

3.2.1 Growers and Grower/Processors Sales, Value Added and Employment.

Pedigreed seed production activities of the 861 certified seed growers in Manitoba in 1997 generated total farm gate sales of $77.15 million (Table 3.2, and as was given in Table 2.1). Subtracting the costs of inputs from this sales value gives a contribution to GDP of $32.76 million. From this GDP, growers paid $6.82 million in wages and salaries in 1997 to paid employees (see Grower Survey Results, Summary 5b). It is estimated that for all of Manitoba, seed growers employed 186 full-time, 226 part-time and 546 seasonal hired employees in 1997.

Total farm gate sales for grower processing activities was $6.54 million in 1997, with a GDP of $4.15 million. Grower/processors paid $2.59 million in wages and salaries to paid employees. The estimated number of hired employees in 1997 was 65 full-time, 45 part-time and 82 seasonal. Together growers and grower/processors contributed $36.91 million of value added in 1997.

The number of unpaid full-time equivalents (FTE) employed by certified growers and growers/processors was 1,026. Unpaid FTE's would include owner/operators that do not pay themselves a wage, as well as any unpaid partners or family labour. Owner/operators that do pay themselves a wage would be included in the above estimates for wages and salaries.

Estimates for grower employment are for certified growers only, no employment estimates were made for common forage seed production,

3.2.2 Seed Company Sales, Value Added and Employment

Seed company sales net of seed costs were estimated from survey results as $89.83 million for 1997 ($129.20 million of sales minus $39.37 million of seed costs; Table 3.2), as was given in Table 2.1. Subtracting other commodity purchases of $61.68 million gives an estimated GDP for seed companies of $28.15 million. The estimated number of employees was 155 full-time equivalents, with wages of $7.27 million. As total employment for the seed companies was estimated as full-time equivalents, no part-time or seasonal employment figures were estimated.

3.2.3 Seed Industry Research and Producer Royalty Payments

Variety development and breeding research provides the technology for maintaining and improving the seed quality, plus provides employment directly and indirectly. Expenditures in Manitoba for seed research for 1997 was estimated as $22.9 million ($19.37 million plus an estimated $3.53 million in royalty and levy payments by seed growers). Research employment was an estimated 292 full-time equivalents with wages of $13.74 million. This includes research by 17 private and public institutions. Of the $3.53 million of royalty and levy payments collected from seed growers, royalties are returned to the seed breeder and used for further research, and levies are operational revenue for those marketing seed varieties. Employment figures for research cannot be added to employment for seed companies as some of the former would already be included in the latter and double counting would occur.

3.2.4 Components of Seed Growers' Direct Value Added

The value added contribution to the Manitoba economy in 1997 of $36.91 million by the pedigreed seed growers production and processing activities, is estimated as the sum of the production and processing gross margins, or value added ($32.76 million plus $4.15 million, Table 3.2). From a financial performance perspective, the value added or gross margin is the amount of cash available to pay for labour, management, indirect taxes and the capital required for operating the business. These components of value added are summarized in Table 3.3 and include values for certified seed growers and growers/processors together.

Table 3.3: Value Added Components of Manitoba Certified Seed Growers (Growers and Grower/Processors), 1997

	Manitoba Seed Growers[1]	
	Totals	**Per Producer**
Number of Producers	861	
1. Total Sales	$83,690,000	$97,201
2. Production Costs[2]	46,770,000	54,321
3. Value Added (1-2)	36,910,000	42,869
4. Wages & Salaries	9,406,000	10,925
5. Property Taxes	1,842,000	2,139
6. Returns before Noncash Costs Deducted (3-4-5)	25,662,000	29,805
7. Depreciation & Opportunity Costs	29,236,000	33,956
8. Returns to Mgmt. (6-7)	**($3,574,000)**	**($4,151)**

[1] Numbers may not all add due to rounding.

[2] Production costs are net of taxes, rent, salaries and wages, and depreciation; taxes, salaries and wages and depreciation are components of value added; rents are assumed to be transfers between Manitoba producers and Manitoba landowners.

Sources: Manitoba seed grower data from survey estimates; numbers may not add due to rounding.

The depreciation and opportunity cost for seed growers was estimated at $29.24 million (from Grower Survey Results, Table Summary 5b). The value of assets was multiplied by an opportunity cost of capital of 6 percent plus a depreciation allowance of 5 percent for buildings and 10 percent for machinery (Table 4, Grower Survey shows values of land, buildings and machinery/equipment for survey respondents). Although not illustrated in Table 3.3, the normal

accounting procedure would be to subtract the noncash costs to give returns to labour and management. Subtracting depreciation and opportunity costs of $29.24 million from the total gross margin of $36.91 million gives a return to labour and management of $7.67 million. Deducting wages and salaries paid of $9.41 million and municipal taxes of $1.84 million gives a negative aggregate value of -$3.57 million for payment to management. Looking at seed growers on a per producer average basis (with no weighting for size of operation), Manitoba seed growers had an average returns to management of -$4,151 per producer in 1997. The net income for individual growers and processors will vary substantially from this aggregate average (Table 3 and Table 7, Grower Survey).

The opportunity cost reflects an estimate of what the producers could have earned had they put the money invested in land, equipment and buildings into another type of investment earning an estimated six percent on the dollar. The reasoning is that for seed production and processing to be a profitable venture for producers, then after all other costs have been deducted from revenues there should be enough for payment of these opportunity costs as well as payment to the producers for their own labour and management (if it hasn't already been deducted in wages and salaries).

The average negative returns to management of -$4,151 per producer indicates that after depreciation and opportunity costs are deducted there is no revenue left for the producer's payment or profit. The questions in the survey on wages and salaries did not ask if any of these wages and salaries were for paying the producer, however, the survey results estimated 1,026 unpaid full-time equivalents (FTE's) for the province's seed growers.

Alternatively, and as illustrated in Table 3.3, seed growers in aggregate could ignore depreciation and opportunity cost payments of $29.2 million and use the funds as a payment to labour and management. From Table 3.3, returns to labour and management before noncash costs are deducted are $25.66 million or an average of $29,805 per producer.

To get an idea of the seed growers position relative to other Manitoba agricultural producers, the similar calculations as were done for the seed producers were done for all Manitoba agricultural producers using Manitoba Agriculture data (from Manitoba Agriculture Yearbook, 1997). This included all agricultural producers (eg. livestock, crops, horticultural, etc.) and so is not a direct comparison between seed production and commercial crop production, but gives some basis for comparing seed production to the aggregate agricultural production industry. For the 24,383 agricultural producers in Manitoba in 1997 the calculations, with depreciation and opportunity costs deducted, indicated a negative aggregate value of -$412 million for payment to management, giving an average of -$16,912 per producer, indicating that seed growers were in a better position than the average Manitoba agricultural producer.

3.2.5 Seed Growers 1997 Income Relative to Previous Years

Survey respondents were asked to indicate how their 1997 net income compared to previous years (see Table 3 in Grower Survey Results). Of the large growers that responded, 58.9 percent indicated 1997 income was average, 28.6 percent indicated 1997 income was below average and 12.5 percent indicated their 1997 net income was above average. The above average

group indicated net income was 26 percent above average and the below average group indicated net income was 29.4 percent below average. Of the small grower respondents, 51.5 percent indicated their 1997 net income was average, 39.4 percent indicated it was below average and 9.1 percent indicated it was above average. The above average group indicated net income was 18.3 percent above average and the below average group indicated net income was 62.3 percent below average.

Of the large grower/processors that responded, 62.5 percent indicated their 1997 net income from seed processing was average, 31.2 percent indicated it was below average and 6.2 percent above average. The above average group indicated net income from processing was 40 percent above average and the below average group indicated net income was 14.4 percent below average. Of the small grower/processors, 40 percent felt their 1997 net income from processing was average and 60 percent felt it was below average. The below average group indicated net income was 65 percent below average.

3.3 Indirect Economic Impacts

The direct value added economic impacts discussed above are the contributions of the seed industry to the economy after the costs of commodity purchases or services have been deducted. These costs are deducted because they are the value added to the economy by the industry that produced the commodity, and, therefore, including them would cause double counting of value. However, because they are value produced by other industries because of the business given to these industries by the seed industry, they may be referred to as indirect impacts of the seed industry. Indirect impacts are summarized in Table 3.4. Indirect impacts were calculated by multiplying purchases by a value added to output ratio of 0.372434 as calculated by MacMillan and De Matos (1992).

Total costs of production for Manitoba's certified seed production and processing were estimated at $46.8 million ($44.4 million for production and $2.38 million for processing; also see Table 2.3). Production of these inputs by the supplier industries generates additional indirect value added to the Manitoba and Canadian economy of an estimated $17.42 million ($16.53 million for production and $0.89 million for processing).

Total costs of production for Manitoba's common forage seed production were an estimated $6.04 million which related to an indirect value added of $2.25 million.

Seed company purchases (excluding seed purchases) were estimated at $61.68 million, which, in turn, related to an indirect value added contribution of $22.97 million.

From the above, total purchases were an estimated $114.5 million, resulting in an estimated total indirect value added impact of $42.64 million. Grower municipal taxes paid by growers and grower/processors totaled $1.84 million.

Table 3.4: Indirect Economic Impacts of the Seed Industry on the Manitoba Economy, 1997

Grower Farm Gate Production	
Purchases from other sectors	$44.39 million
Indirect value added	$16.53 million
Grower Processing	
Purchases from other sectors	$ 2.38 million
Indirect value added	$ 0.89 million
Common Forage Seed Production	
Purchases from other sectors	$6.04 million
Indirect value added	$2.25 million
Seed Companies	
Purchases from other sectors excluding seed purchases	$61.68 million
Indirect value added	$22.97 million
Total Indirect Impacts	
Total Purchases from other sectors	$114.5 million
Total Indirect value added	$42.64 million
Grower Municipal Taxes	
Grower production	$ 1.54 million
Grower processing	$ 0.30 million

Sources: Purchases from Grower Survey Results and Seed Industry Results. Purchases multiplied by a value added/output ratio of 0.372434 (from MacMillan and De Matos, 1992) to get indirect value added.

3.3.1 Seed Grower Input Purchases

Table 3.5 gives the total estimated purchases by major purchase type, for all Manitoba seed producers from the Grower Survey Results (does not include seed processing purchases). Forage seed is given separately from the other crops. Chemicals and fertilizer purchases accounted for the largest proportion of total purchases, together accounting for approximately 36 percent of purchases. Seed purchases accounted for close to 12 percent of total purchases. Custom processing costs were $4 million for crops other than forages. Processing costs for forages were $0.13 million; all forage producers in the survey sold their seed to a seed or marketing company, and therefore most producers would sell seed to these companies unprocessed. Custom pollination costs of $2.71 million applied only to forage seed producers, accounting for 35 percent of their total costs.

Table 3.5: Manitoba Seed Growers Total Input Purchases for Seed Production, 1997[1]

	All Crops Except Forages	Certified Forages	Total Crops	Percent of Total
Number of Acres	277,860	47,502	325,362	
Sector	----------Millions of Dollars----------			
Royalties & Levies	$3.55	$0.00	$3.55	8.00%
Chemicals	6.36	1.64	8.00	18.02%
Fertilizer	7.32	0.91	8.23	18.54%
Seed	4.96	0.24	5.20	11.71%
Custom Processing	4.00	0.13	4.13	9.30%
Custom Pollination	0.00	2.71	2.71	6.10%
Marketing Costs	0.36	0.04	0.40	0.90%
Inspection Fees	0.57	0.11	0.68	1.53%
Bags & Tags	0.04	0.00	0.04	0.09%
Others[2]	9.58	1.88	11.46	25.81%
Total Costs	**$36.74**	**$7.66**	**$44.39**	**100.00%**

[1]Does not include seed processing purchases.
[2]Others includes fuel, utilities, repairs, custom work, insurance, and interest on operating.
Sources: Grower Survey Results, Tables 5A & 5B; royalties from Summary 6b; numbers may not all add due to rounding.

Summary 5a and 5b in the Grower Survey Results and Table 2.3 gave the estimated total cost of production of each of the crop types for all Manitoba seed producers. Purchases were highest for CWRS wheat, $14 million, followed by forages, $7.67 million.[6] The large producer group accounted for almost 74 percent ($33 million) of the total purchases.

3.4 Grower Assets, Outlook and Expectations for the Future

A measure of the strength of an industry is the capital invested in that industry, the outlook of the stakeholders, and the plans they have for their business. The grower survey asked respondents for estimates of their current investments for land, machinery and buildings and the proportion used specifically for their seed growing or processing operation. They were also asked if they had expanded in the recent past and to indicate their future expansion plans.

The 55 large growers that responded had an average of $370,602 per grower invested in land for seed production, and the 31 small grower respondents had an average of $127,495 per grower. Large respondents had 40 percent of their land (owned and rented) in seed production and 60 percent in commercial grain production. Small respondents had 21 percent of their land in seed production and 79 percent in commercial grain production. Small grower respondents had slightly more per grower invested in land for commercial grain production than did large growers ($374,898 per grower for small growers and $364,212 for large growers).

The large growers that responded had an average of $117,550 invested in buildings used strictly for their seed business (production and processing) and an average of $254,601 invested in machinery and equipment used strictly for their seed business. Small grower respondents had, for the same investments, $46,698 on average for buildings and $98,436 for machinery and equipment. Large grower and small grower respondents had similar debt to asset ratios for their seed production and processing business, both close to the 12.5 percent level.

An equal proportion of the large and small respondents, 35 percent, indicated they had expanded in the past three years, with an equal average value of expansion of $122,182 per producer expanding. Sixty-one percent of the large grower respondents have replaced equipment in the past three years (average of $94,169 per respondent replacing), compared to 51.6 percent of the small grower respondents (average of $110,856 per respondent replacing).

Fifty-four percent of large respondents and 60 percent of small respondents indicated they planned to expand sometime within the 5 years between 1998 to 2002. Average value of expansion intentions were $121,944 per producer for the large grower respondents and $100,311 per producer for the small grower respondents. Sixty-two percent of large respondents and 56.4

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[6]Costs per acre for each of the crops for seed production and by large or small grower size are given in Summary 2 and the main Tables 5A and 5B of the Grower Survey Results, with the figures in Summary 2 including royalty payments. Tables 5A and 5B of the Grower Survey Results gives detailed information on the types of purchases, and the differences between purchases for seed production versus for commercial production.

percent of small respondents planned to replace equipment sometimes within the five year period. Average value of equipment replacement plans were $112,667 per producer for the large group and $63,647 for the small group.

Using the survey results, estimates were made for assets and investment decisions for all of Manitoba (for 861 producers in total). Table 3.6 summarizes producers' total fixed assets for land, buildings, machinery and equipment for 1997, as well as recent investment decisions and future investment plans for seed production and processing operations only (Tables 4 and 11 of the Grower Survey Results gives the detailed results). The 861 seed producers and producer/processors had estimated investments of $195.81 million for land, $43.86 million in buildings and $97.98 million for machinery and equipment for their seed growing and, if applicable, processing operations. This gave a total investment of $337.65 million in fixed assets for land, buildings, machinery and equipment in 1997.

Table 3.6: Manitoba Seed Growers Investment in their Seed Producing and Processing Operations - 1997 Fixed Assets, and Previous and Future Investments

861 Manitoba Producers	**All Producers $ million**
Fixed Assets:	
Land	195.81
Buildings	43.86
Machinery & Equipment	97.98
Total Above Assets	**$337.65**
Investments Made from 1995 - 1997:	
Expansions	26.19
Replacements	35.62
Total Previous Investments	**$61.81**
Annual Previous Investments	**$20.60**
Planned Investments for 1998 - 2002:	
Expansions	37.56
Replacements	32.14
Total Future Investments	**$69.68**
Annual Future Investments	**$13.94**

Sources: Calculated from data in Tables 4 and 11 of Grower Survey Results; numbers may not all add due to rounding.

The total value of expansions over the past three years for all Manitoba seed growers was estimated at $26.19 million and total replacements were estimated at $35.62 million. This gave total estimated investments during the 1995 to 1997 period of $61.81 million, or $20.6 million per year.

The total value of planned expansions for the five year period from 1998 to 2002 for all Manitoba seed growers was estimated at $37.56 million, and total planned replacements were estimated at $32.14 million. This gives total planned investment during the 1998 to 2002 period of $69.68 million, or $13.94 million annually. Thus, producers either plan on reducing their investments during the 1998 to 2002 period, in comparison to the 1995 to 1997 period, or were cautious about estimating future intentions for as far as five years into the future.

Table 11 of the Grower Survey Results also illustrates seed growers current activities and their expectations for a number of activities over the next five years, as well as their number of years of experience. This information is summarized in Table 3.7, giving the sample responses for the large and small grower groups and using these to estimate Manitoba totals for all 861 growers in 1997. Regarding their current seed growing activities, 45.4 percent of the respondents are a member of a seed grower group, 67.1 percent produce seed under contract to other growers and about 11 percent contract other growers to produce seed for them. It is mainly the large growers that contract other growers.

With regard to intended activities over the next five years, an estimated 7.7 percent plan to go out of business and another 17.5 percent plan on retiring. Of note is that in 1997 there were 861 MSGA members and in 1999 there were 785 members, a reduction of 9 percent; some of this decrease, however, may be attributed to unseeded pedigreed acres caused by the spring flooding and wet conditions at seeding time in parts of Manitoba in 1999.

An estimated 35.7 percent of growers plan on expanding their retail sales and 9.2 percent plan on reducing their retail sales. An estimated 54.4 percent plan on increasing their acreage contracted to a company and only 2.1 percent plan a reduction in this area.

Seed growers have, on average, 17 years of experience in the seed growing business and 18 years in the processing business, indicating a significant number of years in the seed industry for Manitoba growers. Large growers have been in the seed production and processing business, on average, for a longer period than small growers (20 and 15 years, respectively, for seed production and 23 and 16 years, respectively, for seed processing).

Growers were asked if they would encourage their children to enter the seed growing business (Table 14, Grower Survey Results). Close to 53 percent of the large growers and 39 percent of the small growers indicated they would encourage their children to enter the industry. The most cited reasons for not encouraging their children to enter the industry were inadequate profitability, including some of the growers belief that the size of their operation was too small to be profitable, or that the future in the seed business was poor.

Table 3.7: Grower and Grower/Processor Current Activities and Expectations for the Next Five Years, Sample Responses and Manitoba Estimates

	Large Growers	Small Growers	All Manitoba Growers
Current Activities[1]	**Sample Responses**		**861 Producers**
Member of Seed Grower Group (excluding SeCan)[2]	27 (56) 48.21%	14 (32) 43.75%	391 45.37%
Produce seed under contract to other growers	45 (57) 80.70%	19 (32) 59.38%	578 67.13%
Contract other growers to produce seed for them	11 (57) 19.30%	2 (32) 6.25%	95 10.99%
Activities over next 5 Years			
Number of Responses	53	30	861
Go Out of Business	3.77%	10.00%	7.74%
Retire	13.21%	20.00%	17.53%
Operate a Plant	32.07%	23.33%	26.51%
Not Operate a Plant	18.87%	13.33%	15.34%
Expand Retail Sales	33.96%	36.66%	35.68%
Reduce Retail Sales	1.89%	13.33%	9.17%
Increase Acreage Contracted to a Company	67.92%	46.66%	54.39%
Reduce Acreage Contracted to a Company	0.00%	3.33%	2.12%
Have More Growers Produce for Them	15.09%	6.66%	9.72%
Have Fewer Growers Produce for Them	1.89%	0.00%	0.69%
Join a Group that bids on New Varieties	22.64%	33.33%	29.44%
Average Years of Experience			
Production Business	20.05 (57)	14.97 (33)	16.82
Processing Business	22.76 (17)	15.67 (6)	18.25
Encourage Children to Enter Seed Growing Industry			
Percent that would encourage children	52.63% (57)	38.71% (31)	43.77%

[1] The numbers in brackets are the number of respondents for that category.
[2] Membership in SeCan is open to all seed growers. Historically, seed growers accessed seed for multiplication through SeCan. Today, with changes in seed marketing, there have been a number of grower-owned seed companies established.
Source: Grower Survey Results

3.5 Use of Pedigreed and Common Seed

The Canadian variety registration and seed certification process provides a unique quality control system for adding economic value to food products produced from Canadian commercial crops. Canadian grains, oilseeds, specialty crops and forage seed cannot be sold commercially by variety name unless the seed is certified seed. Varieties are registered under the Seeds Act with the Canadian Food Inspection Agency (CFIA).

Manitoba commercial producers have a choice of purchasing either certified or common seed. Many wheat producers purchase certified seed and produce commercial grain from this seed for several years, and then replace the seed with certified seed as the seed yield and disease resistance decreases over time. Most canola producers purchase certified seed every year because of yield and disease resistance benefits of certified seed relative to seeding their own product. In addition, the increased usage of TUA's contractually prevents canola producers from reseeding these varieties using their own seed.

A substantial portion of forage seed, mainly alfalfa, is sold as common not certified seed. After a contract term is expired alfalfa growers will often continue to produce alfalfa seed from the same piece of land for several more years and sell this seed as common seed. Also, whether a producer sells alfalfa seed as certified or common is often a factor of the prices of the two at the time and whether the producer is tied up in a contract. At times, spot prices of common alfalfa may be higher than what the certified seed producer may be getting in a contract, and thus producers who are able to will sell their seed as common seed.

Given the choices available in the Manitoba seed market, the difference between the market value of certified seed versus that of common seed is one measure of the extra economic value associated with certified seed. This extra economic market value, however, is a very conservative estimate of just one component of the total economic value associated with the Canadian pedigreed system. Because certified and common seed are not two distinct and separate commodities, but rather common seed originates from certified seed, a case can be made that common seed receives spillover economic and quality benefits associated with the pedigreed seed system. A case could also be made that the availability of common seed effectively reduces the economic value of pedigreed seed and thus can be considered a weakness of the seed industry.

While the proportion of the commercially seeded acres seeded with certified seed relative to common seed is unknown, some indication of the degree of certified seed usage can be gained by examining the estimated amount of certified seed produced in 1997 for each crop and comparing the acres that could be seeded (using average seeding rates) with the actual 1998 seeded area for commercial crop. Table 3.8 gives this information, using Manitoba Agriculture estimates of 1998 acres for commercial crop production. The certified seed that was sold by seed growers from 1997 production, as estimated by the survey, is used with average seeding rates to estimate the acres and percent of the 1998 commercial crop that could have been sown with this certified seed. There was also a substantial amount of the seed growers' production from seed

Table 3.8: Manitoba 1998 Acres that Could be Sown with 1997 Production from Seed Acreage, Using Production Sold as Certified Seed and Production Sold as Commercial Grain.

		Production from 1997 Manitoba Seed Acreage					% of Commercial Acreage Could Seed		
Crop	Unit used	(1) Units Sold for 1998 Seed Use	(2) Units Sold as Commercial Grain	(3) Seeding Rate (units/acre)	(4) Acres that Could be Seeded with Certified Seed (1)	(5) Acres that Could be Seeded with All (1)+(2)	(6) 1998 Commercial Acres	(7) % of Acres that Could Seed with Certified (4)/(6)	(8) % of Acres that Could Seed with All (5)/(6)
Spring Wheat[1]	bu	2,367,007	1,770,141	1.54	1,537,018	2,686,460	2,955,000	52.0%	90.9%
Durum Wheat	bu	74,840	104,115	2.20	34,018	81,343	199,901	17.0%	40.7%
Winter Wheat	bu	116,705	0	2.00	58,353	58,353	85,001	68.6%	68.6%
Barley	bu	1,270,626	579,334	1.75	726,072	1,057,120	1,299,975	55.9%	81.3%
Oats	bu	709,652	251,411	2.25	315,401	427,139	1,000,000	31.5%	42.7%
Rye	bu	25,394	0	1.25	20,315	20,315	120,089	16.9%	16.9%
Flaxseed	bu	453,097	131,071	0.80	566,371	730,210	700,025	80.9%	104.3%
Canola	bu	419,615	111,259	0.10	4,196,150	5,308,740	2,749,938	152.6%	193.0%
Peas	bu	399,399	329,671	2.40	166,416	303,779	259,946	64.0%	116.9%
Canary Seed	bu	21,093	1,913	0.80	26,366	28,758	49,914	52.8%	57.6%
Buckwheat[2]	bu	11,718	n/a	1.20	9,765	9,765	29,899	32.7%	32.7%
Beans[2]	lbs	1,642,435	n/a	63.75	25,764	25,764	100,000	25.8%	25.8%
Lentils[2]	lbs	429,240	n/a	50.00	8,585	8,585	15,073	57.0%	57.0%
Mustard Seed[2]	lbs	640,420	n/a	5.88	108,915	108,915	9,884	1101.9%	1101.9%
Sunflower Seed[2]	lbs	11,115	n/a	2.35	4,730	4,730	125,031	3.8%	3.8%

[1]Includes CWRS wheat and other spring wheats; excludes durum and winter wheat.

[2]Buckwheat, beans, lentils, mustard seed and sunflower seed available seed for 1998 use calculated from CSGA 1997 acreage data and Manitoba Agriculture 1997 average yields. All estimated yield for these five crops applied to certified seed sales; units sold as commercial grain not available (n/a).

Sources: Survey estimates; Manitoba Agriculture Yearbook, 1997; Manitoba Agriculture Industry Profiles 1997 (Manitoba Speciality and Forage Crops; Grains and Oilseeds); /www.gov.mb.ca/agriculture/

acreage that was sold as commercial crop rather than as seed (see Table 2.2). If seed growers had been able to sell this grain as seed also, additional Manitoba commercial crop acreage could have been seeded with this certified seed. Table 3.8 also gives the total acres and total percent of the various commercial crop types that could have been seeded with certified seed had these commercial crop units been sold as certified seed. The 2.37 million bushels of spring wheat sold as seed, as shown in Table 3.8, includes 2.03 million bushels of CWRS wheat and 0.34 million bushels of other spring wheats; similarly the bushels of spring wheat sold as commercial grain includes CWRS wheat and the other spring wheats included in the survey.

The survey did not give sufficient information for estimating seed production of buckwheat, mustard seed, sunflower seed, beans and lentils, therefore production was estimated using average yields for each from the Manitoba Agriculture 1997 Yearbook and the known pedigreed seed acres from CSGA data. Since no estimates were available regarding the amount of these seed crops that were sold as seed versus commercial grain, all production was considered sold as seed.

From Table 3.8 and looking first at the units that were sold as certified seed, only canola and mustard seed certified seed production in 1997 was in excess of what would be required for Manitoba's 1998 total acreage (153 percent and 1102 percent, respectively). For the remaining crops, the percent of the 1998 acreage that could be sown with certified seed produced in 1997 ranged from a low of 3.8 percent for sunflower seed to a high of 80.9 percent for flaxseed. The 2.4 million bushels of spring wheat sold as certified seed was sufficient to seed about 52 percent of 1998s' estimated 3.0 million acres of commercial spring wheat. This means that the remaining 48 percent was seeded with either imported or common seed. Of the companies that provided seed purchases information, none indicated they imported wheat seed from out of province, therefore it would seem reasonable to assume the remaining was seeded mainly with common Manitoba produced seed. In fact, of the companies that indicated their purchase locations, the major purchases outside of Manitoba were for forage seed and canola seed.

Canola sales as certified seed was 50 percent greater than what was required for seeding Manitoba's 1998 commercial crop and would contribute to the value of seed processed in Manitoba and exported out of province (the amount used as seed in Manitoba would be even less than indicated as it does not take into account the seed imported from other provinces). Mustard seed production was far in excess of what would be required to seed Manitoba's 1998 commercial crop. However, mustard seed production on certified acreage was estimated in Table 3.8 based on CSGA data of acres and Manitoba Agriculture average yield estimates, as indicated above. It is unknown how much of this estimated production was actually sold as certified seed and how much as commercial crop.

When that portion of the seed producers' 1997 production that had to be sold as commercial crop was instead considered as part of their certified seed sales, the proportion of Manitoba's 1998 total crop acres that could be sown with certified seed rises substantially for many of the crops. For example, had all the production from spring wheat seed acreage been sold

as certified seed, the percent of the spring wheat that could be seeded with this certified seed increased from 52.0 percent to 90.9 percent, barley increased from 55.9 percent to 81.3 percent, and flaxseed increased from 80.9 percent to 104.3 percent. The canola seed produced by Manitoba seed growers in 1997 was almost double what was required for 1998 commercial production.

The information in Table 3.8 can be considered to signal both a weakness and an opportunity to the seed industry. Certified seed growers must sell a substantial amount of their crop as lower priced commercial crop rather than as seed, decreasing seed growers profits and increasing their risks. Table 3.8 indicates there is considerable potential for expanding the amount of the commercial crop acreage that is seeded with Manitoba produced certified seed. If seed growers were able to sell all of their production from certified acreage as certified seed, then for some crops, such as spring wheat, barley and flax, they could, at least for 1998, have been able to supply almost all the seed required by commercial producers. For other seed crops, even if all of the production from certified seed acreage had sold as certified seed this still would not have met the seed requirements for the commercial acreage, indicating a market opportunity for seed growers to explore. For example, all the production from certified rye seed acreage was sold as certified seed, but this was only enough for seeding about 17 percent of the commercial crop plantings in 1998. A question that might be asked is, where did commercial producers get their seed? Was it common seed kept from previous years, or certified seed imported from outside the province?

And finally, the estimates in Table 3.8 are very rough estimates based on what producers sold as seed, average seeding rates, and commercial acres planted in 1998. As is discussed in the next chapter, these estimates vary substantially from other industry estimates. The problem is that there are no reliable estimates available on how much of the commercial crop is actually seeded with certified seed.

4 Strategic Analysis of Manitoba's Seed Industry

A comprehensive assessment of the value of the seed industry has never been undertaken before. The Board of the Manitoba Seed Growers' Association (MSGA) believes that a lack of a measure of the industry's worth has led the industry to be undervalued. Consequently, it has not received the same attention as other Manitoba sectors when it comes to strategic planning, programs, development and venture capital investment.

A situational analysis of Manitoba's seed industry strengths, weaknesses, opportunities and threats (SWOT analysis) is an important part of the strategic management process (Kreitner 1992, p. 186). A strategic analysis will take into consideration the changes and challenges facing the seed industry to summarize development strategies identified by seed growers, seed companies and related sectors, and provide a clear vision of future directions . The SWOT analysis performed in this chapter forms the basis for defining strategies to promote increases in the value added by the Manitoba seed industry.

The seed industry is undergoing tremendous changes. Advances in breeding research and development have always made important contributions to the high quality and value of Canada's agricultural crops. The focus on seed, however, has intensified with high investments in this area by private industry. Seed can be considered as the mechanism for transfer of technology.. This presents opportunities as well as challenges to all players in the seed industry. One such challenge is in gaining public acceptance of transgenic crops.

Demand for agricultural products is also undergoing considerable changes, both on the domestic and international front. Commercial crop trends and the forecasted demand for nutraceuticals and functional foods presents many new opportunities to both commercial crop growers and seed growers, as does the growth in demand for products that are identity preserved (IP) right up to delivery to the end user.

How well Manitoba's seed growers meet the challenges presented to them and take advantage of the opportunities depends on a number of factors. This chapter is organized under five main topics for discussion and identification of the challenges and opportunities facing the seed industry. The five main topics include:

1 **Major Players and their Roles** - besides the seed growers, there are a number of other players involved in the seed industry. The capacities of these players may be regulatory, research, seed growing, or marketing and retail.

2 **Quality Assurance, Value Added and Investment** - Manitoba seed growers have the advantage of Canada's regulatory and quality assurance system to help them capture value added from the domestic and international markets.

3 **Advances in Biotechnology and Other Seed Research**- this is a huge growth area which presents many opportunities as well challenges to the seed industry. How well is Manitoba's seed industry positioned to accept these opportunities and challenges?

4 **Market Demand and Trends for Certified Seed** - who are the seed growers main competitors and what are the market risks involved in seed production. The latest trends in demand for agricultural products include IP products, nutraceuticals and functional foods. What do these trends mean to seed growers ? What tools do Manitoba's seed growers have to recognize and respond to market demands and trends?

5 **Seed Industry Development and Investment Opportunities and Challenges** - in order to respond to market demands and trends seed growers need to be informed and responsive. This has never been more important than in today's fast changing seed industry. Where do the major investments for seed related research come from, how does the industry attract more investment, and how does investment in other components of the agricultural industry impact the seed industry?

Each of the five topics listed above is discussed below. The seed industry's strengths, weaknesses, opportunities and threats are examined for each of these topics, including how the industry recognizes and reinforces their strengths, responds to weaknesses and threats, and acts on opportunities. A summary of the SWOTs analysis is given in the final section of this chapter.

4.1 Major Players and their Roles

Numerous institutions, both private and public, and individuals are involved in the process of bringing high quality certified seed to the commercial producer (Figure 4.1). Besides the seed growers and seed companies, there are many associations and public and private institutions directly concerned with seed in various capacities. The roles of these players are described below. In addition, there are numerous commodity groups that have associations with an interest in the Manitoba seed industry, including, for example, the Manitoba Canola Growers Association, Manitoba Forage Seed Association, Manitoba Pulse Growers Association, the Flax Council of Canada and the Canola Council of Canada.

4.1.1 Regulatory Agencies, Associations and Public Corporations

The **Canadian Seed Growers Association (CSGA)** is Canada's official seed pedigreeing agency, as authorized by the Canada Seeds Act, with responsibility for prescribing standards and issuing crop certificates for pedigreed seed of all crops, except potatoes. The CSGA came into being in 1904, originally staffed by Agriculture Canada employees, with the election of its first grower President in 1926. Provincial organizations such as the **Manitoba Seed Growers Association (MSGA)** act as a liaison between seed growers and the national association, and conduct promotional and extension programs on a provincial basis.

The **Canadian Food Inspection Agency's (CFIA) Seed Section** activities include: administration and enforcement of the Seeds Act and Regulations; establishment of seed standards; accreditation of establishments, operators, graders, seed analysts and seed laboratories; accreditation of the Canadian Seed Institute; and establishment of germination and mechanical purity (weed) standards.

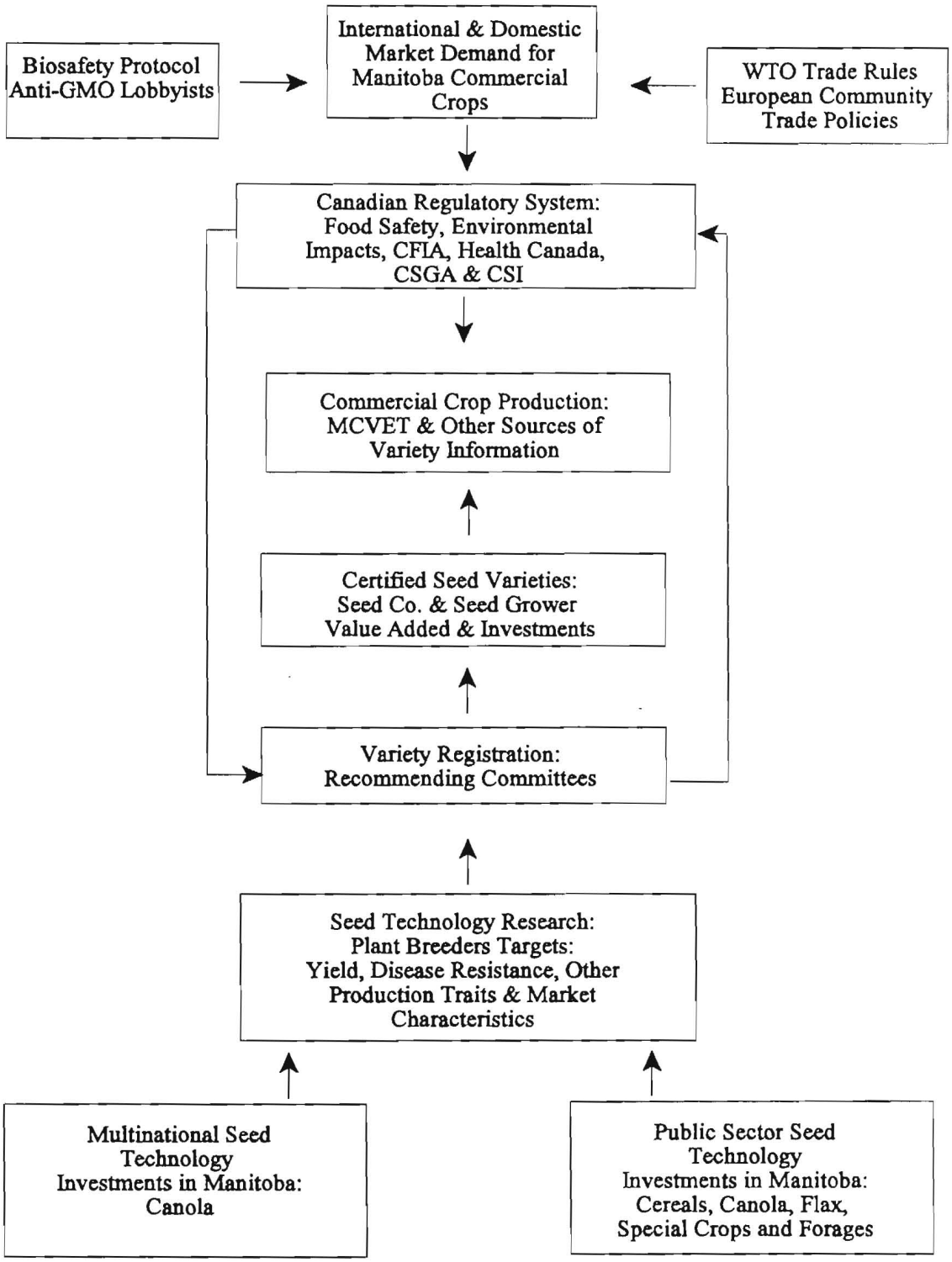


Figure 4.1: Manitoba Seed Industry, Quality Assurance, Value Added & Investment

The **Plant Biotechnology Office** of the CFIA conducts environmental safety assessments of plants with novel traits (PNTs). PNTs are plants which possess traits or characteristics sufficiently different from the same or similar species to require an assessment of risk. PNTs can be derived by recombinant DNA technologies as well as through traditional plant breeding, and are often referred to as Genetically Modified Organisms (GMOs). The term Genetically Engineered Organism (GEO) more narrowly refers to products developed through recombinant DNA technology. Organisms created through this process are often referred to as transgenic (CSGA 2000).

The **Variety Registration Office** of the CFIA is responsible for registering crop varieties. The **Prairie Registration Recommending Committees for Grain (PRRCG)** recommends which varieties should be registered on the basis of merit relative to checks. The Committee consists of breeders, analysis industry, plant pathologists, processors, exporters and farmers. The **Western Canadian Canola/Rapeseed Recommending Committee (WCC/RRC)** is responsible for recommending new canola and rapeseed varieties. This committee does not contain exporter representatives. Hybrid seed corn is not part of the variety registration process. Standards are being added for new crops such as hemp and condiment mustard.

The **Canadian Seed Institute (CSI)** is a nonprofit organization which, as of Dec 31, 1999, is responsible for seed quality assurance in Canada. The CSI was founded by the Canadian Seed Growers Association, the Canadian Seed Trade Association and the Commercial Seed Analysts Association of Canada. Previously, the Canadian Food Inspection Agency was responsible for seed quality assessment, accreditation and inspections. The CSI is responsible for: evaluating seed establishments and seed laboratories against CSI quality systems standards; assessing graders' and operators' knowledge and competency; regularly reviewing industry performance; co-ordinating the training and accreditation of quality systems experts; and recommending to CFIA the accreditation of seed establishments, new seed processing facilities, seed laboratories, and operators and graders. Third-party inspection services are used to gain public and buyer assurance for purity, cleanliness and quality.

The **Canadian Seed Trade Association (CSTA)** is an association representing a wide range of Canadian businesses involved in development, production, processing and sales of seed. The CSTA lists itself as serving a number of functions to members including to act as a vehicle to represent member concerns to regulatory bodies, to promote the business interests of members, to foster foreign relationships which would be of benefit to members, and to identify and find solution to seed industry concerns (http://www.cdnseed.org/). The CSTA is actively involved in Plant Breeders' Rights legislation.

The **Commercial Seed Analysts Association of Canada (CSAAC)** is an association of seed analysis laboratories with the objectives of representing its members on matters pertaining to seed analysis, continuing education of its members, and communication of information to its members and member customers.

The field crop variety testing program conducted by the **Manitoba Crop Variety Evaluation Team (MCVET)** gives farmers information on the growth and yield characteristics of new varieties. MCVET provides farmers with a third party source of information for making decisions on the suitability of these varieties to their farms. *Seed Manitoba*, published through a partnership of the Manitoba Cooperator, Manitoba Seed Growers Association and Manitoba Agriculture and Food, reports Field Crop Variety Recommendations and lists growers in the Pedigreed Seed Directory.

In contrast to cereal varieties, the MCVET Committee data and Canola Production Centre data from the Canola Council appears limited in scope relative to the GMO canola variety production trait characteristics. Extensive trials of GMO canola varieties are conducted by seed companies and this trial data could be evaluated by the MCVET Committee to the benefit of seed growers and commercial canola producers. For example, UGG's Proven Seed ads claim to have the largest seed performance test program in the Prairies (Proven Seed, UGG, 1999). Multi-variety trials include comparisons between Proven seed and up to ten rival varieties with the same site and growing conditions. AgrEvo ads claim the highest yields for Invigor hybrid canola. Monsanto ads claim that Roundup Ready canola production systems give the biggest yields and highest returns. A critical issue for canola seed growers and commercial producers is the relative production and market benefits and costs associated with alternative herbicide tolerant and conventional canola varieties.

Canada's regulatory system for seed has international recognition. The **Plant Health and Production Division of CFIA** is the Designated Authority in Canada responsible for expediting the international movement of pedigreed seed. Canada participates in the Organization for Economic Cooperation and Development (OECD) Seed Certification Schemes for herbage (forage), oilseed seed and cereal seed (CSGA 1996, p.52) and supports the use of high quality seed in participating countries. The Schemes expedite the international movement of pedigreed seed. Canada's interest in the Schemes has been primarily in the multiplication of domestic and foreign varieties for export. For example, equivalence has been established between OECD schemes for the Varietal Certification of seed moving in International Trade and Canadian forage seed classes.

4.1.2 Seed Research and Development

Seed technology research expenditures by the public sector and multi-national seed companies are a key factor generating seed industry value added in Manitoba (see Figure 4.1). **Public sector** seed research in Manitoba, and other parts of Canada, for cereals, canola, special crops and forage seed has maintained Canada's competitive position in international markets. Until the mid-1980s, cereal breeding research in western Canada had been almost exclusively by AAFC, such as at the Cereal Research Center in Winnipeg. Universities now perform about 25 percent of the research and commercial producers contribute to breeding programs through check-off funds (Meristem 1999). Some provincially funded research is also conducted. **Private sector** research is increasing at a much faster rate than public research, particularly research by large multinational corporations. Private sector multinational research and market development

for western Canada have focused on canola. The estimated $77.5 million of canola beyond the farm gate sales, accounted for 86 percent of total beyond the farm gate seed sales in 1997, indicating the importance of canola sales to seed companies. Private/public joint research initiatives are also increasing.

In contrast to public sector research, it is essential for private companies to obtain an economic return on seed technology research expenditures. Private sector multinational research focuses on seed technology characteristics which can be priced in seed markets. For this reason multinational corporate research focuses on hybrid vigor and novel trait production characteristics such as herbicide tolerance, pesticide resistance and disease resistance.

In addition, multinational seed companies have advantages relative to public sector agencies associated with economies of size. Development and marketing of hybrids and production characteristics in different varieties requires an enormous research budget. Research spending is important in terms of market development and impacts of the employment and expenditures on the provincial economy. Private and public sector 1997 contributions in Manitoba to seed research and development (an estimated $19.37 million and $3.53 million from seed grower royalties and levies) generates improvements in variety characteristics and production traits to meet the needs of the end user markets.

Recent research investment in Manitoba is illustrated by: 1) Monsanto and private sector partners have initiated a $10 million Crop Development Center at the University of Manitoba, supported by both Manitoba Agriculture and Food and Agriculture and Agri-Food Canada = s Cereal Research Center and 2) the Canadian International Grains Institute (CIGI), the Canadian Wheat Board (CWB) and the brewing industry are initiating a significant barley research program.

Many companies have merged or formed alliances. In particular, chemical companies have purchased or aligned themselves with seed companies, or pharmaceutical companies and called themselves 'life-science' companies. The impetus has been to take full advantage of recent advances in seed research.

4.1.3 Seed Growers, Processors and Retailers

The role of **seed growers** and **growers/processors** is to propagate the high quality varieties produced by the seed breeders and, along with **seed companies**, provide commercial producers with seed certified to have the genetic attributes of a specific variety. Seed growers and seed companies transfer new seed technology from plant breeders to commercial producers. From the Seed Grower Survey Results, Manitoba seed growers on average grow 3 to 4 crop types out of the 10 analyzed in this study (CWRS, durum, winter wheat, other wheat, barley, special crops, flax, canola, pulses, and forages) and 1 to 3 varieties within each crop type. Seed growers and grower/processors have considerable experience (average of 15 years for small growers and 20 years for large growers) and operations are expanding. Manitoba growers are knowledgeable and

experienced with new varieties and new agriculture technologies adapted to Manitoba's climate and soil productivity.

A number of seed growers have reacted proactively to the changes that are occurring in the seed industry by joining together to form their own seed companies. The initial stimulus for these alliances was apparently the tendering of publicly developed varieties for sales and the concern that an individual grower would have fewer varieties to choose from for seed growing. By joining together and forming their own companies, these growers now have the ability to tender for publicly developed varieties. By forming these alliances, these seed growers are now in a position to take advantage of many of the other changes that are occurring in the seed industry.

Major seed retail operations based in Manitoba are listed in Appendix 3. In addition to corporate seed companies, of the 861 MSGA growers in 1997, an estimated 193 of these growers also owned seed processing facilities in 1997 (Grower Survey Results).

4.2 Quality Assurance, Value Added and Investment

The Manitoba seed industry's quality assurance system for cereals, oilseeds, special crops and forage in international and domestic markets is one of the best in the world (Figure 4.1). In contrast, the US American Seed Trade Association (ASTA) has recognized its quality assurance limitations and has highlighted the need for the type of improvements which have long been part of the Manitoba and Canadian system (ASTA 1999).

The Manitoba seed industry quality assurance program has two essential control points: 1) seed variety registration by the Canadian Food Inspection Agency (CFIA), and 2) seed variety certification administered by the CSGA. These quality controls do not exist in the US seed industry and provide a major location advantage for value added and investment in Manitoba's seed industry compared to the US system.

Critical steps in the quality assurance system include (Figure 4.1):

- Plant breeders breed new varieties with improved yield, hybrid vigor, disease resistance, other production traits, and market characteristics relative to variety checks.
- New varieties are compared with variety checks, assessed by recommending committees and recommended for variety registration and commercial production.
- Varieties recommended for approval by the recommending committees are formally approved by the CFIA's Variety Registration Office. The Canadian regulatory system approves the registration of new varieties based on genetic purity of new seed varieties, nutritional food safety of products for human consumption and animal feed, and environmental impact assessments.
- Certified seed for commercial production is grown by Manitoba Seed Grower Association members under rigorous regulations established by the CSGA. Prior to sale, seed is processed under standards established by the CSGA and administered by the CSI.

- Performance of new varieties under growing conditions at several locations across the province is evaluated by MCVET for the benefit of commercial producers and results published annually in the publication *Seed Manitoba.*
- Crop producers purchase certified seed varieties for commercial production.
- Seed industry products are marketed in domestic and export markets consistent with WTO trade rules and phytosanitary requirements.

4.2.1 Variety Registration

Seed certification and variety registration are essential elements of quality control, both of which Canada already has a well developed system, although there are some who question the extent to which variety registration is needed. High quality assurance standards are met throughout the seed industry, as well as in commercial production and marketing. For example, the Canadian Grain Commission (CGC) and the CWB are continually assessing the quality control system for wheat in relation to end user requirements and variety characteristics (Worden 1998).

Prior to registration, new varieties undergo co-operative field testing at numerous locations, plus undergo quality analysis at CGC's Grain Research Laboratory. The next step is to be recommended by the appropriate recommending committee for registration. The current registration process has come under intense scrutiny for a number of reasons (Anderson Eva 1997), including:

- concerns over the make-up of the recommending committees and that the basis of recommendation for new varieties is too subjective, and
- registration and performance testing of varieties should be totally separate and farmers should be in control of deciding which varieties to grow based on their performance.

To gain registration, new wheat varieties must be equal to or better than existing varieties within their class (eg. CWRS) and must be kernel visually distinguishable (KVD) from registered varieties of any other class. KVD is the basis of segregating different classes of wheat through the transportation and handling system from farm to customer, enabling an efficient and relatively inexpensive means of classifying and moving bulk shipments of grain (CWB/Canada Grains Council 1996).

KVD ensures consistency in end-use quality characteristics by class but limits the release of new varieties within classes (Dahl, Wilson and Wilson 1999, p307). New varieties of wheat that have shown promise due to various quality characteristics have been denied registration because they were not visually distinguishable from another class of wheat. This has put the KVD requirements under scrutiny by many members of the grain industry.

Relaxation of KVD (which occurs for contract registration), means more segregation of shipments through an IP system, increasing the paper trail from breeder to customer (CWB/Canada Grains Council 1996). Without the KVD class requirements, there would be opportunity for registration of more varieties, which in turn should spell greater opportunities for seed growers to multiply these new varieties (CWB/Canada Grains Council 1996). Elimination of

KVD requirements should mean movement toward more use of certified seed and less common seed, providing these IP systems are based on use of certified seed. For example, the US cereal giant General Mills is willing to pay farmers a premium to produce and deliver specific varieties of wheat to improve product characteristics (Country Guide, May 2000).

In contrast to the Canadian system, the US does not have variety registration required under a Seeds Act, with a national association of growers responsible for prescribing standards and issuing crop certificates. In the US, companies have their own quality standards and maintain that the competitive market system ensures that only the best varieties will survive. In the US, seed companies sell seed to commercial producers by brand name rather than variety name. Disputes over Intellectual Property Rights are settled in court actions. The president of the American Seed Trade Association (ASTA), recognizing the limitations of the US system in remarks to the World Seed Conference in September 1999, called for a new global quality assurance model (ASTA 1999).

Major changes are rapidly being made in the regulatory environment including: Novel Traits Approvals, Patent Act, Biosafety Committee, the Plant Breeders' Rights (PBR) Advisory Committee (regarding intellectual property rights), and Transportation of Dangerous Goods (regarding safe transportation and handling of treated seed). The seed industry is working with Agriculture and Agri-Food Canada, the Canadian Food Inspection Agency (CFIA), Environment Canada, Health Canada, and other government bodies. The new Canadian Food Safety and Inspection Act will clarify the role of Health Canada as setting health, safety and nutritional standards while the CFIA is to enforce rules and regulate agriculture inputs and plant and animal health. These rapid changes at times create bottlenecks in the regulatory process, with regards to acceptance and registration of new varieties. The substantial increase in submissions of genetically engineered plant material proceeding under the Seed Act is, according to industry sources, creating a bottleneck in the regulatory process associated with staff shortages. This has an impact in terms of how quickly new varieties are available to seed growers for multiplication purposes.

The current variety recommending system is predicated on a comparison of the Merit "of new candidates with a selection of checks". The CFIA is developing a process for responding to a review of the variety registration system in Canada. The review, completed in March 1999 (www.cfia-acia.agr.ca), was prompted by developments in biotechnology and the need to keep Canadian agri-business competitive at home and abroad. From the review process, new categories of seed variety registration are being considered (pers. comm., G. Watson, June 2000). One category would be registration with merit, which is very similar to the present system of registration but would apply to fewer crops than is currently the case. Another category, the "Listing" category, would include crops that have varieties that are officially recognized but do not require merit testing. Information on variety performance of these crops will be required but will not be used as part of the regulatory variety registration review process. Varieties under the listing will not have testing regulations or a recommending committee. Seed varieties with novel traits will continue to require regulatory approval.

4.2.2 Seed Certification

The Canadian seed industry organization has unique characteristics. In particular, seed certification and pedigreeing of seed, which provides the basis for quality control, is ensured by the CSGA. The CSGA is authorized by the Canada Seeds Act to be the official pedigree agency responsible for prescribing standards and issuing crop certificates for Canadian produced pedigreed seed of most agricultural crops.

The pedigreeing of seed ensures genetic purity, which is especially important for such factors as yield, quality, disease resistance and morphological characteristics (Canadian Seed Growers' Association, Circular 6-94). Seed can only be considered to be pedigreed seed after it meets the following five conditions (CSGA 1996, p49 and Circular 6-94):

- a grower of the pedigreed seed crop has planted breeder, select, foundation or registered class seed (or their foreign equivalent) that has been graded and labeled in compliance with Canada's Seeds Act and Regulations,
- the grower of the crop has submitted to Canadian Seed Growers' Association a completed "Application for Crop Inspection",
- the standing, uncut, crop has been field inspected by an authorized inspector,
- the official "Report of Crop Inspection" verifies that the crop has met all requirements of the Canadian Seed Growers' Regulations (e.g. previous land use, pedigree of seed planted, isolation, and purity) which authorizes a "Crop Certificate" to be issued, and
- the seed harvested from the pedigreed seed crop has been conditioned, graded, and labeled to meet the requirements of Canada's Seeds Act and Regulations, which permits the seed to be advertised for sale by variety name.

4.3 Advances in Biotechnology and Other Seed Research

In the early 1900s, crop development was based on the notion of common seed purchased by the farmer. Next, an emphasis on varietal development occurred with the Seeds Act regulations to ensure varietal integrity and uniform quality. In the "Third Wave of Development", processors are working with plant breeders to define many diverse varieties with specific characteristics consistent with demands of consumers (Leask and Anderson 1998, p3).

Biotechnology and other seed technologies have contributed greatly to this "Third Wave" as well as to bring production benefits to producers. The area of biotechnology advances that has been receiving the most public attention is genetic engineering that has enabled insertion of DNA sequences from one plant or organism type into the genes of another plant type, transferring desired characteristics to the receiving plant. The resulting organism is referred to as a transgenic plant. The process of transformation, through the introduction of genes or DNA into a plant, has about a 20 year history (Keller, 1997, p4). Numerous transgenic crops have been produced, including corn, soyabeans, tomatoes, potatoes and canola. At present, canola is the most important transgenic crop grown in western Canada.

Advances in genetic engineering and in traditional breeding methods by plant breeders in western Canada has made phenomenal progress with respect to canola production traits and variety characteristics. Industry sources indicate that about seventy percent of the canola crop planted in western Canada in 1999 had novel trait characteristics. Eleven canola novel traits had been approved for food use as of June 1999; six for herbicide tolerance, three for hybridization systems, one for high oleic acid-low linoleic acid and one for laurate and myristate levels (Consumers's Association of Canada and The Food Biotechnology Communications Network 1999, p.15). The number of canola varieties with a specific novel trait is increasing rapidly. Roundup ready canola seed varieties available in western Canada have increased from six in 1999 to 17 in 2000. Varieties bred through traditional breeding methods have other herbicide tolerances (for example, Pioneer^{R} brand "Smart Canola" from Proven Seed, with Odessey/Pursuit tolerance). Monsanto provides Roundup tolerant genetic material to plant breeders on a royalty free basis. Under the Technical Use Agreement (TUA), the farmer purchasing the seed signs a contract agreement which stipulates they pay Monsanto $15 per acre for the use of their technology, and will not sell or use any of the resultant crop as seed.

Genetic engineering for canola is a close second to hybrid corn, which is primarily grown in eastern Canada and has 15 novel traits approved. In contrast to canola, corn does not require variety registration. Genetic manipulation of wheat and other cereals has proven to be more challenging because of a more complex gene structure. Research for transgenic as well as hybrid wheats, however, has been ongoing and it is expected that Roundup ready wheat will be available by 2003 to 2005.

While GMO crops have many potential benefits, they have, however, been receiving considerable negative attention by activist groups, the media, some consumers, and a small segment of the scientific community that are yet to be convinced of their safety. The fears over GMO crops are:

- consumers uncertainty of the safety of the food products made with these crops, with many dubbing them "Frankenfoods",
- consumer concerns about the presence of unknown allergens and toxins in the food products made with these crops,
- concerns that super weeds will be produced from herbicide tolerant crops, and
- concerns over the potential for impacts on other non-target insects such as the monarch butterfly.

Consumer backlashes have mainly been in Europe to date, with many European countries having banned products made with GMO crops. United States companies that export into countries that want to be GMO free are segregating GMO from non- GMO crops (e.g. corn).

One point of note, is that when companies in the export markets talk about nonacceptance of GMO crops, the discussion seems to focus on the need to segregate *until the public is ready to accept these crops*, with the expected time period for this acceptance ranging between five to ten years. The general consensus seems to be that GMO's are here to stay and that public concerns about GMO food safety issues can be reduced by information and promotion of existing seed

industry quality controls. Anti-GMO lobby groups have not provided evidence that the seed industry quality assurance system has not worked. Lobbyists also ignore scientific evidence that GMO canola oil is nutritionally equivalent to non-GMO canola oil (the novel trait is not present in the oil) and that GMO canola production requires lower pesticide use and promotes soil conservation.

Regardless of the safety of GMOs and the public acceptance of these crops in the future, many companies have taken the position that since the customer is always right, if the customer does not want GMOs, then GMO crops will not purchased. Companies want assurances that the product they buy is GMO-free. The Canadian Wheat Board has taken the position, with regards to wheat, that "no transgenic varieties should be registered for commercial production in Canada until either they have achieved full commercial acceptance in all their potential markets, or until we have cost effective technologies to segregate by variety throughout the system" (Arason 1999).

A recent trend in the seed industry has been the movement of large chemical companies into what they term the 'life sciences' through purchases or mergers with seed companies, as well as mergers and/or acquisitions between chemical companies and pharmaceutical companies. Seed technology research by these multinational companies is being completed at a very large scale. It is estimated, for example, that plant genomics R&D funding in the U.S. by life science companies is at least 30 times that of the U.S. federal government (Rausser 1999). Du Pont, for example, plans to make many of its chemicals from plant material rather than petroleum derivatives, and will use recently acquired Pioneer Hi-Bred seeds as the feedstock for its bio-engineered chemicals (Taylor III, 1999). A key management strategy being used by Dupont is "Knowledge Intensity". Rather than sales volume growth, profit increases are being sought by finding new applications and customers for products. Pioneer evaluates 130,000 new hybrid varieties of corn every year with the aim of improving yield and reducing disease, but only about one in 20 become commercial products. One new variety of corn, for example, has been developed as a poultry feed which improves the taste and consistency of chicken meat, but also reduces the amount of phosphorous in chicken manure. Dupont is but one example of the focus multinationals are placing on making use of available technologies, including biotechnology, and seedstocks to respond to end user requirements.

Biotechnology, in fact, is speculated as being the factor that will have the largest impact on Canada's quality assurance system, with its potential for creating varieties geared to specialized end uses and the strain these additional varieties will place on the quality system as it is presently structured (CWB/Canada Grains Council 1996). This is particularly true if there is a requirement to segregate GMO crops from non-GMO crops.

Another issue with increased private breeding research is 'intellectual property rights.' While patents are not allowed in Canada on living forms, including plants, patents may be obtained for 'novel genes.' This enables the owner of the patent to control the use of these genes, for example, for use in any new varieties (Meristem 1999). A concern with patenting of gene material is that these patents will be mainly in the hands of the private multinationals that have the

resources to finance research in these areas. Canada also has 'Plant Breeders Rights' which gives the developers of a variety control over the variety's sale and multiplication of the variety.

Use of various seed treatments to deliver a variety of inputs has grown considerably over the last few years and is expected to be a growth industry (Anderson 1997). Treatment of seed in western Canada began with canola (almost all pedigreed canola seed is treated) and is moving into the cereals. Seed treatments are currently mainly for crop protection, but it is expected that in the future these treatments may cover a wide range of functions, from turning on genes that have been inserted into the plant to affecting nutrient uptake (Anderson 1997). The seed treatment business in Canada was estimated to be worth $50 to $60 million in 1997.

Survey responses from 17 companies and public institutions with research expenditures indicated most have plans to expand research operations in Manitoba. Monsanto's aforementioned Crop Development Center at the University of Manitoba is one of the largest currently planned initiatives. The initial plan is to create 30 new technology jobs in two years with capacity available to double the size of the operation in the future. Crop development and protection research projects will be aimed at increasing yields, enhancing resistance to pests, and improving nutritional content. The facility is supported by Manitoba Agriculture and Food and Agriculture and Agri-Food Canada's Cereal Research Center and encourages industry partnerships for researchers at the University of Manitoba.

Research spending in other areas of agriculture besides seed and crop development will have an indirect impact on the seed industry through the opportunities and demands that will be presented. The Agriculture Research and Development Initiative (ARDI) and the St. Boniface General Hospital Research Center are planning to spend a total of $6 million to establish a center of excellence that will provide medical based research into the linkages between agriculture and food products and health. The University of Manitoba Faculty of Agriculture has proposed a $23 million nutraceutical and functional foods research center. The nutraceutical industry is an area expected to experience tremendous growth, with the potential to present many opportunities to agricultural producers, including seed producers.

All of this is of relevance to the seed growers. Use of biotechnology and other seed technologies can assist in development of varieties for very specific end uses, and the best, and perhaps the only, way to ensure the crop that is planted is the expected variety is to start with certified seed. Expansion in the nutraceuticals and functional foods industry could bring opportunities for growing certified seed for new crop types. Also, the increased availability and use of these privately-owned varieties means there will be fewer public varieties available for growers to multiply and sell, and they will increasingly have to look for some kinds of arrangements to grow the seed for the companies that own the varieties.

4.3.1 GMO Access and Food Labeling

Global trading rules established by the World Trade Organization (WTO), including Trade Related Intellectual Property Rights (TRIPS), as well as the United Nations Environment

Program (UNEP), provide international constraints to strategic development of the Manitoba seed industry. Safe movement of goods is a key trade issue. Labeling of GMO and non-GMO plants and plant products has been proposed as a means of resolving differences in the international acceptance of GMO products. The CWB has recommended the delay of Roundup ready wheat until market access or workable segregation methods have been established. The Flax Council of Canada has proposed delays in approval of GMO flax until international trade rules are better defined (Flax Council 1999).

Restricted market access for GMO canola in Europe is a weakness which is causing concerns in the canola industry. Manitoba's canola does not have market access in countries which ban GMO products, such as Germany and France. Irregular purchases of canola from Manitoba (Manitoba Agriculture, *Manitoba Grains & Oilseeds Industry Profiles, 1997,* p48) have been made previously by Germany ($16.22 million in 1996) and France ($1.89 million in 1996). In addition, many food stores in the UK have been establishing non GMO product lines. Archer Daniels Midland has recently indicated that it wants to be in a position to supply a growing number of customers who are wary of genetically modified crops. Corn producers in Ontario and the US are being provided with lists of grain handling facilities that have indicated a willingness to purchase, receive and handle GMO corn.

Manitoba's most important 1998 export markets for canola (bulk and processed) were the U.S. ($268.3 million), Japan ($167.2 million), Hong Kong ($148.1 million), China ($125.8 million), and Mexico ($67.22 million); these five together comprised 92 percent of the $843.3 million in 1998 bulk and processed canola exports (http://www.gov.mb.ca/agriculture/statistics/). Japan was Manitoba's largest 1998 export market for unprocessed canola ($167 million of the $380 million). On April 25, 2000, Japan's Health Ministry made it mandatory for suppliers to provide proof that GMO foods meet ministry safety standards (Biotech in Brief, May 2000) and "Japan has so far approved 29 GM varieties of seven crops, including corn, soybeans, potatoes and rapeseed (Dow Jones, April 26, 2000)". Also, Japan will require, as of April 1, 2001, that foods with detectable levels of genetically modified protein or DNA be labeled as such (Hedley, 2000). This, however, excludes vegetable oils, as protein is not detectable in refined oil.

Labeling of food for presence of GMO products, either on a mandatory or voluntary basis, has generated considerable debate. Canada is playing a leading role internationally in the development of an effective labeling policy, and chairs the Food Labeling Committee of the international standards-setting body for food (The Consumers' Association of Canada and The Food Biotechnology Communications Network, 1999, p.11). Canada supports a voluntary system of labeling for GMO foods plus the need to communicate with consumers by a number of means such as the Internet, news releases, and point of sales techniques. Label claims will be subject to inspection.

Support for mandatory GMO labeling as a Biosafety requirement for international trade is growing. The Biosafety Protocol (UNEP, 2000) includes a 'may contain' clause for transborder movement of commodities. Mandatory labeling can be viewed as supporting a trend to variety branding and seed certification with IP marketing in Manitoba and Canada.

4.4 Market Demand and Trends For Certified Seed

Certified seed producers face even more risks beyond the normal production risks facing commercial crop producers. Seed production has additional costs over commercial crop production for such things as seed, royalties, inspection and certification, and therefore requires a level of revenue to cover these additional costs. But, as was indicated in Table 2.2, a significant portion of the 1997 seed growers crop was sold as commercial crop, not as seed. Since, according to the CSGA (http://www.seedgrowers.ca/foreword.htm), only about two percent of inspected crops are declined pedigreed status, it would appear that the remainder of 1997's seed crop was sold as commercial crop because the grower could not find a suitable market for the seed and thus, certified seed supply exceeded demand in 1997/98. Using spring wheat as an example, from Table 3.8, for all of spring wheat production on seed acreage in 1997, 2.4 million bushels was sold as seed and 1.8 million bushels sold as commercial crop, or 57 percent sold as seed and 43 percent as commercial crop.

The excess supply of spring wheat seed from 1997 production indicates seed growers require information on market demands and trends in terms of, not only the commercial crops trends and the type of certified seed demanded, but also the varieties that commercial growers will demand. In addition, seed growers need to know where the industry is heading in terms of transgenic crops and other types of biotechnology, who the multinational players are and will be, and who will have control of the industry in the future. Growers need to be aware of these trends before making investment decisions which will impact their operation over the short- and long-term.

An examination of the $36.91 million contribution to value added by the seed growers from within the farm gate (see Table 2.3) indicates that the greatest contribution to total value added was by wheat ($10.97 million), followed by canola ($4.75 million), forage seed ($4.37 million; not including common forage seed), flax ($3.93 million), barley ($3.50 million), special crops ($2.65 million) and pulses ($2.36 million). Forage is almost as large a contributor to value added as wheat if common seed is included. All seven crop types have significant potential market opportunities. Beyond the farm gate, total sales net of seed costs are greatest for canola, followed by forage seed (see Tables 2.1 and 2.2).

The Manitoba seed industry faces a major development and investment challenge to translate the multi-billion dollar market opportunities into value added by crop type in Manitoba. IP marketing and production trait technology are key value added processes for what Rausser (1999) has identified as the process of transforming traditional agriculture from a commodity business to a differentiated product business.

4.4.1 Identity Preserved Markets by Crop

The demand for identity preserved (IP) systems in the grain industry is a growing trend. An IP system as defined in CGC (1998) "is one that will facilitate the segregation of parcels of grain that are visually indistinguishable from other parcels." Customers are increasingly asking for

products with specific quality characteristics, thus increasing the demand for segregations. These demands are not only for segregations by such quality characteristics as protein or moisture levels within classes of a crop, but also for segregations by varieties within a class. In the latter case, end users are increasing their demands for varieties that have the specific quality characteristics they require. Seed companies estimate that commercial end use cereal, oilseed and forage IP sales ranged from 0 to 25 percent in 1997 and that IP sales in the year 2007 will range from 20 to 50 percent (Seed Industry Survey).

Growth of the IP system presents many opportunities to the seed industry, most specifically, that use of certified seed in an IP system ensures that the producer of the crop for the IP market is planting the required variety. Therefore, as the IP system develops and grows, so too should demand for certified seed by producers delivering into these IP markets.

A number of challenges exist, however, which will affect the degree to which the seed industry will be able to take advantage of the demand for IP products. Such challenges mainly pertain to the ability of Canada's transportation and handling system to deliver these products to the end user at the level of segregation demanded. Such constraints include, among others; the lack of storage space within the transportation and handling system; rationalization of the grain industry; difficulties in the present system in assigning accountability for mix-ups at various stages of the transportation chain; and the present Kernel Visual Distinguishability (KVD) system, which requires that all varieties of a crop class have specific visual characteristics.

The "Third Wave of Development," in which the grain industry is moving towards identity preserved products, will demand changing practices from farmers to processors, but most particularly for grain handlers and shippers. Critical issues include: accountability and liability for mistakes, testing costs and delays (Seguin 1997, p 42-43). For example, problems occurred with AC Karma when a shipment was expected to be 100 percent AC Karma, but which tested at only 75 percent AC Karma after loading (Seguin 1997, p 41). Problems also occur with soft white spring wheat where low protein is important, but where protein is higher at the unload terminals than when tested prior to shipment.

The CSGA pedigreed seed system, an IP system, has been refined and revised over a number of years. The CSGA had input into the CGC's discussion paper on IP systems and suggested the following requirements for future IP crop programs (CGC 1998, p.12):

- use of pedigreed seed (usually Certified seed) at planting,
- some form of field inspection and a verification of previous land use,
- confirmation by the CSGA that the planting stock is authentic pedigreed seed,
- farmer declaration, attesting to the accuracy of the completed application and agreeing to comply with IP program requirements,
- an on-farm quality assurance system that can be audited to ensure that the grain produced from the IP crop has been kept clean and segregated,
- a sign off declaration at every transfer stage to transfer the responsibility and liability from one party to the next,

- samples kept at each transfer stage of the process (i.e. seed grower, farmer, primary elevator, shipper/handler, terminal, vessel, etc),
- a schedule of penalties for non-compliance be determined for each stage of the process, and
- a systems verification plan to ensure overall compliance and effectiveness.

The CGC (1998) incorporated many of the above requirements into its recommended framework for an IP system. However, the framework recommended use of seed that was either certified or verified. Verified seed is defined as "seed one generation removed from Certified seed, where the same farmer who grew the Certified seed verifies the variety with a declaration supported by the original Certified seed tags or invoices" (CGC 1998, p.12). From the CSGA's above requirements for an IP system, use of certified seed is the beginning point and the foundation on which to base an IP system. While it is critical to have a full series of steps for maintaining the quality of the product along the transportation and handling chain and for establishing accountability for mistakes, the first step for an IP system should be to ensure that the desired product is produced at the farm level.

The current move towards IP products presents an opportunity to the seed industry, providing it is a requirement that certified seed be used to produce the commercial crop. If this requirement does not come from within the system itself, it may well come from the customers. Canada's well structured certified seed system and its ability to ensure the purity of the variety being planted is being used as a selling feature to customers for IP products. Identity preserved markets are discussed below for various individual crops.

Wheat: Quality in an IP context is defined by variety quality characteristics such as high protein, protein quality for specific bakery products, or improved milling yields. A recent study (MRAC and CWB 1999, p4) defines high quality wheat as CWRS wheat Nos. 1 and 2 with 13 percent protein or better. A long time period is required to develop new varieties of wheat and thus to tailor wheat to specific IP markets. Three years of coop testing is required before being presented to the PRRCG for registration (full registration, interim registration or contract registration). Three years are normally required for multiplication by registered seed growers after full registration before full commercial production.

The wheat industry has the potential to change from marketing high volume, high quality bulk commodities, such as CWRS wheat, to identity preserved, high value, high quality, varieties for specific customers. Public wheat breeding programs have been developing new classes of wheat to meet niche market demands (Meristem 1999). This niche market development and tailoring wheat breeding to specific end user requirements is conducive to an IP program, where specific varieties best meet these end user requirements. However, the industry forecast is for only about 1 percent of identity preserved products in wheat markets.

Britain's largest independent bakery, Warburton's Ltd., sources bread wheat varieties CDC Teal, AC Barrie and AC Elsa through identity preserved contracts with Manitoba farmers. These contracts are the only IP sales in the CWRS class. The critical focus of IP programs is the

contract. Electrophoresis tests are conducted on cargo loading samples by the CGC and on cargo unloading by Warburton in England. Bread made in England by Warburton has a high quality and apparently often sells for twice the price of a regular loaf (University of Saskatchewan). Pasta processing from durum wheat, noodle processing from CPS wheat and frozen dough from CWES wheat are also potential candidates for IP markets for specific wheat varieties.

Variety-specific delivery programs are offered by the CWB to farmers to ensure sufficient supplies of varieties needed to conduct extensive testing in domestic and export markets. Farmers who use pedigreed seed are eligible to sign up in advance for the CWB's special delivery programs. The CWB will guarantee 100 percent acceptance of eligible grades and pay for on-farm storage until the date of delivery. Varieties for which the CWB is offering contracts for the 2000/2001 crop year include: AC Vista, a Canada Prairie Spring White (CPSW) wheat; AC Crystal, a Canada Prairie Spring Red (CPSR) wheat; AC Morse, a Canada Western Amber Durum (CWAD) wheat; and AC Navigator, an extra strong CWAD variety. According to Geddes (Country Guide May 200), the Italian durum buyers are looking for specific durum varieties to use in pasta/semolina blends. In addition, General Mills is buying the bulk of its wheat for flour and pasta markets in variety specific purchases and building strong ties with grower and grower groups (Country Guide May 2000).

Barley: Malting Barley is an example of a type of IP system that has worked in Canada for a long time (Seguin, 1997, p 40). A producer's barley is sourced by a selector as malting barley not only on the basis of the variety demanded, but also that it meets the specific quality requirements for malting. While Harrington is the variety primarily demanded for malting, growing conditions contribute to the characteristics sought by the buyer, not just the variety quality characteristics. Barley suitable for malting is selected directly from producers on the basis of tests and moved through the system as intact units to terminal position or to malt houses. Malting barley, however, does not follow the CSGA's aforementioned recommendations for an IP system in that certified seed is not specified as a required starting point. The paper trail of quality control and for accountability does not start until the farmer makes his delivery.

Oats: Since the early 1990's, the Quaker Oat Company (CSGA. 1997, p.4-5) has steadily increased the volume of Canadian oats for its products (70 to 90 percent of the oats it mills in the US are Canadian grown). The US Food and Drug Administration's 1997 decision to allow companies like Quaker to advertise health benefits of food products made from oats has renewed interest in oat consumption. Quaker buys to specifications rather than grades, being concerned with kernel uniformity, low and uniform moisture content, and groat-to-hull ratios with a minimum protein level of 11.25 percent. Cargill's success in meeting Quaker's demand for quality is due to commitment, understanding the customers requirements, and producer awareness and education of these requirements. Growers' forward sales supply agreements are based on standards which translate into grower premiums of about $0.14 per bushel for 3CW oats. In Manitoba, Quaker targets Robert, Riel, AC Assiniboia and AC Medallion. The system favors beginning with certified seed to meet quality specifications. The food-grade oat market is expected to move to IP production over time.

Flaxseed: Solin varieties are IP'd for specific customers, and the limited production and number of varieties contributes significantly to the success in this IP system (Seguin 1997, p 41). Linola is used by Unilever in Becel margarine due to its consistent high level of unsaturated fats. Given the high nutritional qualities of flaxseed (high fiber and omega-3 oil) and the demand for flaxseed meal in the production of omega-3 eggs, a high potential value added Manitoba market demand exists for branded flaxseed varieties produced with certified seed. It is important to note that about 19 percent of flaxseed commercial acreage is produced with common seed (Table 3.8).

Canola/Rapeseed: Rapid change is occurring in the canola/rapeseed markets. Only two conventional canola varieties were listed in the top 10 in 1997 as ranked by Manitoba Crop Insurance acreage data. From a market perspective, it may be possible for the seed industry to obtain a price premium for non-GMO canola marketed as an IP product. Dow Agrosciences, in partnership with James Richardson International, is marketing IP varieties under the Natreon trademark. Nex 700 is a canola oil with important nutritional and performance advantages. An important feature of certain Nexera canola varieties is that they are a natural, non-GMO source of canola oil that is stable, does not require hydrogenation and is very low in trans fats.

Limagrain Canada Seeds is working with Paterson Grain with two of its canola varieties, LG3222 and LG3260, on high oil contract opportunities. Intermountain Canola, a subsidiary of Cargill, is successfully cultivating new Asian and American markets for two varieties of specialty trait canola, both of which are low in linolenic acid. One designer canola, IMC 02, sells as a premium no odor oil (CSGA 1998).

High erucic acid rapeseed (HEAR) oil varieties developed by the University of Manitoba are produced under IP contracts for Canamera Foods (Castor produced on 16,769 acres and Neptune produced on 842 acres in 1998 in Manitoba, Manitoba Crop Insurance Corporation). IP systems, based on ISO 9000 quality management systems, are in place and operational for HEAR oilseed destined for domestic processing (CGC 1998, p8). HEAR oilseed is used in the production of oleochemicals, such as erucamide used in polyethylene films. Canola specifies less than 2 percent erucic acid and HEAR contains about 50 percent. HEAR varieties are registered under contract registration and the seed is tracked "Certified through to Oil".

Forage Seed: Seed companies indicate identity preserved markets are 20-25 percent of sales in the forage seed market. Forage seed is marketed primarily by variety within 12 distinct product types including: alfalfa, trefoil, timothy, ryegrass, fescue, clover, canary grass, wheatgrass, bluegrass, bentgrass, bromegrass and orchard grass. The Canadian Seed Trade Association (CSTA) in January 1999 improved its quality label for premium certified turf seed destined for the US and Canadian markets (www.cdnseed.org/PQS.htm). The market driven program is administered by the CSTA, and the lab chosen to conduct the testing must use Canadian procedures for Canadian markets and US procedures for US markets, as well as being acceptable to both the shipper and buyer.

4.4.2 Variety Branding and IP Markets

Seed industry market development and increasing value added in Manitoba will be associated with IP varietal research and development. The potential for additional value added can be increased if commercial market contract specifications are based on seed industry variety certification quality controls. For example, value added in noodle, pasta and malting barley markets could be enhanced with seed variety branding and certification based on end user market requirements. At present, the CWRS bread wheat market class does not appear to have great potential for variety branding and certification. The Warburton IP contract specifies three wheat varieties but amounts to only 1% of CWRS sales.

Wheat classes (e.g. CWRS) are brand names which are identified with specific high quality characteristics which differentiates Canadian wheat from that of competitors in domestic and international markets (see Kotler et al., 1999, p.273 for a discussion of brand strategies). Variety brand extensions such as specific durum varieties for pasta and new brands for new varieties such as hard white wheat which do not fit into current classes can be expected. Implementation of new branding strategies requires analysis of the increase in the potential market value associated with brand extensions or modifications.

Since only pedigreed seed can be sold by variety name, major potential value added benefits associated with variety branding include: 1) a reduction of commercial producer use of common or bin run seed and 2) increased returns to varietal development research. For example, brewers prefer the barley variety Harrington. Market preferences for other varieties are developing. Without a variety branding and malting industry requirement for variety seed certification, the full economic value of Harrington seed for malting is not reflected in the seed price. A low return on varietal development research on Harrington and new malting barley varieties results because the full market value of specific variety characteristics is not priced in the seed. Initiation of variety branding and certification based on end user market requirements can be expected to increase research dollars spent on varietal development research. In addition, value added will increase for seed growers, the seed industry beyond the farm gate, commercial producers and food processors.

GMO canola varieties are in effect variety branded and marketed to commercial canola producers and end use markets. The various herbicide tolerant and other production traits are promoted and sold by brand name. It is important to note that the primary end market for the brand is the commercial producer. A market price for seed technology and a return on varietal development research is ensured by the nature of hybrid seed technology and technology use agreements for Roundup tolerant varieties. Hybrid vigor is not maintained if commercial producers use seed from hybrid production. Farmers sign contracts to pay a per acreage fee for the use of Roundup technology embedded in the seed.

Forage seed companies selling in domestic and foreign markets promote seed quality and seed certification which is in effect a type of variety branding. The development and marketing of

variety branding has resulted in increasing seed company/seed grower contract arrangements for GMO canola seed and forage seed production.

4.4.3 Commercial Crop Trends

Knowledge of the trends in commercial crops in terms of the types of crops, the acres planted, and market demand and prices will assist seed growers in decision-making regarding which certified seed crops to grow. It will also help producers identify opportunities where demand for various crops is expanding.

Manitoba has a competitive advantage in international markets associated with high quality products produced or originating from certified seed and sold in domestic and international markets. The pedigreed seed system, therefore, is an essential element contributing to the high quality, and, thus, value of Manitoba's commercial crop. As given in Appendix 2, the 1997 Manitoba farm gate value of crop production for cereals, oilseeds, forage and specialty crops was $1.6 billion and the value of exports (unprocessed and process) was $1.7 billion. Of note is that for the first time ever, the farm value of production was higher for canola in 1997, at $524.5 million, than for wheat, at $472.4 million. This continued into 1998, where the farm value of production for canola was $596.8 million, 34 percent higher than the $444.3 million for wheat (Manitoba Agriculture Yearbook 1998).

Value added by seed crop kind can be expected to vary with international commodity price cycles and trends. According to Boyd (Grain News, Jan 2000, p33) a typical international wheat price cycle lasts 5 years from peak to peak and the last peak was in 1996; another peak in international wheat prices could occur in 2001. Low grain prices and the reduction in transportation subsidies have increased acreage of forage crops. In addition, international beef prices have been at a high level for several years contributing to an increasing demand for forage seed. Price cycles will also affect the demand for certified seed in that when commercial crop prices are depressed, commercial producers will have a greater tendency to use bin run or common seed, rather than certified seed, in their efforts to reduce their input costs.

Edible beans are an example of a crop with good potential for increasing the amount sown with certified seed, as well as an example of the need for seed growers and industry to be aware of changing trends in commercial production. The MSGA data base indicates there were 20 pedigreed bean growers in Manitoba in 1997, with a total of 1,249 acres, with production sufficient to provide about 26 percent of the seed required for the 1998 commercial bean production. The 1998 Manitoba commercial bean production of 159 million pounds from 100,000 acres was an increase of 51 percent from 1997 (http://www.gov.mb.ca/agriculture/). Appendix Figures A2.27 and A2.28 illustrate the increasing bean production in Manitoba. The dramatic increase in edible bean production in Manitoba is associated with expanding international markets. One current constraint is that certified bean seed problems associated with germination and blight reduce the profitability of certified seed. Bean seed for commercial producer contracts' production is now primarily selected from the current year's harvest. Research and development are required to mitigate such constraints. A potential exists for increasing certified bean seed

production of specific varieties with good germination and disease resistance and targeted for international markets

4.4.4 Competition in the Seed Industry

In the "first wave of development" producers relied on their own crop for seed for the next year. With the second wave, as more varieties became available, producers were made aware of the merit of using certified seed to ensure genetic purity and true to type seed. As was discussed in Chapter 3, the proportion of the Manitoba's commercial crop that is planted with Manitoba produced certified seed, however, is relatively low for most crops, other than canola and possibly mustard seed (see Table 3.8). It is expected that with increased variety branding and certification as part of IP production and marketing, the use of common seed will be reduced.

The availability of common seed, or "bin run" seed, from commercial production forces certified seed growers to compete with this lower cost alternative, even though common seed receives spillover benefits from certified seed. This creates externality problems, whereby the user of a good has not paid for the use of this good, with the good in question being the research and development costs of the certified seed. Although it may be argued that producers of cereal crops who use common seed are paying research and development costs through checkoff fees and their tax dollars, they are not paying the full costs. Royalty fees deducted from certified seed sales are channeled back into research and development, but users of common seed avoid paying these royalty fees.

An additional consideration that should be of concern to the seed growers is that there seems to be no real firm knowledge of just how much of the commercial crop in Manitoba, and in fact western Canada, is grown with certified seed versus common seed. Table 3.8 and the related discussion makes use of the amount of the estimated amount sold by seed growers in 1997 as seed, the acres of commercial crop sown in 1998, and seeding rates, to calculate how much of the 1998 commercial crop the certified seed could sow for each of the crop types. These, however, are just estimates to give an idea of the degree of certified seed usage. Also, other estimates vary substantially, with CSGA apparently estimating that 85 to 90 percent of cereal crops are seeded with common seed (Zacharias and Anderson 1998). The amount of the crop seeded with certified seed versus common seed is an important piece of market information the seed growers are currently missing.

As well, in the so-called "Third Wave of Development," as multinational companies invest heavily in seed technology to produce hybrid seeds and transgenic crops, or in development of various seed treatments, sales of certified seed may increasingly be by these companies or companies with which they have made some sort of retailing arrangements. Use of common seed in oilseeds such as canola is not the problem as in cereals. As previously mentioned, use of hybrids, genetically engineered herbicide resistant varieties, and TUA's decreases or eliminates the ability to use common canola seed.

Use of genetically engineered varieties, such as in canola, however, has advanced to the point where genetically engineered canola varieties produced by grower contracts with multinational seed companies have a large share of total Manitoba production, in contrast to the conventional canola seed produced by independent growers. In addition, although Manitoba 1997 seed production was sufficient to seed 1.5 times the commercial 1998 acreage, one third of the 1998 commercial crop was planted with varieties that were not grown as seed in Manitoba in 1997 according to CSGA data, indicating the seed was imported. InVigor, AgrEvo's hybrid canola is a major canola seed variety imported into Manitoba from Saskatchewan, where AgrEvo's North American headquarters are based. Hyola, Advanta's hybrid canola seed is also imported into Manitoba and is popular here with commercial producers. Manitoba seed growers are at a disadvantage when a variety becomes popular with Manitoba commercial producers but the owner of the variety and growers of the certified seed are located elsewhere. In contrast to hybrid canola seed, the majority of Roundup ready canola seed is produced by Manitoba seed growers.

Considerable potential exists for seed growers to expand the use of Manitoba produced certified seed for commercial production. This is evident in the proportion of 1998 commercial acreage that could be seeded with 1997 produced certified seed as given in Table 3.8 and discussed previously. In particular, development of IP markets for the commercial crop, whereby specific varieties would receive a price premium, would have positive impacts for the seed industry. Commercial producers need to be made aware and convinced of the value and advantages of using certified seed over common seed.

The main competition now for Manitoba's independent seed growers may be considered to be common seed and multinational companies. Once transgenic and hybrid wheat becomes available to commercial producers, and if transgenic wheat becomes as popular with producers as transgenic canola, multinational companies control of the seed technology used for western Canada's commercial crop will rise dramatically.

In addition to the competition the seed growers themselves are facing, Manitoba is competing with Saskatchewan and Alberta, as well as the US for jobs and income associated with the expanding seed industry and related value added activities. For example, Dow AgroSciences with headquarters in Alberta recently announced the introduction of the Nexera brand canola seed for use in the production of "Natreon" brand canola oil as part of a value-added seed strategy. AgrEvo based in Saskatchewan has a significant share of the Manitoba canola seed market.

US hybrid corn seed industry consolidation based on genetic engineering has resulted in three dominant companies, Dupont/Pioneer Hi-Bred, Monsanto, and Novartis. In contrast, significant competition throughout Manitoba, Saskatchewan and Alberta exists in the canola breeding programs of five multinationals. Worldwide 1998 sales for each of these five multinationals companies investing in canola seed technology that is being sold in Manitoba are (Economist, Dec 23, 1999, p33):

- Syngenta (Novartis +Astra/Zeneca, $8 billion agribusiness sales)
- Aventis CropScience (Hoechst/AgrEvo+Rhone-Polenc, $5 billion agribusiness sales)

- Dupont +Pioneer Hi-Bred/UGG/Proven Seeds, $5 billion agribusiness sales
- Monsanto+Pharmacia & UpJohn, $4 billion agribusiness sales, and
- Dow Chemical, $2 billion agribusiness sales.

Western Canadian multinational canola seed technology, production and marketing research is concentrated in Manitoba associated with the favorable growing climate, seed growers expertise, and the expertise in the public research facilities located in Manitoba. Regional head offices for three of the five multinationals: Monsanto, Advanta Seeds, and Dupont/Pioneer through UGG Proven Seeds are located in Manitoba. Agricore and the public sector research agencies in Manitoba also have investments in canola varietal development research. AgrEvo's canola research and seed production is based in Saskatchewan with seed trials in Manitoba. Dow AgroSciences research and seed production is based in Alberta and Saskatchewan.

4.4.5 Contracting

Contracting is increasing between growers, seed companies and processing industries to achieve benefits from new seed technology production traits, as well as variety specific quality controls in export markets. Many forms of contracts and agreements are possible ranging from fixed price and specifications to market based prices fixed at the time of delivery. Contracts can also be specified to share price and production risks between the buyer and seller.

Increased productivity is expected by some seed and large grain companies with the trend to more integration and specialization in seed production and processing. Many growers expect to increase acreage contracted to a company. Seed companies see the need to increase contract arrangements associated with IP market development.

For CWRS and durum wheat, barley, oats and flax seed and other grains the value of seed sales by independent growers to commercial grain producers, primarily on an open market basis, are more than twice the value of sales to seed companies (Table 2.2). In contrast, seventy percent of canola and one hundred percent of forage seed sales are made to seed companies primarily on a contract basis. Canola seed is sold by seed companies to commercial producers in Manitoba. Forage seed is sold by growers to companies, which process the seed and export the majority out of Manitoba. As transgenic varieties of other commercial crops become available in western Canada it would be expected that contract arrangements between seed growers and seed companies would also increase.

4.5 Seed Industry Development and Investment Opportunities and Challenges

The sales value information given in Tables 2.1 and 2.2 indicates that seed companies substantially increase the sales value of the canola seed they purchase from seed growers. It is estimated that, in comparison to the other crops, canola seed growers and companies have the greatest sales value of $87 million net of seed costs, accounting for almost half of the $182 million total final sales (see Table 2.1). Seed industry value added and sales of canola beyond the farm gate is expected to increase with the development of IP markets.

Manitoba's climate supports a wide diversity of crop production capabilities, and the seed industry is heavily dependent on the strength of the commercial crop industry. Development and investments which increase the value of Manitoba's commercial crops should, in turn, increase demand for high value certified seed and will also increase the value of this seed. Conversely, when crop prices are depressed, as in the current farm income crisis, commercial producers looking at ways to reduce their costs, will tend to use their own common seed rather than invest in certified seed.

Commercial crop production in Manitoba is a preferred high quality supply source for multinational grain companies. Manitoba's seed industry is driven by end user demands in export markets for cereals, oilseeds, forage, pulses and specialty crops of $1.7 billion in 1997 (Table 3.2). Multi-billion dollar value added opportunities more than 30 times the 1997 level of exports have been identified for Manitoba seed and related industries including: $62 billion international market for nutraceuticals and functional foods (oats, buckwheat, flax, canola oil, hemp oil, and wheat fibrotein), livestock feed (flaxseed meal for omega-3 egg and meat products and canola meal for livestock production), plant based oil as a substitute for petrochemical feed stock (high erucic acid rapeseed or HEAR oil), pasta processing (durum wheat), noodle processing(CPS wheat) and frozen dough (CWES wheat).

The number of novel trait field trials by crop kind reported by the CFIA is a significant indicator of market potential assessments and research investments by seed companies. Novel trait field trials are an important step in the GMO varietal research and development process. For example, between 1997 and 1998 canola field trials in Canada almost doubled from 224 to 537, alfalfa trials increased from 7 to 61, but wheat trials decreased from 19 to 13. Trials for other commodities in 1998 were: 12 mustard, 4 barley, 3 pea and 1 flax. In order for a new variety with a novel trait to be registered for food or animal feed use, animal feed safety approval and environmental approval based on field trials is required from the CFIA and food safety approval is required from Health Canada. The status of novel trait approvals is given in a CFIA web site (www.cfia-acia.agr.ca/english/plant/pbo/okays.html).

Seed companies and exporters indicate that the positive advantages of a low Canadian dollar more than offsets the exclusion from European markets for canola because of its GMO status. Increased value added research can be expected for flaxseed markets if GMO status does not restrict future market access for flaxseed exports to European markets. Analysis is required to determine if market premiums for non-GMO canola varieties would cover the costs of such an IP niche market development. Canada has embarked on bilateral analysis with the EU to investigate the potential for a common approach for trade in GMOs, sponsored by the Department of Foreign Affairs and International Trade.

Previous sections of this chapter outlined some of the market opportunities for seed growers. It is hypothesized that capital constraints in Manitoba are the major bottleneck to the development of these market opportunities. For example, the value added potential and market opportunities for canola oil and livestock meal production and marketing in Manitoba have been

well known since the 1980s but large scale production of PeaCan meal (pea and canola meal mixture) has not yet been initiated.

One reason for the privatization of the United Grain Growers was the limitation on the ability of coops to raise expansion capital. New generation producer coops are also a mechanism for funding major Manitoba agro-industrial projects, such as the $120 million fiber board plant at Elie, Manitoba, which uses wheat straw as an input. A new generation coop structure is being used for producer procurement of straw for the plant.

Global wheat market competitors such as the Australian Wheat Board promote benefits for Australian wheat producers from value added activities by direct investments in grain processing facilities to promote global market expansion. In contrast, producer/investors are having difficulty initiating additional pasta processing plants in Western Canada. Increasing pasta processing on the prairies would enable the processors to work closely with the seed industry. Under such a situation, plant breeders would develop cultivars with quality requirements tailored to match pasta producers specifications. Seed growers would multiply these varieties to provide the certified seed for commercial producers to grow for the pasta processors. The added bonus, is that the end user would be situated in close proximity to the seed developers and growers, and could be closely involved in the cultivar development process. Similar Manitoba value added processing market opportunities may exist for Asian noodles and frozen dough.

Manitoba lost a major share of the beef packing industry when a world scale plant was built in Alberta in the 1980s. Manitoba could have lost the investment in hog production and processing that is presently occurring in the province, but actions were taken by industry and government to provide incentives for world scale pork production and processing in Manitoba. Such actions are required to promote Manitoba investments to develop the potential value added in the seed industry from multi-billion dollar market expansions in nutraceutical and functional foods. The seed growers need to be fully aware of these potentials and keep themselves closely aligned with any such activities in order to show the benefits of starting with certified seed in producing the crops required for these production facilities.

This current study has examined the value added by a number of different seed crop types. More in-depth study on the individual crop types, again on a variety basis, would give a greater understanding of the market and opportunities for each of these crop types. This could include an individual SWOT type analysis on a crop basis. Manitoba's forage seed industry, for example, has a well developed export market into the U.S., exporting not only the majority of Manitoba's forage seed production, but also forage seed from Saskatchewan and Alberta. The export market includes both certified and common forage seed, with the split between the two market driven. The importance of the forage seed industry to the value added by the seed industry has been discussed. In order for the forage seed industry to take full advantage of market opportunities, it would be useful to have good measures on all aspects of the industry. However, currently there are no statistics available on the amount and value of the flow of seed between provinces. This is true for all seed crops, but is particularly important for forage seed because of the amount of seed

from other provinces that flows through Manitoba. Complete information on interprovincial and international trade would be useful to the industry for planning and valuation purposes.

Manitoba is competing with the U.S. for the lead position in GMO cereal production and marketing. Plant biotechnology research is currently dominated by Dupont, Monsanto and Novartis, followed by Aventis CropScience, Dow and Advanta Seeds (Rausser 1999). Integration with food processors and users is also proceeding, as in, for example, Monsanto and Cargill/Continental and Pioneer/Archer Daniels Midland and Conagra. According to Rausser (1999), future integration and economies of size will link plant biotechnology research and development with commercialized nutraceuticals.

Western Canadian multinational cereals seed technology research is being concentrated in Manitoba (see section 4.4.4 above). Manitoba advantages include:

- the low value of the Canadian dollar relative to conducting similar research in the U.S.,
- support by the Manitoba and Canadian government for plant biotechnology research,
- commercial crop producers in Manitoba are early adopters of new technology (for example, the percent of Manitoba's canola area that is hybrid canola is the highest for western Canada),
- value added and investment opportunities are high in Manitoba,
- oilseed and cereal research expertise in Manitoba is internationally recognized,
- Canada's well structured Plant Breeders Rights and quality assurance system.

Seed industry development strategies are based on seed technology imbedded in herbicide tolerant systems, hybridization, and seed treatments. The challenge for Manitoba in the next decade is to become the world leader in GMO cereals and canola production and marketing. Value added activities are increasing rapidly with respect to canola in Manitoba. Value added activities based on GMO cereal crops could start in the next three years, starting with Roundup ready wheat, followed by other herbicide tolerant systems and hybrids if GMO wheat markets can be developed. If GMO wheat becomes as popular with producers as GMO canola, with about 70 percent of canola acres planted with GMO varieties, then an enormous increase in Manitoba sales of certified seed will occur.

4.6 Summary of SWOTs Analysis

The strengths, weaknesses, opportunities and threats to the seed industry are summarized below, as well as in Figure 4.2.

4.6.1 Strengths

Quality Assurance/Regulatory Strengths

- Canada's pedigreed seed system, and the strength of Canada's institutional arrangements for assuring the pedigreed status, has recognized importance. Canada's quality assurance program has two essential control points: variety registration and seed certification.

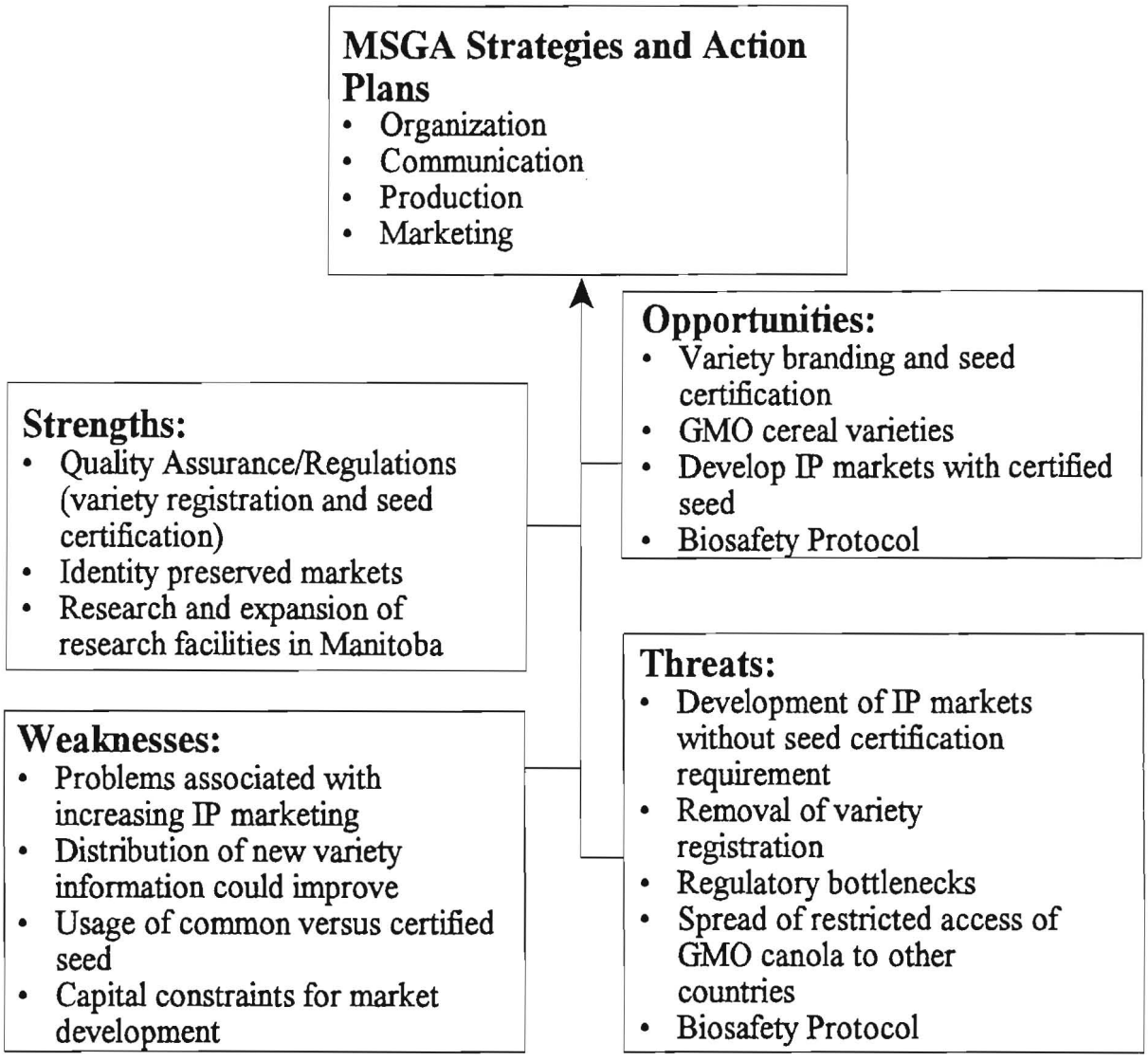


Figure 4.2: Manitoba Seed Industry - Strengths, Weaknesses, Opportunities and Threats

- The Variety Registration Office of the Canadian Food Inspection Agency (CFIA), is responsible for registering crop varieties, based on the recommendations of the Prairie Registration Recommending Committees for Grain (PRRCG) and the Western Canadian Canola/Rapeseed Recommending Committee (WCC/RRC). Variety registration maintains a quality standard for the applicable commercial crops, such that only varieties meeting certain quality specifications may be registered. In contrast, commercial crop producers in the US face a "buyer beware" situation in purchasing specific seed varieties.
- The pedigreeing of seed ensures genetic purity, which is especially important for such factors as yield, quality, disease resistance and morphological characteristics. Seed certification is administered by the Canadian Seed Growers Association (CSGA), which prescribes standards and issues crop certificates for pedigreed seed crops. The Seed Section of the CFIA oversees the administration of the Seeds Act; accredits the Canadian Seed Institute (CSI); establishes germination and mechanical purity (weed) standards; and enforces the Seeds Act and Regulations. The Canadian Seed Institute is responsible for seed quality assurance in Canada. The CSI is responsible for: evaluating seed establishments and seed laboratories against CSI quality systems standards; assessing graders' and operators' knowledge and competency; regularly reviewing industry performance; co-ordinating the training and accreditation of quality systems experts; and recommending to CFIA the accreditation of seed establishments, new seed processing facilities, seed laboratories, and operators and graders.
- The new Canadian Food Safety and Inspection Act will clarify the role of Health Canada in setting health, safety and nutritional standards while the CFIA is to enforce rules and regulate agriculture inputs and plant and animal health.
- The quality assurance system that exists in Manitoba provides a major competitive advantage over the U.S., which does not have variety registration required under a Seeds Act, nor a national association of growers responsible for prescribing standards and issuing certificates.
- In order to keep apace of changes in the agricultural industry, the Seeds Act and variety registration system have been amended over the plus-75 years they have been in existence in Canada. A review of the variety registration system was completed in March 1999, prompted by developments in biotechnology and the need to keep Canadian agri-business competitive at home and abroad.
- International recognition is given Canada's regulatory system for seed. The Plant Health and Production Division of the Canadian Food Inspection Agency (CFIA) is the Designated Authority in Canada responsible for expediting the international movement of pedigreed seed. Canada's participation in the Organization for Economic Cooperation and Development (OECD) Seed Certification Schemes expedites the international movement of pedigreed seed.

Biotechnology and Other Seed Research Strengths

- Public and private sector seed research in Manitoba and other parts of Canada has maintained Canada's competitive position in international markets.
- The considerable multinational corporate research on hybrid vigor and novel trait production characteristics such as herbicide tolerance, pesticide resistance and disease

resistance gives production benefits to seed growers and commercial producers. Canola is the western Canadian crop most affected by private research funding to date, with considerable resources currently being channeled into wheat research.

- Multinational seed companies have advantages relative to public sector agencies associated with economies of size. Joint arrangements, such as the Monsanto/federal government/provincial government $10 million Crop Development Center at the University of Manitoba, will provide public agencies access to privately held gene patents.
- Manitoba's highly experienced seed growers and seed companies transfer new seed technology from plant breeders to commercial producers.
- Advances in genetic engineering and traditional breeding methods by plant breeders in western Canada has made phenomenal progress with respect to canola production traits and variety characteristics. Industry sources indicate that about seventy percent of the canola crop planted in western Canada in 1999 had novel trait characteristics.
- Transgenic, as well as hybrid wheats, are in the pipeline, with Roundup ready wheat expected to be available by 2003 to 2005.
- Survey responses from 17 companies and public institutions with research expenditures indicated most have plans to expand research operations in Manitoba.
- The Agriculture Research and Development Initiative (ARDI) and the St. Boniface General Hospital Research Center are planning to spend a total of $6 million to establish a center of excellence that will provide medical based research into the linkages between agriculture and food products and health.
- The University of Manitoba Faculty of Agriculture has proposed a $23 million nutraceutical and functional foods research center.
- Manitoba's attributes for attracting research resources include agro-Manitoba's favorable growing climate, Manitoba's seed growers expertise (average of 15 to 20 years of experience), the expertise in the public research facilities located in Manitoba, and a low Canadian dollar.

Branding, Identity Preserved (IP) and Other Market Characteristics Strengths

- Seed companies estimate that commercial end use cereal, oilseed and forage IP sales ranged from 0 to 25 percent in 1997 and that IP sales in the year 2007 will range from 20 to 50 percent.
- The CSGA pedigreed seed system, an IP system, has been refined and revised over a number of years, placing Manitoba seed growers in a good position for understanding the requirements of an efficient, fully functional and accountable IP system.
- With the 1997 provincial farm gate value of crop production at $1.6 billion and exports at $1.7 billion, the pedigreed seed system is an essential element contributing to the high quality, and thus value of Manitoba's commercial crop.
- CWB wheat and barley are sold by class designations which have a recognized brand value associated with high quality and service in international markets.
- Canola varieties are branded by seed companies as a means of differentiating seed production traits as well as oil product quality characteristics in end use markets.
- Forage seed companies promote specific varieties and seed certification in domestic and international markets.

- Manitoba's seed growers are experienced and resourceful, adapting to the rapid changes that are occurring in the seed and agriculture industry with such endeavors as formation of grower-owned seed companies, developing contracts or alliances with companies, and taking advantage of industry trends, such as increased usage of seed treatments.
- Many growers, grower/processors and seed companies are investing in expansion and capital replacement.

4.6.2 Weaknesses

Quality Assurance/Regulatory Weaknesses

- Canada's ability to take advantage of IP markets is dependent on the ability of its transportation and handling system to maintain the level of segregation required to assure identity preservation. This will present challenges to a system which is currently geared to deliver bulk commodities and is in a process of rationalization. A system will be required for assigning accountability for mix-ups at various stages of the transportation chain.

Biotechnology and Other Seed Research Weaknesses

- Manitoba's GMO canola does not have market access in European Union (EU) countries which ban GMO products, such as Germany and France. Irregular purchases of canola from Manitoba have been made previously by Germany ($16.22 million in 1996) and France ($1.89 million in 1996).

Branding, Identity Preserved and Other Market Characteristics Weaknesses

- The present Kernel Visual Distinguishability (KVD) system for wheat, which requires that all varieties of a wheat class have specific visual characteristics, places constraints on breeders and companies in developing varieties and brands geared to specific end use requirements.
- There is a high usage of common seed on the prairies, with some estimates indicating as high as 85 - 90 percent of commercial cereal crop acreage sown with common seed. This takes away from the market share for certified seed. A consideration that should be of concern to the seed growers is that there seems to be no real firm knowledge of just how much of the commercial crop in Manitoba is grown with certified seed versus common seed; seed growers need full market information in planning development strategies.
- There is a lack of information on amounts and value of interprovincial trade of seed, and to a lesser degree international trade. This is particularly true for Manitoba's forage seed trade, with significant imports from other provinces and the majority of the market for forage seed as international exports, mainly the United States.
- Capital constraints are the major bottleneck for development of market opportunities in Manitoba to benefit the agriculture industry, including the seed growers.

4.6.3 Opportunities

Quality Assurance/Regulatory Opportunities

- Branding, seed certification, electrophoresis variety testing, contracting and food labeling in product markets provide a mechanism for ensuring market incentives for commercial producers to purchase certified seed.
- There is an opportunity for Manitoba to be the world initiator of GMO cereal varieties and gain an enormous international competitive advantage in the seed industry and related sector value added activities if markets for GMO cereals (e.g. Roundup ready wheat) can be developed.
- The review of the variety registration system could result in a system which further increases the seed variety quality standards of the current system relative to the U.S., depending upon the outcome of the review and which crops, if any, remain subject to variety registration with merit.
- Labeling and Biosafety Protocols being developed for international trade in GMOs provide an opportunity for promoting variety branding of Manitoba crops produced with certified seed.
- Bilateral analysis between Canada's Department of Foreign Affairs and International Trade and the EU on common approaches to trade in GMOs, if successful, could provide expanded trade opportunities.

Biotechnology and Other Seed Research Opportunities

- MCVET could be strengthened and expanded to include GMO canola production traits, to provide seed growers and commercial producers with an unbiased third party analysis of canola varieties.
- Improve seed growers' and commercial producers' productivity and profitability with economic analysis of canola cost and returns information comparing herbicide tolerant seed options, seed treatments or hybrid versus conventional varieties.

Branding, Identity Preserved and Other Market Characteristics Opportunities

- Growth of the IP system presents many opportunities to the seed industry, providing the IP system is based on use of certified seed.
- The trend towards branding of seed varieties for specific product markets provides potential value added benefits including reduced use of common seed and increased returns to variety development research.
- Canada's well structured certified seed system and its ability to ensure the purity of the variety being planted can be used as a selling feature to customers for IP products.
- The potential of the wheat industry to change from marketing high volume bulk commodities to identity preserved specific varieties will provide seed growers an opportunity for greater certified seed sales of wheat.
- Improved information on market trends will assist seed growers in making better decisions regarding selection of varieties to produce.
- There are considerable market opportunities for development in such areas as nutraceuticals and functional foods, livestock feed, HEAR oil, pasta processing, noodle

processing, and frozen dough. Developments in these areas would be enhanced by an Identity Preserved system. Specifically, IP products have potential, both for export and for developing the processing industry for these products here in Manitoba. This in turn presents opportunities for the seed growers for providing certified seed for the specific varieties required for these IP markets. It is expected that IP markets based on certified seed can be developed for specific pasta and noodle wheat varieties, as well as barley, oat and edible bean varieties.

- Seed growers can enter into many different types of contracts with seed companies or can grow and market their seed on an independent basis. Analysis of contract options with seed companies and the importance of quality specifications relative to seed company end use markets would assist growers in making their marketing and growing decisions. As well, with the development of IP markets, increasing knowledge of contract options is important for seed growers.
- Considering the high proportion of Manitoba's commercial crop acreage that is planted with common seed, there is a large potential market for seed growers to pursue. In particular, once transgenic wheat varieties are available, and if they become as popular as for canola, seed growers will be able to increase their market share substantially. Manitoba seed growers will face competition from seed produced in other provinces, particularly with respect to hybrid seed production.
- There are a number of market opportunities for certified seed outlined above. To take full advantage of these opportunities seed growers need complete knowledge of their customer base, both current and potential. An area which has been identified as lacking in information is the proportion of the commercial crop that is planted with certified seed. Further research should be done in this area to move beyond the current industry estimates, which range considerably depending on the source. Seed growers could approach such agencies as Manitoba Crop Insurance Corporation or Statistics Canada, that collect seeding information on an annual basis, to incorporate questions on use of certified seed.

4.6.4 Threats

Quality Assurance/Regulatory Threats

- According to the Canadian Seed Trade Association (CSTA), the substantial increase in submissions and field trials of genetically engineered plant material proceeding under the Seed Act is creating a bottleneck in the regulatory process. This has an impact in terms of how quickly new varieties are available to seed growers for multiplication purposes.
- The review of the variety registration system could result in a system which, in effect, reduces the seed variety quality standards of the current system if Canada moves towards the US system, where commercial crop producers face a "buyer beware" situation in purchasing specific seed varieties.
- The Biosafety Protocols could lead to a continuation of the effective ban on EU trade of Manitoba's commercial GMO crops.

Biotechnology and Other Seed Research Threats

- Large scale multinational patented research on hybridization and production traits could displace public sector seed technology research in Manitoba and reduce competition in the seed industry.

Branding, Identity Preserved and Other Market Characteristics Threats

- If certified seed does not become a basic requirement for commercial crops destined for an IP market then the seed industry will not fully benefit from IP market development. IP market developers need to recognize the benefits of variety branding and seed certification.
- Manitoba seed growers lose market share when seed varieties developed and/or owned and multiplied outside of the province become popular with Manitoba commercial growers, such as with imports of canola seed from Alberta and Saskatchewan .
- Spread of GMO market access problems for canola to other trading partners could have major implications on western Canada's canola industry.

5 References

Agriculture and Agri-Food Canada, Trade Evaluation and Analysis Division, Market and Industry Services Branch.

American Seed Trade Association, www.amseed.com, 1999.

Anderson, R.M., "The Road to Tomorrow", *Germination*, Nov., 1997, 1(5):6-10.

Anderson Eva, R., "A System Under Question", *Germination*, March, 1997:24-25.

Arason, G., President and CEO, Canadian Wheat Board, "Marketing in an Era of Biotechnology," presentation at *Canadian International Grains Institute Biotechnology Seminar for Senior Executives Course*, Oct. 19, 1999.

ASTA, *American Seed Trade Association Calls for New Global Quality Assurance Model*, http://www.amseed.com/documents/asta_global_qual_pr_0907.html

Biotech in Brief, May, 2000, 6(1).

Biotech in Brief, April, 2000, 5(1).

Boyd, M., *Grain News*, Jan., 2000, p.33.

Campbell, D., *Seed Manitoba-1998*, p6.

Canadian Food Inspection Agency, www.cfia-acia.agr.ca.

Canadian Grains Commission, *Identity Preserved Systems in the Canadian Grain Industry*, 1998 p12.

Canada Grains Council, *Canadian Grains Industry Statistical Handbook 98*, Winnipeg, Manitoba.

Canadian Seed Growers' Association, http://www.seedgrowers.ca/foreword.htm.

Canadian Seed Growers' Association, *Biotechnology and the Canadian Seed Grower, A quick reference guide*, April, 2000.

Canadian Seed Growers' Association, *Seed Scoop*, 1998, 47(1):3.

Canadian Seed Growers' Association, *Seed Scoop*, 1997, 46(3): 4-5.

Canadian Seed Growers' Association, *Pedigreed Forage Seed Production*, Ottawa, 1996.

Canadian Seed Growers' Association, *Regulations and Procedures for Pedigreed Seed Crop Production*, Foreword, Circular 6-94.

Canadian Seed Trade Association (CSTA), www.cdnseed.org/PQS.htm/

Canadian Wheat Board, www.cwb.ca.

Canadian Wheat Board and Canada Grains Council, *The Future Quality System for Canadian Wheat*, Joint discussion paper by the Canadian Wheat Board and Canada Grains Council, 1996.

Cochran, W.G., *Sampling Techniques* (3rd edition), New York, NY: John Wiley and Sons, 1977.

Consumers' Association of Canada and The Food Biotechnology Communications Network, *A Growing Appetite for Information: Food Biotechnology in Canada*, 1999.

Country Guide, *Seed & Biotech*, "IP Grain Joins the Mainstream", May, 2000:24-25.

Crop Science, 1997, 37:290.

Dahl, B.L., W.W. Wilson, W.W. Wilson, "Factors Affecting Spring Wheat Variety Choices: Comparisons Between Canada and The United States," *Canadian Journal of Agricultural Economics*, 1999, 47:305-320.

Economist, Dec 23, 1999, p33.

Enrique Merigo Orellana, Director of Agribusiness Altex, S.C., Industrial Group Bimbo, "The Mechanized Bread Industry: Actual Situation and Perspectives for the 21st Century," p. 174, In *First International Wheat Symposium, Proceedings*, SAGAR, INIFAP and CIMMYT, Obregon, Sonora, Mexico, 1997, in Spanish.

Flax Council, *Flax Focus*, 1999, 12(1):1.

Hasha, G., *US-Canada Wheat Trade: The Intersection of Geography & Economics, Agricultural Outlook*, June-July, Economics Research Service/USDA, AGO-262,1999.

Hedley, Harold, A., "International Marketing of Genetically Enhanced Grains and Oilseeds: Opportunities and Challenges," presentation to: *Seed into the New Millennium*, Annual Meeting of the Manitoba Seed Growers Association, Brandon, Manitoba, Feb.9, 2000.

Huebner, G., Manitoba Forage Seed Association, personal communication, 1999.

Keller, Wilf, "The Fundamentals and Implications of Biotechnology", in *Biotechnology in Agriculture and Food, Proceedings*, Canada Grains Council, 1997.

Kotler, Philip, Gary Armstrong and Peggy Cunningham, *Principles of Marketing*, Prentice Hall Canada, Scarborough, Ont, 4th Canadian Edition, 1999.

Kreitner, Robert, *Management,* Houghton Mifflin Co., 1992.

Leask, Bill and Robynne Anderson, *Riding the Third Wave*, Canadian Seed Trade Association, 1998, p.3.

Limagrain Canada Seeds Inc., *Western Canada Field Plot Results*, 1998.

Macdonald, Phil, Plant Biotechnology Office, Canadian Food Inspection Agency, personal communication, April, 2000.

MacMillan, J.A. and G. De Matos, *Manitoba/Western Canada Red Meat Industries: Strategies and Impact Analysis*, Manitoba Red Meat Forum Report, 1992.

Manitoba Agriculture, *www.gov.mb.ca/agriculture*, 1999.

Manitoba Agriculture, *Manitoba Agricultural Review 1997*, Program and Policy Analysis Branch, 1998.

Manitoba Agriculture, *Manitoba Agriculture Yearbook, 1997* and *1998* Program and Policy Analysis Branch.

Manitoba Agriculture, *Manitoba Grains & Oilseeds Industry Profiles, 1998*, Program and Policy Analysis Branch, 1999.

Manitoba Agriculture, *Manitoba Grains & Oilseeds Industry Profiles, 1997*, Program and Policy Analysis Branch, Sept. 1998.

Manitoba Agriculture, *Manitoba Grains & Oilseeds Industry Profiles, 1996*, Program and Policy Analysis Branch, 1997.

Manitoba Agriculture, *Manitoba Specialty & Forage Crops Industry Profiles, 1997*, Program and Policy Analysis Branch, Nov. 1998.

Manitoba Bureau of Statistics, Economic Accounts, 1999.

Manitoba Crop Insurance Corporation, *http//mmpp.com/download.html*

Manitoba Rural Adaptation Council and the Canadian Wheat Board, *The Market Competitiveness of Western Canadian Wheat*, MRAC Study Summary, 1999, p4.

Meristem, "The New World of Wheat Breeding", *Meristem, A Special Report on Wheat Breeding*, July 1999.

Proven Seed, UGG, *The 1999 Results Book.* and *The 1998 Results Book.*

Rausser, G., "Private/Public Research: Knowledge Assets and Future Scenarios," *Amer. J. Agr. Econ.*, 1999, 81(5):1011-1027.

Secan, http://www.secan.com.

Seguin, Len, "Product Grading and Identity Preservation", *Biotechnology in Agriculture and Food, Proceedings,* Canada Grains Council, 1997.

Taylor, Alex, "Why Du Pont is Trading Oil for Corn," *Fortune*, April 26, 1999, p154.

United Nations Environment Programme (UNEP), Convention on Biological Diversity, http://www.biodiv.org.

United Nations Environment Programme (UNEP), Convention on Biological Diversity, *Draft Cartagena Protocol on Biosafety*, UNEP/CBD/ExCOP/1/1.5, Jan. 28, 2000.

University of Saskatchewan, Centre for the Study of Co-operatives, *Networking for Success, Strategic Alliances in the New Agriculture, Warburton's Bakery*, http://coop-studies.usask.ca/strategic/who2.html.

Watson, Grant, Plant Biotechnology Office, Canadian Food Inspection Agency, person communication, June 2000.

Worden, G. "Marketing Forces: Preparing the Market", In *Wheat Production and Marketing,* eds. D. Fowler, W. Geddes, A. Johnston, and K. Preston, University Extension Press, University of Saskatchewan, 1998.

Zacharias, A. and C. Anderson, "It All Starts with the Seed. How Does Common Seed Compare to Pedigree Seed?," *Germination*, January, 1998, 2(1):10-12.

Appendix 1: Manitoba Seed Industry 1997 Profiles by Crop

This appendix provides 1997 profiles for each of the crop types covered in the Grower Survey. The profiles give for the respective crop type the production and supply of the seed type in Manitoba, the disposition and farm gate sales, the market distribution of the certified seed sales, and total sales and GDP. For the special crops, summaries are given for oats, canary seed and rye; for the pulses, a summary is given for peas only; and winter wheat is combined with the other wheats. The industry profiles for each of the crops are also summarized in flow charts at the end of this Appendix.

For each of the crops, production from acreage sown as a certified seed crop is dispersed in a combination of four ways: either sold as certified seed, or commercial grain, or screenings, or kept as inventory. Because one of the goals of the study was to estimate the value of certified producers' 1997 production, the value of each of these is included in determining overall value. This is the case even if a portion or all of the crop grown on land intended for certified sales generates revenue through commercial crop sales or screenings. The value of inventory is determined as the value of inventory change between the end of 1997 and end of 1996. This, in effect, will subtract out any inventory from previous years' production and include the value of inventory left from 1997, to take full account of only 1997 production.

A1 CWRS Wheat Seed

A1.1 CWRS Wheat Seed Production and Supply

The industry profile flow chart for CWRS wheat is given as Figure A1.1. There were 405 producers growing Canadian Western Hard Red Spring (CWRS) wheat for certified seed in Manitoba in 1997. The area sown for certified seed was 114,698 acres (46,418 hectares), with an estimated average yield of 35.1 bushels per acre, to give a total production of 4.02 million bushels (see Grower Survey Results, Table 32). Estimated carry-in from 1996 was 0.15 million bushels, giving a supply of 4.17 million bushels. There were also 0.23 million bushels purchased by producers and resold. Only the value of the resale of these purchases are accounted for in calculating values (i.e. the cost of the purchases are subtracted out of gross returns, to include only the increase in value). This gave a total of 4.4 million bushels for dispersal.

A1.2 Disposition of CWRS Wheat Seed Supply and Farm Gate Sales

The farm gate sales from production on certified seed acreage are summarized as follows:

Transaction Type	($million)
Seed Sales	$13.54
Commercial Grain Sales	6.4
Screenings Sales	2.36
Change in inventory	1.37
Cost of seed purchases	-1.05
Farm Gate Sales	**$22.62**

Approximately 50 percent of the 4.4 million bushels, or 2.03 million bushels, was sold as certified seed for use in 1998. The average price of certified CWRS seed was $6.67 per bushel (including a royalty of $0.57 per bushel), with farm gate sales of $13.54 million. The amount of seed sold as commercial wheat was quite large in 1997, an estimated 1.42 million bushels, with farm gate sales of $6.4 million. There were another 0.58 million bushels sold as screenings, for farm gate sales of $2.36 million. The ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 0.37 million bushels. With a beginning inventory of 0.15 million bushels, the value of the change in inventory, or 0.25 million bushels, was $1.37 million. Seed production contributes farm gate sales of $22.6 million, or $197 per acre.

A1.3 Market Distribution of 1997 Certified CWRS Wheat Seed

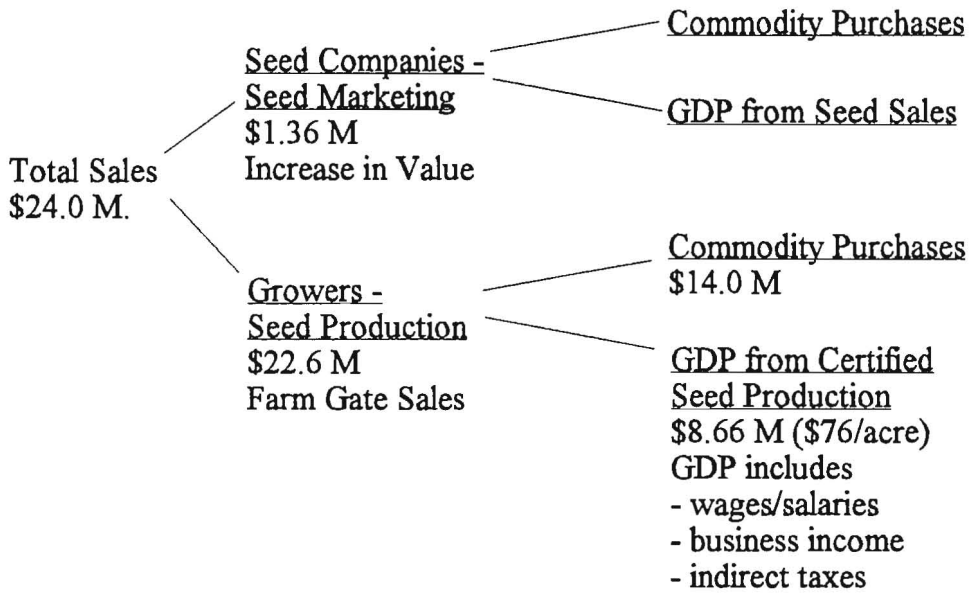
Of the 2.03 million bushels sold as seed, almost half, or 0.98 million bushels, was sold by the producers to commercial producers, for a value of $6.53 million. Another 0.44 million bushels was exported by the producers, to either other provinces (70,000 bushels, with a value of $0.44 million) or the U. S. (0.37 million bushels, with a value of $2.47 million). Producers indicated that use of 1997 seed for seed multiplication was 0.15 million bushels (value of $1.0 million). The remaining 0.46 million bushels was sold to a marketing or seed company for a value of $3.1 million. Further processing of this seed by these companies increased its value by an estimated $1.36 million, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

Therefore, other than the estimated 0.44 million bushels exported, the remaining 1.6 million bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing just over one million acres.

A1.4 Total Sales and GDP of CWRS Wheat Seed

Farm gate sales from seed acreage were $22.6 million, and of this, $3.10 million was purchased by seed or marketing companies, which in turn, resold the seed for $4.46 million, increasing the value of the seed by an estimated $1.36 million. The total sales from 1997 CWRS wheat seed acreage, including the increased in value of $1.36 million by seed companies, was an estimated $24 million.

This $24 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from certified CWRS wheat seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $122 per acre, or close to $14 million for the 114,698 acres. With farm gate sales of $22.6 million, this gives a value added of $8.66 million, or $76 per acre. From this $8.66 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The CWRS wheat growers' production input expenditures of $14 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 0.46 million bushels of seed they purchased from producers by an estimated $1.36 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A2 Durum Wheat Seed

A2.1 Durum Wheat Seed Production and Supply

The industry profile flow chart for durum wheat is given as Figure A1.2. There were 37 producers growing durum wheat for certified seed in Manitoba in 1997. The area sown for certified seed was 6,053 acres (2,450 hectares), with an estimated average yield of 30.6 bushels per acre, to give a total production of 0.18 million bushels (see Grower Survey Results, Table 32). Estimated carry-in from 1996 was 16,094 bushels, giving a supply of 196,094 bushels. There were also 3,707 bushels purchased by producers and resold. Only the value of the resale of these purchases are accounted for in calculating values (i.e. the cost of the purchases are subtracted out of gross returns, to include only the increase in value). This gave a total of 0.2 million bushels for dispersal.

A2.2 Disposition of Durum Wheat Seed Supply and Farm Gate Value

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$0.69
Commercial Grain Sales	0.66
Screenings Sales	0.08
Change in inventory	-0.05
Cost of seed purchases	-0.03
Farm Gate Sales	**$1.35**

Approximately 40 percent of the 0.2 million bushels, or 74,840 bushels, was sold as certified seed for use in 1998. The average price of certified seed was $9.19 per bushel (including a royalty of $0.24 per bushel), with a farm gate value of $0.69 million. Half of the available seed from 1997 was sold as commercial durum wheat, an estimated 100,000 bushels, with a farm gate value of $0.66 million. There were another 15,704 bushels sold as screenings, for a farm gate value of $77,264. The ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 10,634 bushels. With a beginning inventory of 16,094 bushels, the value of the change in inventory, or -5,460 bushels, was -$48,867.

A2.3 Market Distribution of 1997 Certified Durum Wheat Seed

Of the 74,840 bushels sold as seed, 45 percent, or 33,796 bushels, was sold by the producers to commercial producers, for a value of $0.31 million. Another 15,172 bushels were exported by the producers, to either other provinces (5,350 bushels, with a value of $49,253) or the US (9,822 bushels, with a value of $90,426). The remaining 25,870 bushels was sold to a marketing or seed company for a value of $240,000. Further processing of this seed by these

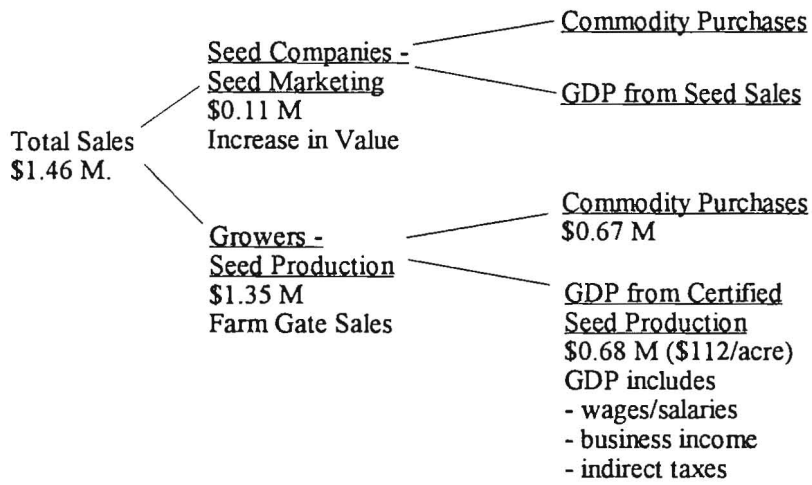
companies increased its value by an estimated $110,000, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

Therefore, other than the estimated 15,172 bushels exported, the remaining 59,666 bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing about 27,121 acres.

A2.4 Total Sales and GDP of Durum Wheat Seed

Farm gate sales from seed acreage were $1.35 million, and of this, $0.24 million was purchased by seed or marketing companies, which in turn, resold the seed for $0.35 million, increasing the value of the seed by an estimated $0.11 million. The total sales from 1997 durum wheat seed acreage, including the increase in value of $0.11 million by seed companies, was an estimated $1.46 million.

This $1.46 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from certified durum wheat seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $111 per acre or $0.67 million for the 6,053 acres. With farm gate sales of $1.35 million, this gives a value added of $0.68 million, or $112 per acre. From this $0.68 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The durum seed growers' production input expenditures of $0.67 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 25,870 bushels of seed they purchased from producers by an estimated $0.11 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A3 Other Wheats Seed (Winter, CPS, CWES)

A3.1 Other Wheats Seed Production and Supply

The industry profile flow chart for other wheats is given as Figure A1.3. There were 147 producers growing wheats other than durum and CWRS wheat for certified seed in Manitoba in 1997. These other wheats would include winter wheat, the soft whites and utility wheats. The area sown for certified seed was 24,032 acres (9,726 hectares), with an estimated average yield of 40.7 bushels per acre, to give a total production of 0.98 million bushels (see Grower Survey Results, Table 32). There was no carry-in from 1996. There were 4,303 bushels purchased by producers and resold. Only the value of the resale of these purchases are accounted for in calculating values (i.e. the cost of the purchases are subtracted out of gross returns, to include only the increase in value). This gave a total of 0.984 million bushels for dispersal.

A3.2 Disposition of Other Wheats Seed Supply and Farm Gate Value

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$2.61
Commercial Grain Sales	1.19
Screenings Sales	0.51
Change in inventory	0.27
Cost of seed purchases	-0.02
Farm Gate Sales	**$4.56**

Almost half of the 0.984 million bushels, or 450,000 bushels, was sold as certified seed for use in 1998. The average price of certified seed was $5.78 per bushel (including a royalty of $0.25 per bushel), with a farm gate value of $2.61 million. An estimated 0.35 million bushels of the seed from 1997 was sold as commercial wheat, with a farm gate value of $1.19 million. There were another 0.13 million bushels sold as screenings, for a farm gate value of $0.51 million. Ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 49,622 bushels. With no beginning inventory, the value of the ending inventory was $0.27 million.

A3.3 Market Distribution of 1997 Certified Other Wheats Seed

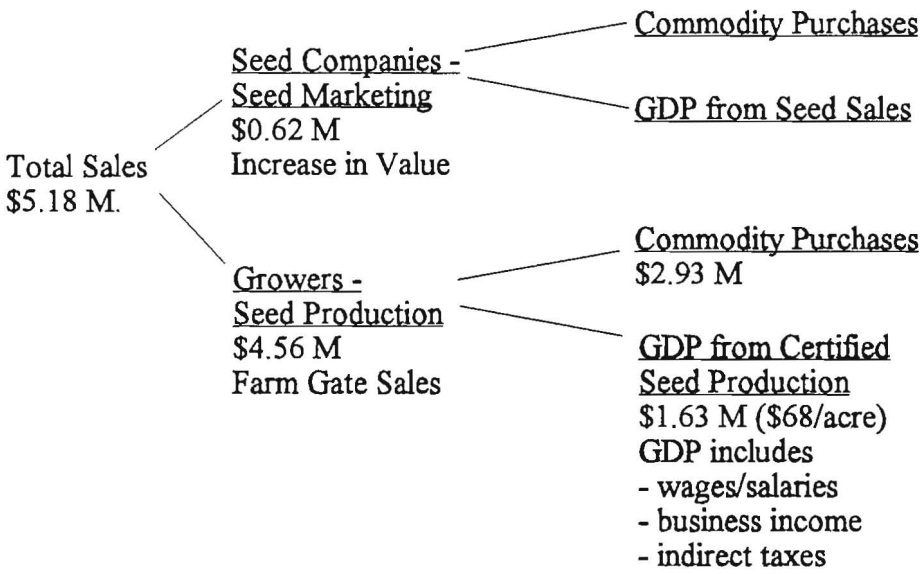
Of the 0.45 million bushels sold as seed, 44 percent, or 0.2 million bushels, was sold by the producers to commercial producers, for a value of $1.16 million. Producers indicated 6,465 bushels (value of $37,341) were used for seed multiplication. There were no exports by producers. The remaining 0.24 million bushels was sold to a marketing or seed company for a value of $1.41 million. Further processing of this seed by these companies increased its value by an estimated $0.62 million, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

Therefore, it appears that all of the 0.45 million bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing approximately 0.30 million acres.

A3.4 Total Sales and GDP of Other Wheats Seed

Farm gate sales from seed acreage were $4.56 million, and of this, $1.41 million was purchased by seed or marketing companies, which in turn, resold the seed for $2.03 million, increasing the value of the seed by an estimated $0.62 million. The total sales from 1997 other wheat seed acreage, including the increased in value of $0.62 million by seed companies, was an estimated $5.18 million.

This $5.18 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from certified other wheat seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $122 per acre or close to $2.9 million for the 24,032 acres. With farm gate sales of $4.56 million, this gives a value added of $1.63 million, or $68 per acre. From this $1.63 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The other wheat growers' production input expenditures of $2.9 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 0.24 million bushels of seed they purchased from producers by an estimated $0.62 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the

direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A4 Barley Seed

A4.1 Barley Seed Production and Supply

The industry profile flow chart for barley is given as Figure A1.4. There were 210 producers growing barley for certified seed in Manitoba in 1997. The area sown for certified seed was 36,341 acres (14,707 hectares), with an estimated average yield of 62.6 bushels per acre, to give a total production of 2.27 million bushels (see Grower Survey Results, Table 32). Estimated carry-in from 1996 was 55,474 bushels. There were also 0.14 million bushels purchased by producers and resold. Only the value of the resale of these purchases are accounted for in calculating values (i.e. the cost of the purchases are subtracted out of gross returns, to include only the increase in value). This gave a total of 2.46 million bushels for dispersal.

A4.2 Disposition of Barley Seed Supply and Farm Gate Value

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$5.00
Commercial Grain Sales	1.39
Screenings Sales	0.73
Change in inventory	0.83
Cost of seed purchases	-0.38
Farm Gate Sales	**$7.58**

Approximately half of the 2.46 million bushels, or 1.27 million bushels, was sold as certified seed for use in 1998. The average price of certified seed was $3.94 per bushel (including a royalty of $0.08 per bushel), with a farm gate value of $5.00 million. An estimated 0.58 million bushels of the seed from 1997 was sold as commercial barley, with a farm gate value of $1.39 million. There were another 0.35 million bushels sold as screenings, for a farm gate value of $0.73 million. Ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 0.27 million bushels. With beginning inventory of 55,474 bushels, the value of the change in inventory was $0.83 million.

A4.3 Market Distribution of 1997 Certified Barley Seed

Of the 1.27 million bushels sold as seed, 53 percent, or 0.67 million bushels, was sold by the producers to commercial producers, for a value of $2.62 million. Producers indicated 67,039

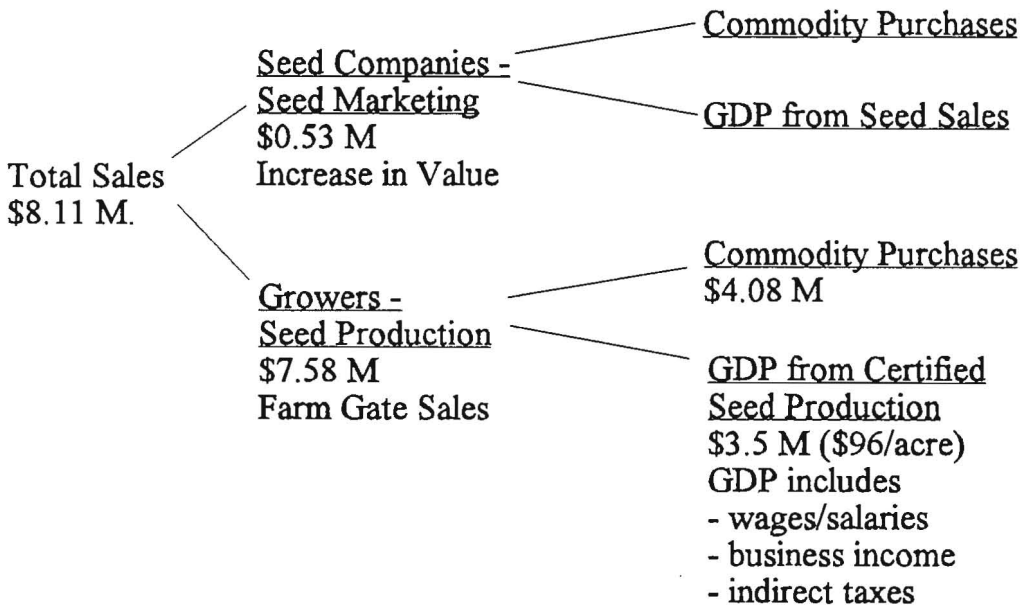
bushels (value of $0.26 million) were used for seed multiplication. Another 0.22 million bushels were exported by producers, either to other provinces (65,303 bushels, with a value of $0.26 million) or the US (0.16 million bushels, with a value of $0.65 million). The remaining 0.31 million bushels was sold to a marketing or seed company for a value of $1.21 million. Further processing of this seed by these companies increased its value by an estimated $0.53 million, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

Therefore, an estimated 1.04 million bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing approximately 0.59 million acres.

A4.4 Total Sales and GDP of Barley Seed

Farm gate sales from seed acreage were $7.58 million, and of this, $1.21 million was purchased by seed or marketing companies, which in turn, resold the seed for $1.74 million, increasing the value of the seed by an estimated $0.53 million. The total sales from 1997 barley seed acreage, including the increased in value of $0.53 million by seed companies, was an estimated $8.11 million.

This $8.11 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from certified barley seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $112 per acre or close to $4.08 million for the 36,341 acres. With farm gate sales of $7.58 million, this gives a value added of $3.5 million, or $96 per acre. From this $3.5 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The barley growers' production input expenditures of $4.08 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 0.31 million bushels of seed they purchased from producers by an estimated $0.53 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A5 Oat Seed

A5.1 Oat Seed Production and Supply

The industry profile flow chart for oats is given as Figure A1.5.1. There were 108 producers growing oats for certified seed in Manitoba in 1997. The area sown for certified seed was 12,415 acres (5,025 hectares), with an estimated average yield of 93.0 bushels per acre, to give a total production of 1.15 million bushels (see Grower Survey Results, Table 32). Estimated carry-in from 1996 was 9,573 bushels, giving a supply of 1.16 million bushels. There were also 96,944 bushels purchased by producers and resold. Only the value of the resale of these purchases are accounted for in calculating values (i.e. the cost of the purchases are subtracted out of gross returns, to include only the increase in value). This gave a total of 1.26 million bushels for dispersal.

A5.2 Disposition of Oat Seed Supply and Farm Gate Value

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$3.16
Commercial Grain Sales	0.5
Screenings Sales	0.44
Change in inventory	0.24
Cost of seed purchases	-0.31
Farm Gate Sales	**$4.03**

Approximately 50 percent of the 1.26 million bushels, or 0.71 million bushels, was sold as certified seed for use in 1998. The average price of certified seed was $4.43 per bushel (including a royalty of $0.40 per bushel), with a farm gate value of $3.16 million. An estimated 0.25 million bushels of seed was sold as commercial grain in 1997, with a farm gate value of $0.5 million. There were another 0.23 million bushels sold as screenings, for a farm gate value of $0.44 million. The ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 68,356 bushels. With a beginning inventory of 9,573 bushels, the value of the change in inventory, or 58,783 bushels, was $0.24 million.

A5.3 Market Distribution of 1997 Certified Oat Seed

Of the 0.71 million bushels sold as seed, 66 percent, or 0.46 million bushels, was sold by the producers to commercial producers, for a value of $2.06 million. Another 6,524 bushels was exported by the producers, to other provinces, for a value of $29,021. No exports to the US were indicated by producers. Producers indicated that use of 1997 seed for seed multiplication was 6,977 bushels (value of $31,031). The remaining 0.23 million bushels were sold to a marketing or seed company for a value of $1.03 million. Further processing of this seed by these companies increased its value by an estimated $0.46 million, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

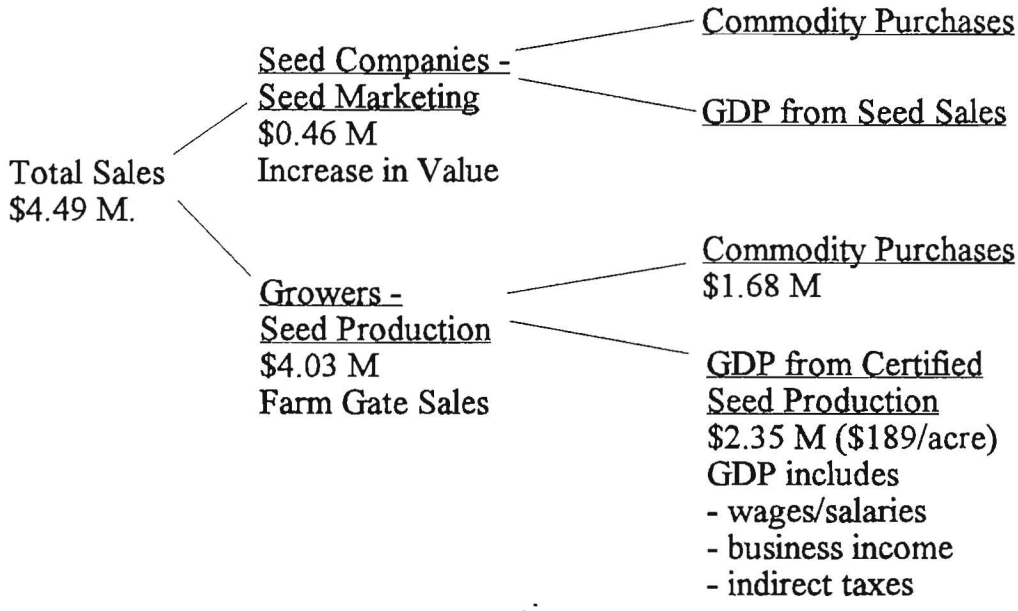
Therefore, other than the estimated 6,524 bushels exported, the remaining 0.71 million bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing approximately 0.31 million acres.

A5.4 Total Sales and GDP of Oat Seed

Farm gate sales from seed acreage were $4.03 million, and of this, $1.03 million was purchased by seed or marketing companies, which in turn, resold the seed for $1.49 million, increasing the value of the seed by an estimated $0.46 million. The total sales from 1997 oats

seed acreage, including the increased in value of $0.46 million by seed companies, was an estimated $4.49 million.

This $4.49 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from certified oats seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $135 per acre or close to $1.68 million for the 12,415 acres. With farm gate sales of $4.03 million, this gives a value added of $2.35 million, or $189 per acre. From this $2.35 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The oats growers' production input expenditures of $1.68 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 0.23 million bushels of seed they purchased from producers by an estimated $0.46 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and

promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A6 Canary Seed

A6.1 Canary Seed Production and Supply

The industry profile flow chart for canary seed is given as Figure A1.5.2. There were 15 producers growing canary seed for certified seed in Manitoba in 1997. Estimates are based on two responses. The area sown for certified seed was 1,735 acres (702 hectares), with an estimated average yield of 15.4 bushels per acre, to give a total production of 26,663 bushels (see Grower Survey Results, Table 32). There was no estimated carry-in from 1996.

A6.2 Disposition of Canary Seed Supply and Farm Gate Sales

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$0.34
Commercial Grain Sales	0.015
Screenings Sales	0.005
Change in inventory	0.027
Cost of seed purchases	0
Farm Gate Sales	**$0.38**

The majority of the seed was sold as certified seed for use in 1998. This amounted to 21,093 bushels, or close to 80 percent of the available seed. The average price of certified seed was $16.04 per bushel (no royalties paid), with farm gate sales of $0.34 million. There were an estimated 1,913 bushels (farm gate sales of $14,883) sold for commercial uses. There were another 1,964 bushels sold as screenings, for farm gate sales of $5,499. The ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 1,693 bushels. With no beginning inventory, the value of the change in inventory, was $27,156. Seed production contributes farm gate sales of $0.38 million, or $219 per acre.

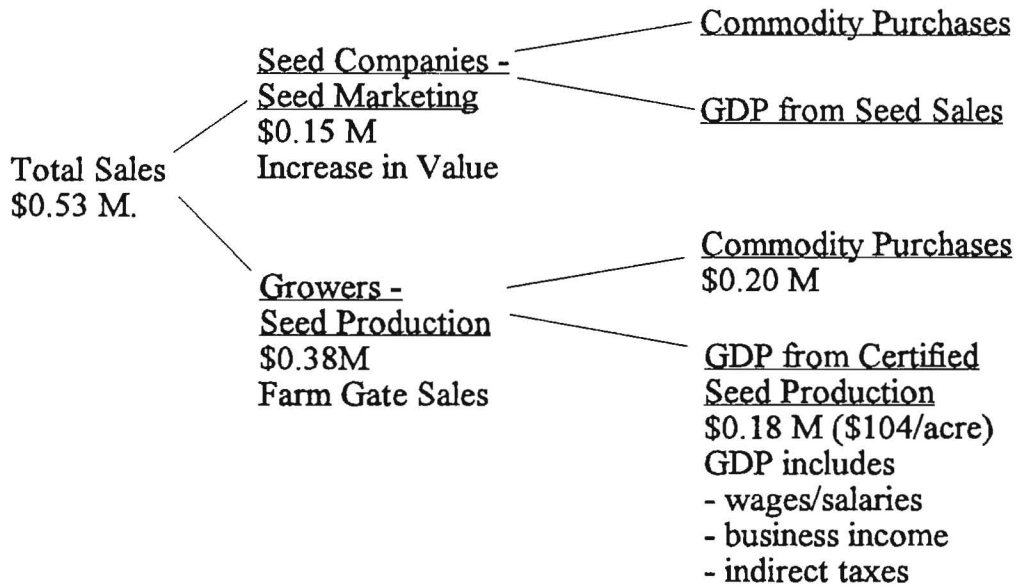
A6.3 Market Distribution of 1997 Certified Canary Seed

All of the 21,093 bushels sold as seed was sold to a marketing or seed company. Further processing of this seed by these companies increased its value by an estimated $0.15 million, for resale into the domestic provincial market to be used for seed multiplication or as certified seed by commercial producers. This 21,093 bushels of seed is sufficient for sowing 26,366 acres of canary seed.

A6.4 Total Sales and GDP of Canary Seed

Farm gate sales from seed acreage were $0.38 million, and of this, $0.34 million was purchased by seed or marketing companies, which in turn, resold the seed for $0.49 million, increasing the value of the seed by an estimated $0.15 million. The total sales from 1997 canary seed acreage, including the increase in value of $0.15 million by seed companies, was an estimated $0.53 million.

This $0.53 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from certified canary seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $118 per acre or $0.20 million for the 1,735 acres. With farm gate sales of $0.38 million, this gives a value added of $0.18 million, or $104 per acre. From this $0.18 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The canary seed growers' production input expenditures of $0.20 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing

costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 21,093 bushels of seed they purchased from producers by an estimated $0.15 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A7 Rye Seed

A7.1 Rye Seed Production and Supply

The industry profile flow chart for rye is given as Figure A1.5.3. There were 10 producers growing rye for certified seed in Manitoba in 1997. Estimates are based on two responses. The area sown for certified seed was 1,038 acres (420 hectares), with an estimated average yield of 47.6 bushels per acre, to give a total production of 49,385 bushels (see Grower Survey Results, Table 32). There was no estimated carry-in from 1996.

A7.2 Disposition of Rye Seed Supply and Farm Gate Sales

The 49,385 bushels were dispersed in one of three ways: either sold as certified seed, or screenings, or kept as inventory; there was no seed sold as commercial grain. Because the goal of the study was to estimate the value of certified producers' 1997 production, the value of each of these is included in determining overall value. This is the case even if a portion or all of the crop grown on land intended for certified sales generates revenue through commercial crop sales or screenings. The value of inventory is determined as the value of inventory change between the end of 1997 and end of 1996. This, in effect, will subtract out any inventory from previous years' production and include the value of inventory left from 1997, to take full account of only 1997 production.

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$0.14
Commercial Grain Sales	0
Screenings Sales	0.06
Change in inventory	0.03
Cost of seed purchases	0
Farm Gate Sales	**$0.23**

The amount of rye sold as certified seed for use in 1998 amounted to 25,394 bushels, or close to 51 percent of the available seed. The average price of certified seed was $5.33 per bushel (including royalties of $3,606), with farm gate sales of $135,401. There were no sales as commercial grain indicated. There were another 17,432 bushels sold as screenings, for farm gate sales of $65,196. The ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 6,559 bushels. With no beginning inventory, the value of the change in inventory, was $34,041. Seed production contributes farm gate sales of $0.23 million, or $221 per acre.

A7.3 Market Distribution of 1997 Certified Rye Seed

Of the 25,394 bushels sold as seed, the majority, 82 percent, or 20,752 bushels was sold by the producers to marketing companies for a value of $0.11 million. Commercial producers purchased 3,482 bushels for a value of $18,577. Producers indicated 1,360 bushels (value of $6,192) were used for seed multiplication. There were no exports indicated by producers. Further processing of the seed purchased by companies increased its value by an estimated $48,722, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

Therefore, an estimated 25,394 bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing approximately 20,312 acres.

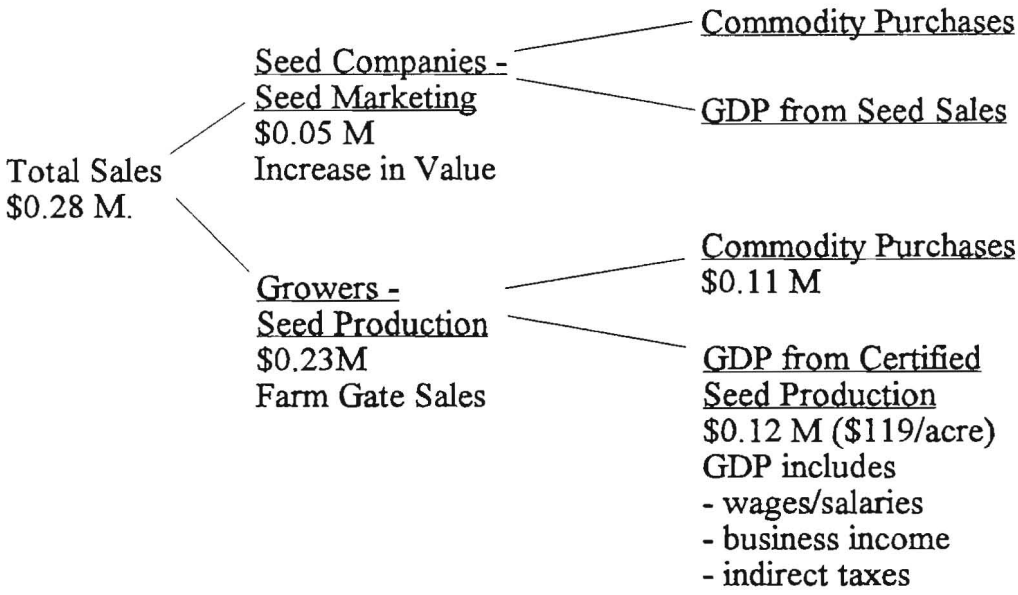
A7.4 Total Sales and GDP of Rye Seed

Farm gate sales from seed acreage were $0.23 million, and of this, $0.11 million was purchased by seed or marketing companies, which in turn, resold the seed increasing the value of the seed by an estimated $48,722. The total sales from 1997 rye acreage, including the increase in value of $0.15 million by seed companies, was an estimated $0.28 million.

This $0.28 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would

be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry.

The total sales from certified rye acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $103 per acre or $106,893 for the 1,038 acres. With farm gate sales of $0.23 million, this gives a value added of $0.12 million, or $109 per acre. From this $0.12 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The rye growers' production input expenditures of $106,893 were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 20,752 bushels of seed they purchased from producers by an estimated $48,722. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A8 Flax Seed

A8.1 Flax Seed Production and Supply

The industry profile flow chart for flax is given as Figure A1.6. There were 213 producers growing flax for certified seed in Manitoba in 1997. The area sown for certified seed was 32,194 acres (13,029 hectares), with an estimated average yield of 21.5 bushels per acre, to give a total production of 0.69 million bushels. Estimated carry-in from 1996 was 3,092 bushels. There were also 57,664 bushels purchased by producers and resold. Only the value of the resale of these purchases are accounted for in calculating values (i.e. the cost of the purchases are subtracted out of gross returns, to include only the increase in value). This gave a total of 0.75 million bushels for dispersal.

A8.2 Disposition of Flax Seed Supply and Farm Gate Value

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$5.79
Commercial Grain Sales	1.24
Screenings Sales	1.24
Change in inventory	0.4
Cost of seed purchases	-0.69
Farm Gate Sales	**$7.97**

Approximately 60 percent of the 0.75 million bushels, or 0.45 million bushels, was sold as certified seed for use in 1998. The average price of certified seed was $12.77 per bushel (including a royalty of $0.56 per bushel), with a farm gate value of $5.79 million. An estimated 0.13 million bushels of the seed from 1997 was sold as commercial flax, with a farm gate value of $1.24 million. There were another 0.13 million bushels sold as screenings, for a farm gate value of $1.24 million. Ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 35,579 bushels. With beginning inventory of 3,092 bushels, the value of the change in inventory was $0.40 million.

A8.3 Market Distribution of 1997 Certified Flax Seed

Of the 0.45 million bushels sold as seed, 53 percent, or 0.24 million bushels, was sold by the producers to commercial producers, for a value of $3.08 million. Producers indicated 15,535 bushels (value of $0.20 million) were used for seed multiplication. Another 11,801 bushels were exported by producers to other provinces, for a value of $0.15 million. There were no exports to the US indicated by producers. The remaining 0.18 million bushels were sold to a marketing or seed company for a value of $2.36 million. Further processing of this seed by these companies increased its value by an estimated $1.04 million, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

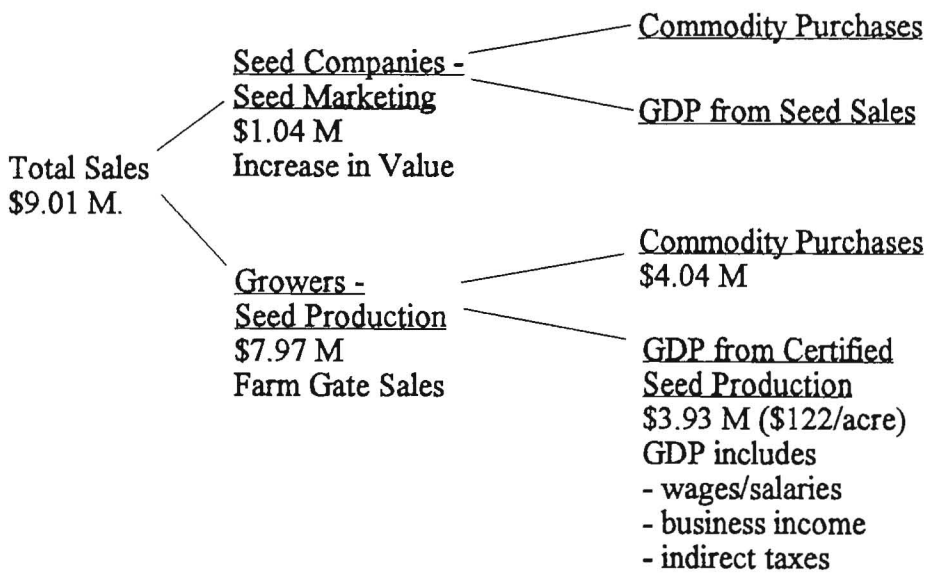
Therefore, an estimated 0.44 million bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing approximately 0.54 million acres.

A8.4 Total Sales and GDP of Flax Seed

Farm gate sales from seed acreage were $7.97 million, and of this, $2.36 million was purchased by seed or marketing companies, which in turn, resold the seed for $3.4 million, increasing the value of the seed by an estimated $1.04 million. The total sales from 1997 flax seed acreage, including the increased in value of $1.04 million by seed companies, was an estimated $9.01 million.

This $9.01 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry.

The total sales from certified flax seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $125 per acre or close to $4.04 million for the 32,194 acres. With farm gate sales of $7.97 million, this gives a value added of $3.93 million, or $122 per acre. From this $3.93 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The flax growers' production input expenditures of $4.04 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 0.18 million bushels of seed they purchased from producers by an estimated $1.04 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A9 Canola Seed

A9.1 Canola Seed Production and Supply

The industry profile flow chart for canola is given as Figure A1.7. There were 118 producers growing canola for certified seed in Manitoba in 1997. The area sown for certified seed was 19,476 acres (7,882 hectares), with an estimated average yield of 31.2 bushels per acre, to give a total production of 0.61 million bushels (see Grower Survey Results, Table 32). There was no estimated carry-in from 1996, and no seed purchased by producers and resold.

A9.2 Disposition of Canola Seed Supply and Farm Gate Value

The 0.61 million bushels were dispersed in one of three ways: either sold as certified seed, commercial grain, or screenings. Because the goal of the study was to estimate the value of certified producers' 1997 production, the value of each of these is included in determining overall value. This is the case even if a portion or all of the crop grown on land intended for certified sales generates revenue through commercial crop sales or screenings There was indicated to be no ending inventory.

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$7.94
Commercial Grain Sales	0.91
Screenings Sales	0.64
Change in inventory	0
Cost of seed purchases	0
Farm Gate Sales	**$9.48**

Approximately 70 percent of the 0.61 million bushels, or 0.42 million bushels, was sold as certified seed for use in 1998. The average price of certified seed was $19.04 per bushel (including a royalty of $3.00 per bushel), with a farm gate value of $7.94 million. An estimated 0.11 million bushels of the seed from 1997 was sold as commercial canola, with a farm gate value of $0.91 million. There were another 77,042 bushels sold as screenings, for a farm gate value of $0.64 million. Again, there was no ending inventory.

A9.3 Market Distribution of 1997 Certified Canola Seed

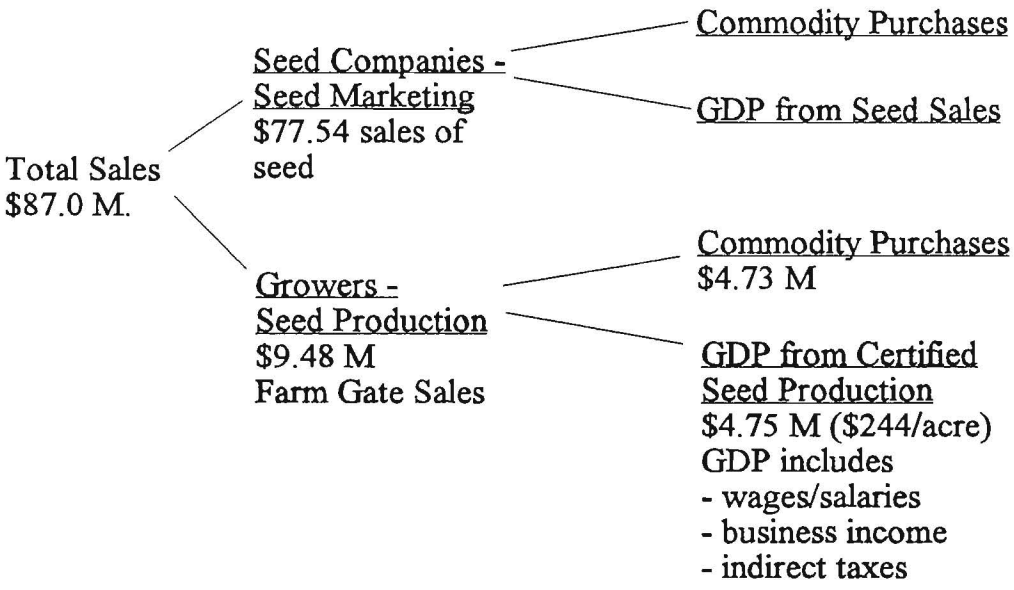
Of the 0.42 million bushels sold as seed, 26 percent, or 0.10 million bushels, was sold by the producers to commercial producers, for a value of $1.98 million. Producers indicated 15,707 bushels (value of $0.30 million) were used for seed multiplication. Another 7,000 bushels were exported by producers to the US, for a value of $0.13 million. There were no exports to other provinces indicated by producers. The remaining 0.29 million bushels were sold to a marketing or seed company for a value of $5.52 million. Further processing of this seed by these companies increased its value by an estimated $57.74 million, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers. Companies also imported an estimated 0.09 million bushels from other provinces. Processing of the imported seed increased its value by an estimated $19.8 million (after the cost of the seed is deducted and including the value of TUA's).

Therefore, an estimated 0.42 million bushels of certified seed produced in Manitoba in 1997 was sold into the domestic market, either by producers themselves or by seed or marketing companies, providing enough seed for sowing approximately 4.2 million acres, and when imports are included, 5.0 million acres.

A9.4 Total Sales and GDP of Canola Seed

Farm gate sales from seed acreage were $9.48 million. Seed company sales of Manitoba produced and imported seed (net of seed costs) was $77.54 million. The total sales from 1997 canola seed acreage and imported canola seed, including the increase in value by seed companies, was an estimated $87.0 million.

This $87.0 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies (including imported seed). Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from certified canola seed acreage in Manitoba and the value added by producers and seed companies (including imported seed) can be summarized as follows:



Production costs for seed producers were estimated as $243 per acre or close to $4.73 million for the 19,476 acres. With farm gate sales of $9.48 million, this gives a value added of $4.75 million, or $244 per acre. From this $4.75 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The canola growers' production input expenditures of $4.73 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the sales value of the 0.29 million bushels of seed they purchased from producers to an estimated $57.74 million, and when the 0.09 million bushels of imported seed is included, another $19.8 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed

companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A10 Dry Pea

A10.1 Dry Pea Production and Supply

The industry profile flow chart for peas is given as Figure A1.8. There were 141 producers growing dry peas for certified seed in Manitoba in 1997. The area sown for certified seed was 25,524 acres (10,329 hectares), with an estimated average yield of 34.8 bushels per acre, to give a total production of 0.89 million bushels (see Grower Survey Results, Table 32). Estimated carry-in from 1996 was 1,646 bushels. There were no purchases for resale indicated by producers.

A10.2 Disposition of Dry Pea Supply and Farm Gate Value

The farm gate sales from production on certified seed acreage can be summarized as follows:

Transaction Type	($million)
Seed Sales	$3.41
Commercial Grain Sales	1.68
Screenings Sales	0.26
Change in inventory	0.78
Cost of seed purchases	0
Farm Gate Sales	**$6.13**

Approximately 45 percent of the 0.89 million bushels, or 0.40 million bushels, was sold as certified seed for use in 1998. The average price of certified pea seed was $8.51 per bushel (including a royalty of $0.93 per bushel), with a farm gate value of $3.41 million. There was an estimated 0.33 million bushels sold as commercial grain, with a farm gate value of $1.68 million. There were another 55,106 bushels sold as screenings, for a farm gate value of $0.26 million. Ending inventory, which consisted of seed kept by producers for their own use, as well as seed not used in 1998, was 0.10 million bushels. With a beginning inventory of 1,646 bushels, the value of the change in inventory, or 98,354 bushels, was $0.78 million. Taking all these transactions into account, seed production contributes a farm gate value of $6.13 million, or $240 per acre.

A10.3 Market Distribution of 1997 Certified Dry Pea Seed

Of the 0.40 million bushels sold as seed, almost half, or 0.16 million bushels, was sold by the producers to commercial producers, for a value of $1.41 million. Producers indicated that use

of 1997 seed for seed multiplication was 20,787 bushels (value of $0.18 million). There were no exports of seed indicated by producers. The remaining 0.21 million bushels was sold to a marketing or seed company for a value of $1.81 million. Further processing of this seed by these companies increased its value by an estimated $0.80 million, for resale into the domestic provincial market to be used also for seed multiplication or as certified seed by commercial producers.

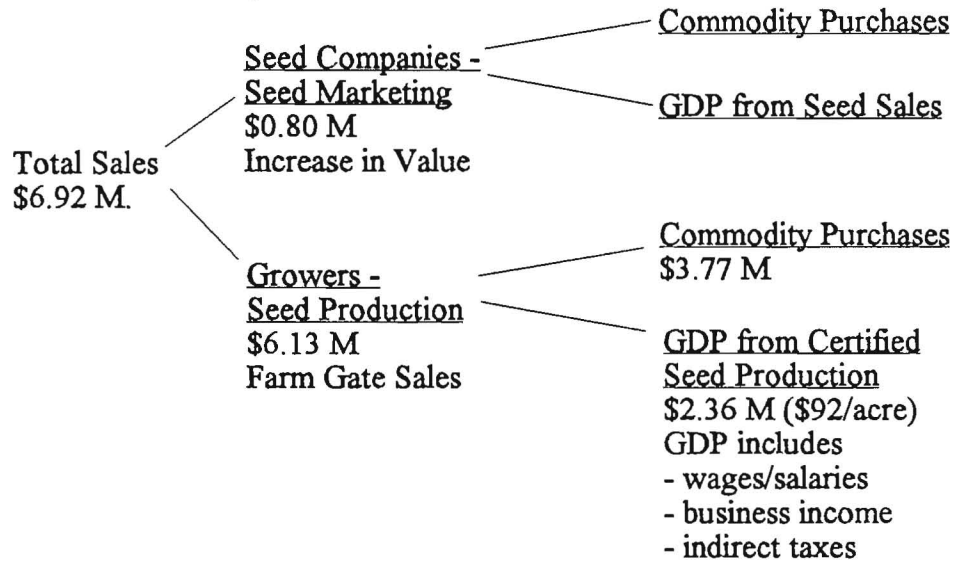
The 0.40 million bushels of certified seed produced in Manitoba in 1997 provides enough seed for sowing about 0.17 million acres of dry peas, either for seed or as a commercial crop. There were 259,946 acres of dry peas in Manitoba in 1998, therefore the 1997 certified seed production provided enough seed for approximately 64 percent of the 1998 seeded acreage.

A10.4 Total Sales and GDP of Dry Pea

Farm gate sales from seed acreage were $6.13 million, and of this, $1.81 million was purchased by seed or marketing companies, which in turn, resold the seed for $2.61 million, increasing the value of the seed by an estimated $0.8 million. The total sales from 1997 pea seed acreage, including the increased in value of $0.8 million by seed companies, was an estimated $6.92 million.

This $6.92 million reflects the total sales value from seed acreage, plus the increase in the value of the seed purchased and resold by companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain and provides a measure of the net incremental value added to the Manitoba economy by an industry.

The total sales from certified pea seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for seed producers were estimated as $148 per acre or close to $3.77 million for the 25,524 acres. With farm gate sales of $6.13 million, this gives a value added of $2.36 million, or $92 per acre. From this $2.36 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management.

The pea growers' production input expenditures of $3.77 million were spent on: fertilizer, chemicals, custom processing, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the 0.21 million bushels of seed they purchased from producers by an estimated $0.8 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

A11 Forage Seed - Common and Certified Seed

A11.1 Forage Seed Production and Supply

The industry profile flow chart for forage seed is given as Figure A1.9. There were 335 producers growing forage for certified seed in Manitoba in 1997. The area sown for certified seed was 47,502 (19,224 hectares), with an estimated average yield of 325 pounds per acre, to give a total production of 15.4 million pounds (see Grower Survey Results, Table 32). There was no estimated carry-in from 1996. Estimated area for common forage seed was 37,498 acres, with an estimated yield of 261 pounds per acre, this gives an estimated production of 9.79 million pounds.[1] This gives a total of 23.3 million pounds of forage seed.

Differences in average yield between certified and common forage seed are due mainly to the difference in mix of forage crops between the two. The survey did not allow for estimates of average yield of common forage seed; estimated yield of 261 pounds per acre was taken from Manitoba Agriculture, *Manitoba Specialty & Forage Crops Industry Profile*, and which is an estimated yield for all forages, common and certified. Common forage seed is mainly alfalfa. The certified forage seed yield is a weighted yield of a number of different forage crops, some of which have very high average yields.

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[1] Total estimated forage seed acres in 1997 was 85,000 (personal communication, G. Huebner, Manitoba Forage Seed Association), therefore common seed acreage was estimated as total acres minus certified seed acreage. Average yields of 261 lbs./acre for common seed was taken from Manitoba Agriculture, *Manitoba Specialty & Forage Crops Industry Profiles*, p. 53.

A11.2 Disposition of Forage Seed Supply and Farm Gate Sales

Of the15.4 million pounds produced by certified growers there were 2.0 million pounds of screenings, for which producers received no value. This gave 13.4 million pounds of certified forage seed, with an estimated farm gate sales value of $12.0 million. All the certified seed produced in 1997 was estimated as sold for 1998 use, which meant no ending inventory. Farm gate sales for common seed was an estimated $8.7 million, to give total farm gate sales of $20.7 million.

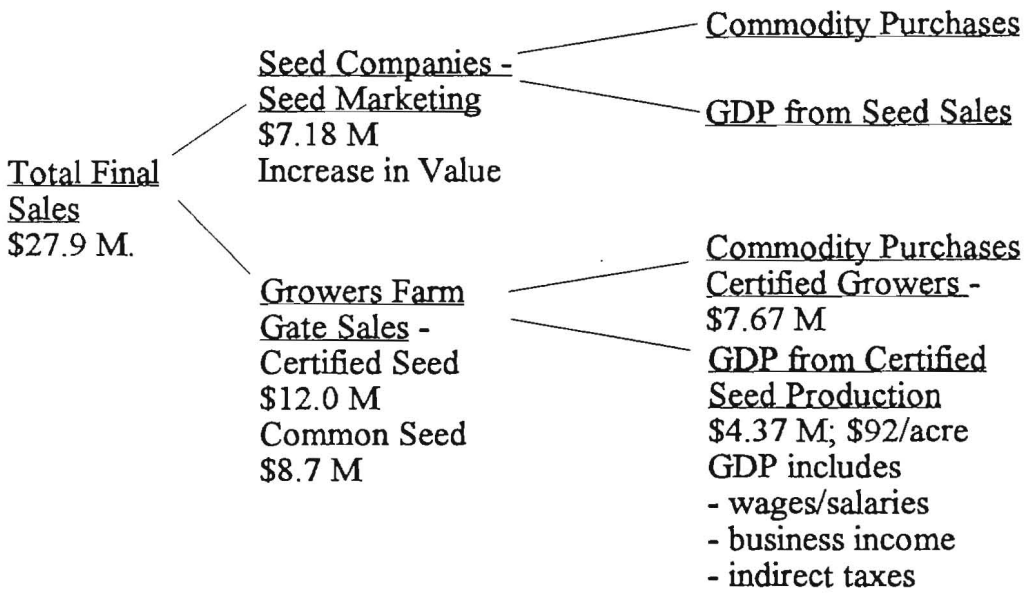
A11.3 Market Distribution of 1997 Certified Forage Seed

From the survey results, all of the 13.4 million pounds of certified seed was sold to a marketing or seed company for the above value of $12.0 million. Further processing of both certified and common seed by these companies increased the value of all seed to an estimated $27.9 million, assuming that the common forage seed was also purchased by seed companies. Companies also purchased seed from other provinces or countries. The imports from other provinces are unknown. Imports from other countries are estimated as $2.9 million, but may not include imported forage seed that enters Canada via a different province and then moves to Manitoba interprovincially.

Of the available seed (including imports), an estimated 1.2 to 2.3 million pounds was sold into the domestic Manitoba market. This would be used for 1998 certified seed production or for seeding or reseeding the 1.9 million acres of tame hay or 0.8 million acres of improved pasture in Manitoba in 1998. Exports of forage seed to other countries was large, an estimated 35 million pounds for a value of $36.0 million (Agriculture and Agri-Food Canada, TEAD, Market and Industry Services Branch), indicating there is a net import of forage seed from other provinces. Export figures include certified and common seed. The US received the majority of the exports, amounting to $26 million, or 72 percent of total exports. Alfalfa accounted for approximately 40 percent of the value of the exports for 1997. These figures refer to total international exports for 1997 and may include production from years prior to 1997 and may not include all of 1997 production. No estimates of exports to other provinces was available.

A11.4 Total Sales and GDP of Forage Seed

The total value of sales of Manitoba produced 1997 forage seed of $27.9 million includes the $20.7 million farm gate sales by producers to seed companies for common and certified seed, as well as the $7.18 million increase in value of the seed by the seed companies. Included within this total sales value is the value of commodity inputs purchased from suppliers (from the producers perspective this would be the costs of production). The direct value added by an industry to the economy, or its gross domestic product (GDP), is the value of the commodities produced by that industry minus the value of commodities purchased for production. Value added then eliminates any double counting as one moves through the supply chain, and provides a measure of the net incremental value added to the Manitoba economy by an industry. The total sales from forage seed acreage in Manitoba and the value added by producers and seed companies can be summarized as follows:



Production costs for certified seed producers were estimated from survey results as $161 per acre or close to $7.67 million for the 47,502 acres. With farm gate sales of $12.0 million, this gives a value added of $4.37 million, or $92 per acre. From this $4.37 million, producers must pay wages and salaries, opportunity costs, municipal taxes and returns to management. No production costs were available for common forage seed, although they are considered to be quite similar to certified seed production costs, other than inspection costs.

The forage seed growers' certified seed production input expenditures of $7.67 million were spent on: fertilizer, chemicals, custom processing, custom pollination, seed, fuel, utilities, repairs, custom work, marketing costs, inspection fees, bags and tags, insurance, operating interest, and royalties. These expenditures on inputs generate additional indirect value added (GDP) in these supplier industries (e.g. the fertilizer and chemical industries).

Seed or marketing companies increased the value of the certified and common seed they purchased from producers by an estimated $7.18 million. From this must also be deducted any other input purchases other than the seed costs (which have already been deducted), to give the direct value added generated by the seed companies. In addition, sectors supplying inputs to seed companies generate indirect value added in Manitoba. Major sectors generating indirect value added resulting from seed company activities include those involved in: advertising and promotion; production of seed treatments (such as herbicides and pesticides); transportation services; as well as seed technology traits and other seed related research.

While the forage industry profile outlined here and summarized in Figure A1.9 in Appendix 1 provides a summary of the value and activities of the industry, it also demonstrates the areas where lack of information may constrain the industry in achieving its full market potential. Information on interprovincial flow of forage seed is required for the industry to

completely understand what its value and current status is and where its limitations and potentials lay. This is true for any seed crop, but particularly true for forages, since the industry imports significant amounts of forage seed from other provinces and the majority of the forage seed processed in Manitoba (including seed produced in Manitoba and seed imported from other provinces) is exported out of country, mainly to the United States.

Figure A1.1: Manitoba CWRS Wheat Seed, 1997

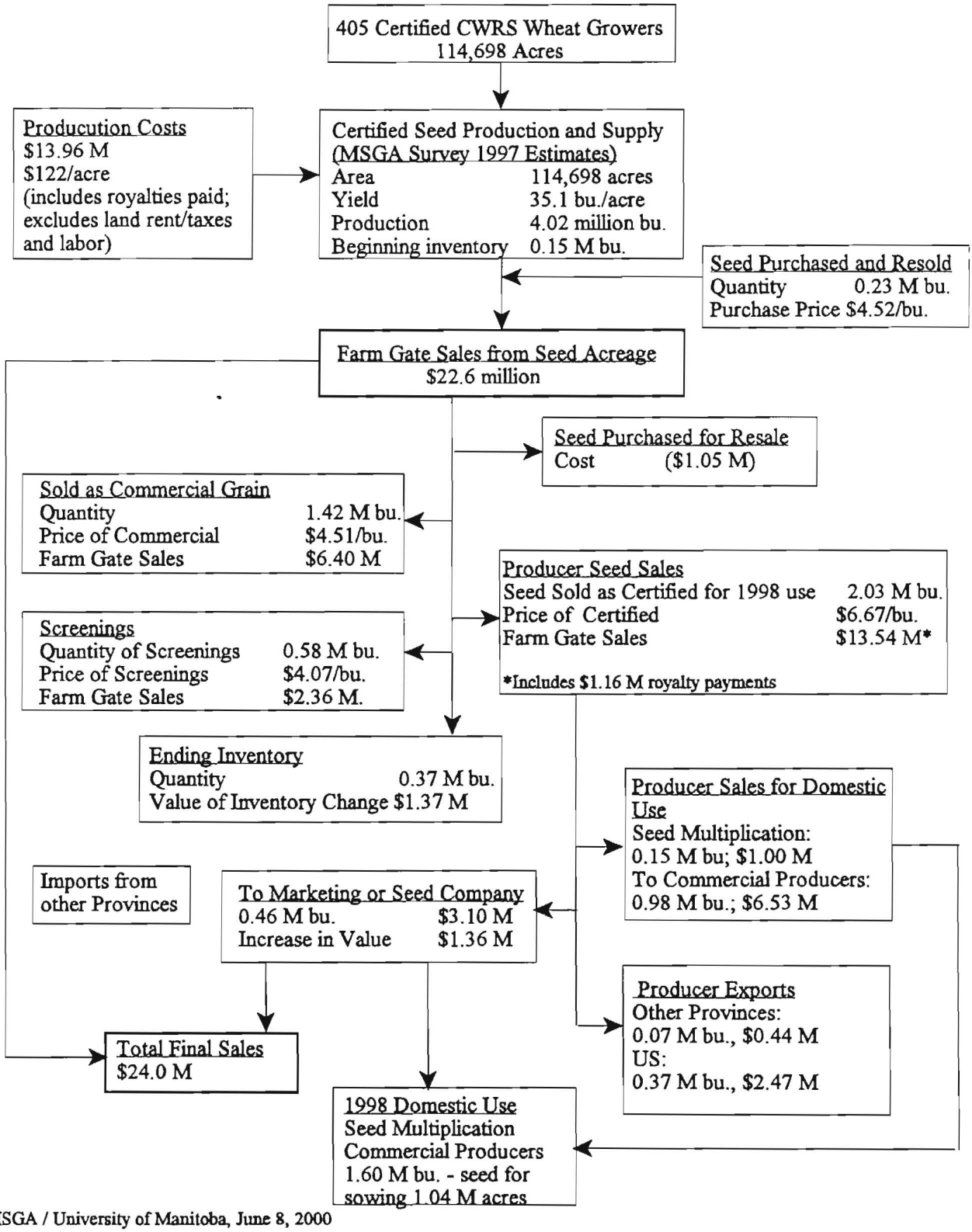


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Figure A1.2: Manitoba Durum Wheat Seed, 1997

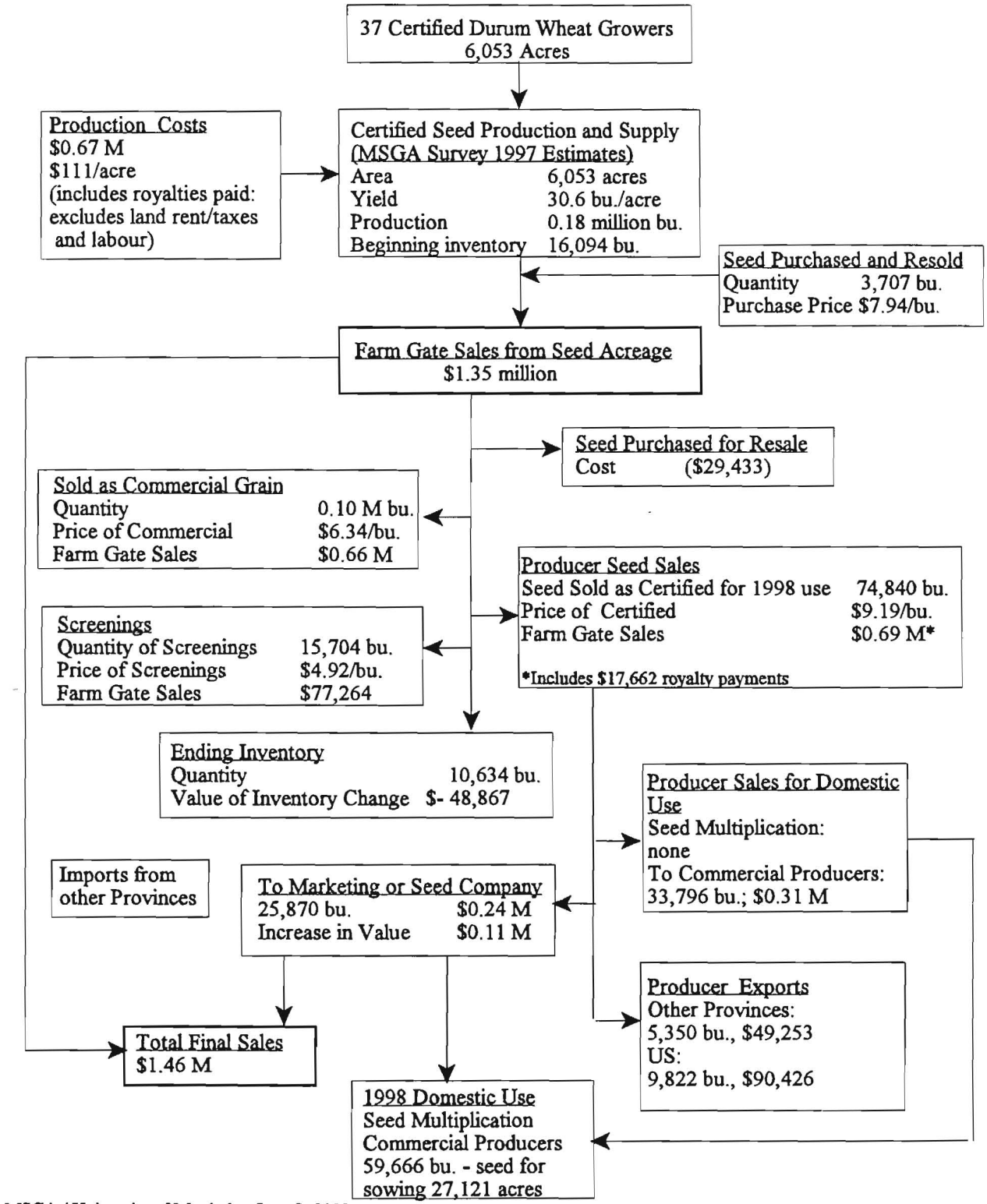

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Figure A1.3: Manitoba Other Wheat Seed, 1997
(Includes Winter Wheat, Canada Prairie Spring Wheat, Canada Western Extra Strong Wheat)

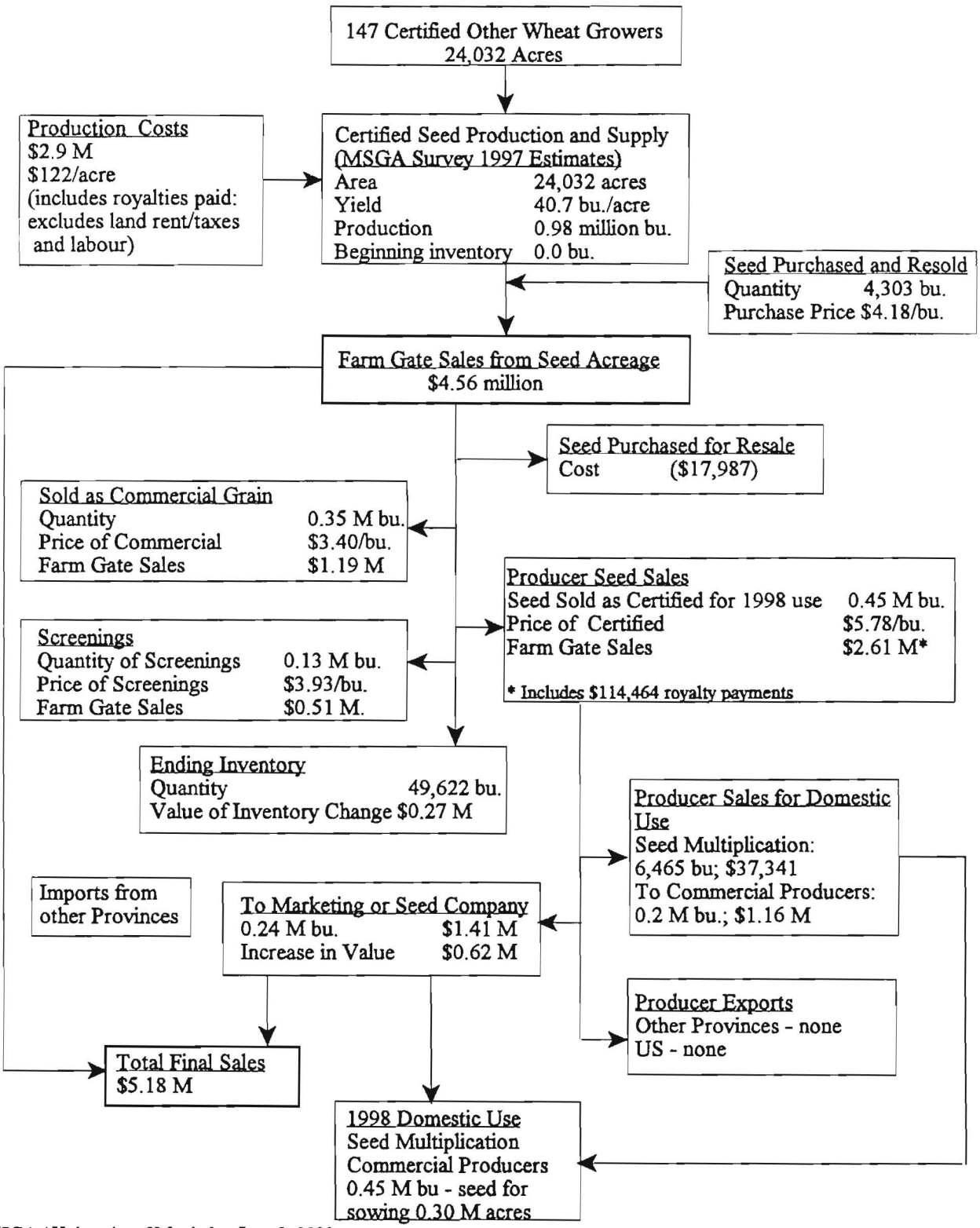

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Figure A1.4: Manitoba Barley Seed, 1997

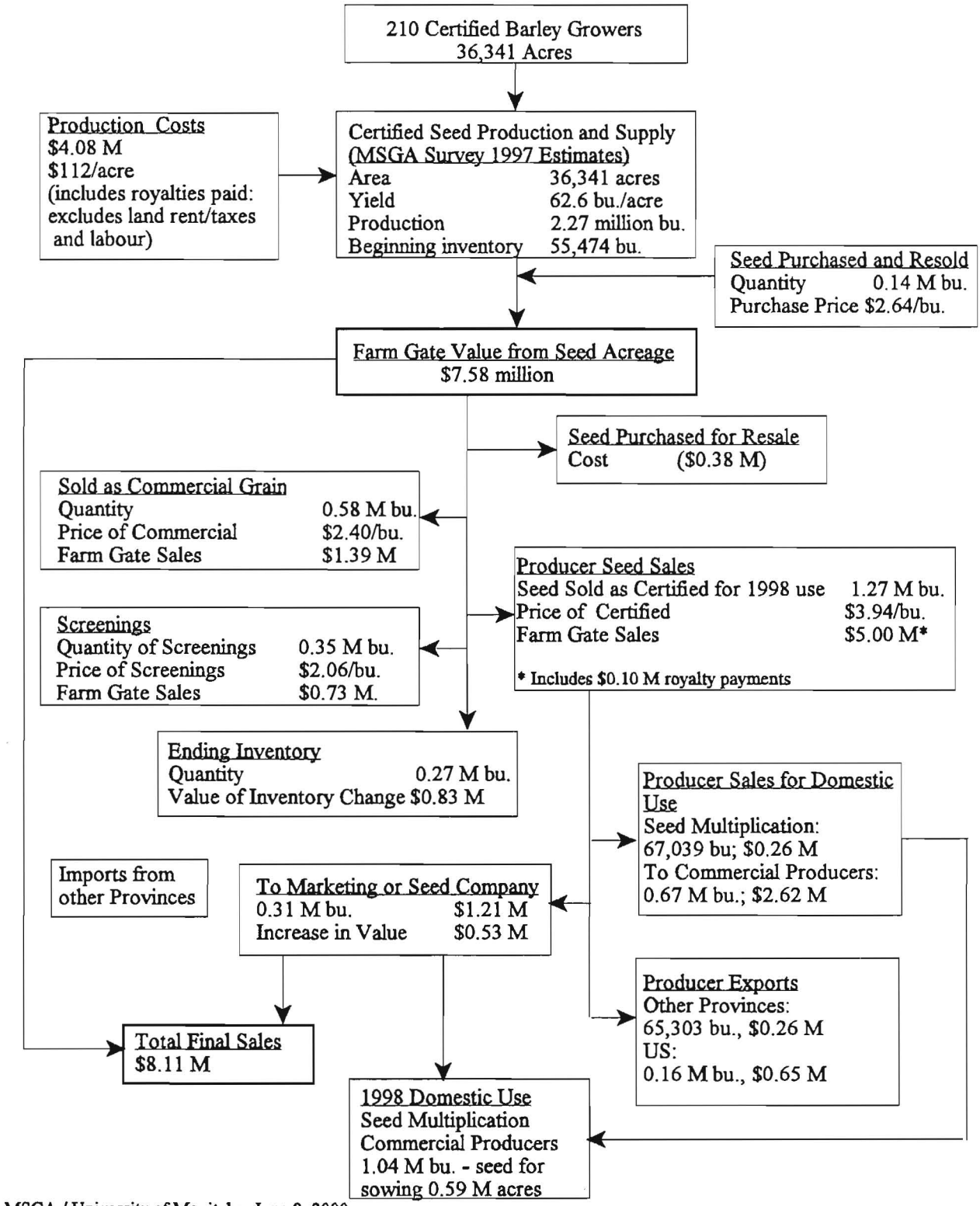

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Figure A1.5.1: Manitoba Oat Seed, 1997

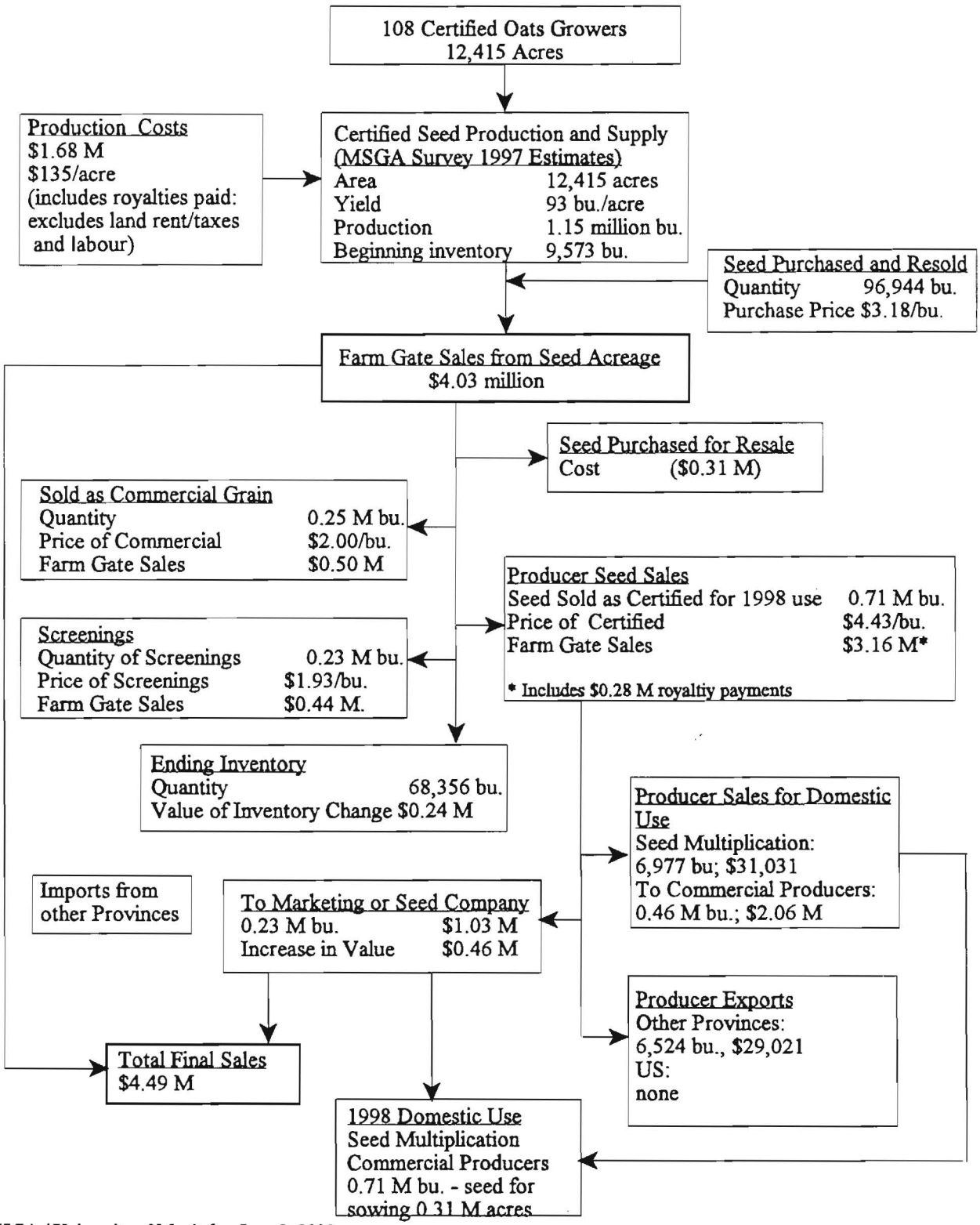

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Figure A1.5.2: Manitoba Canary Seed, 1997

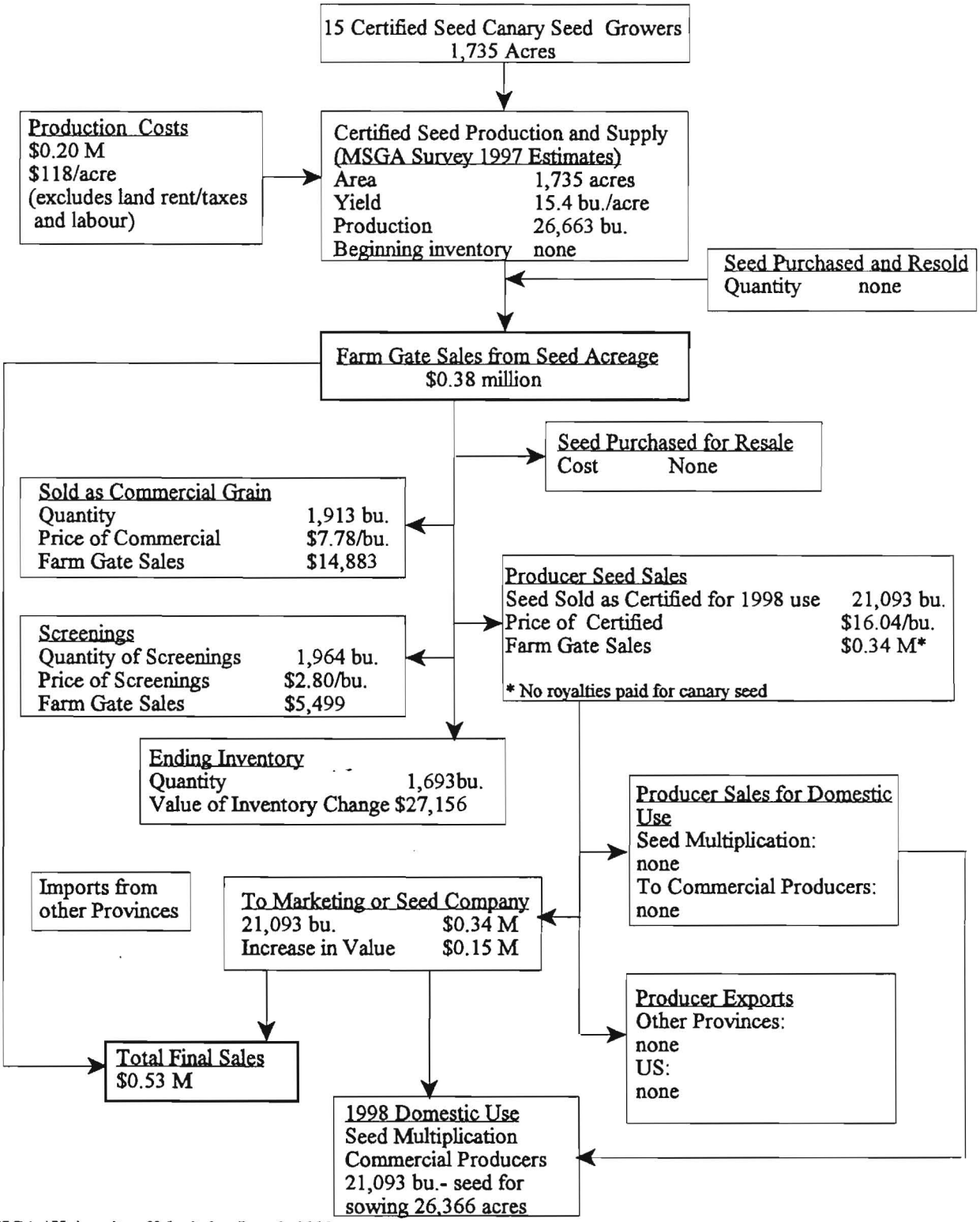

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Figure A1.5.3: Manitoba Rye Seed, 1997

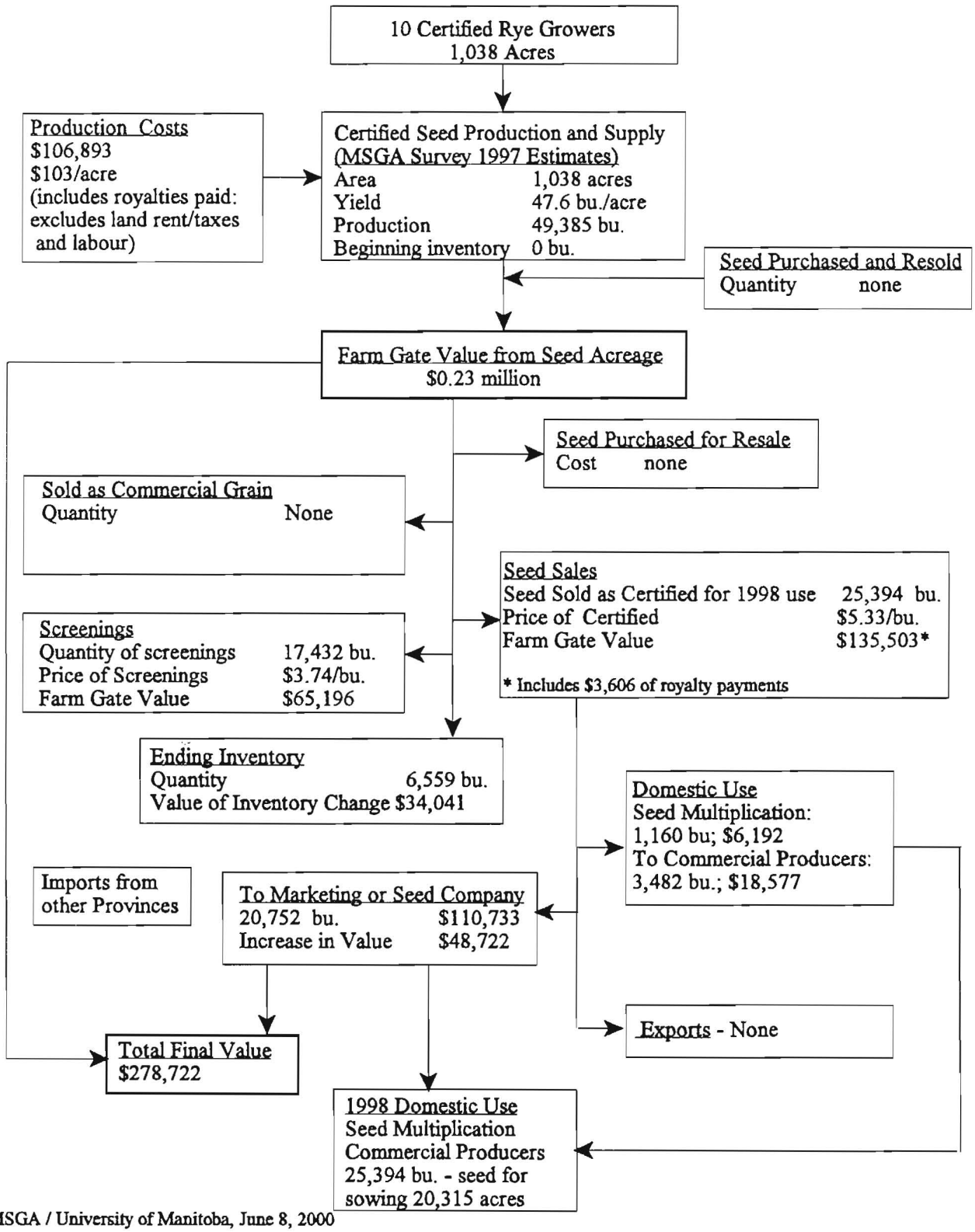

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Figure A1.6: Manitoba Flax Seed, 1997

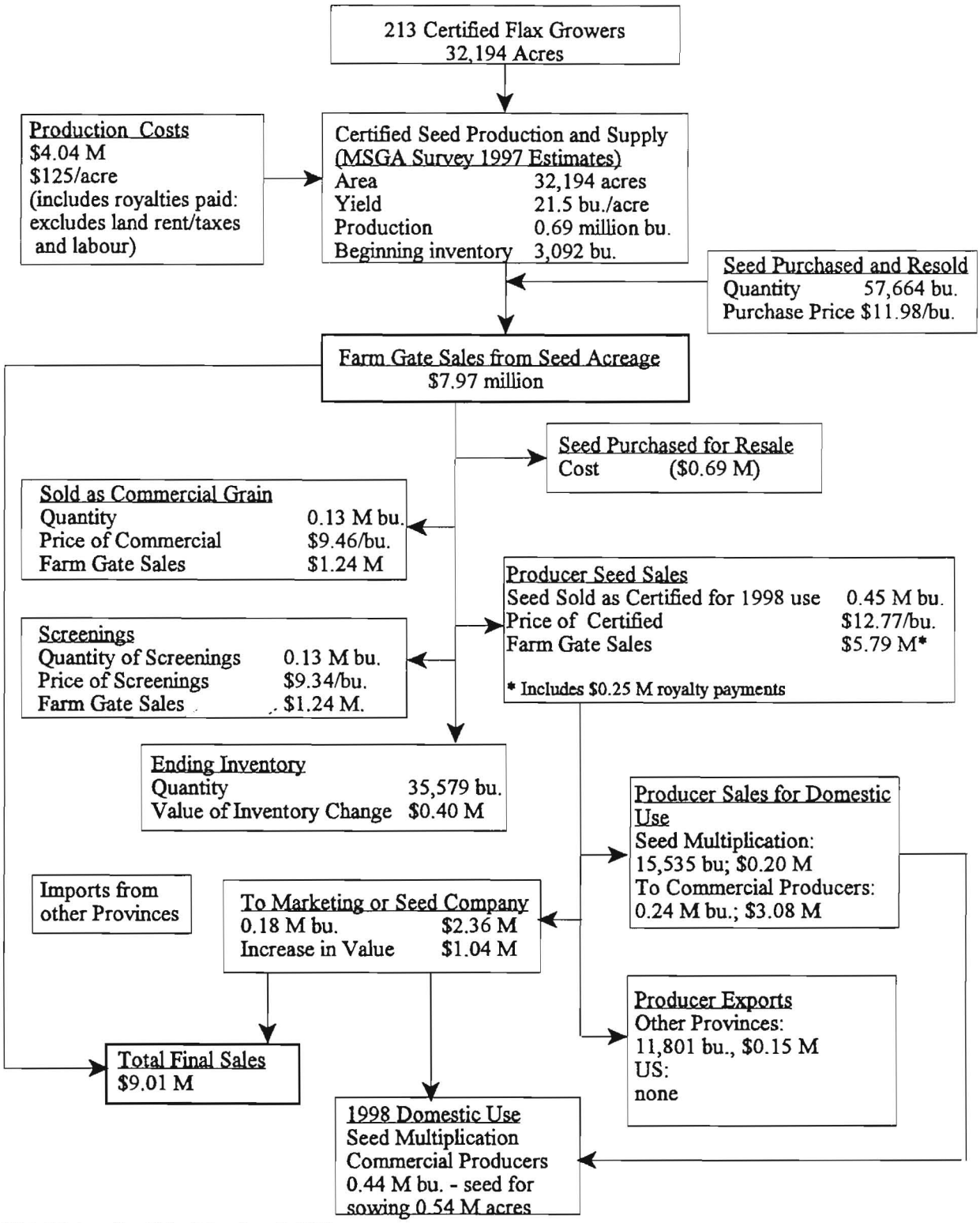

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Figure A1.7: Manitoba Canola Seed, 1997

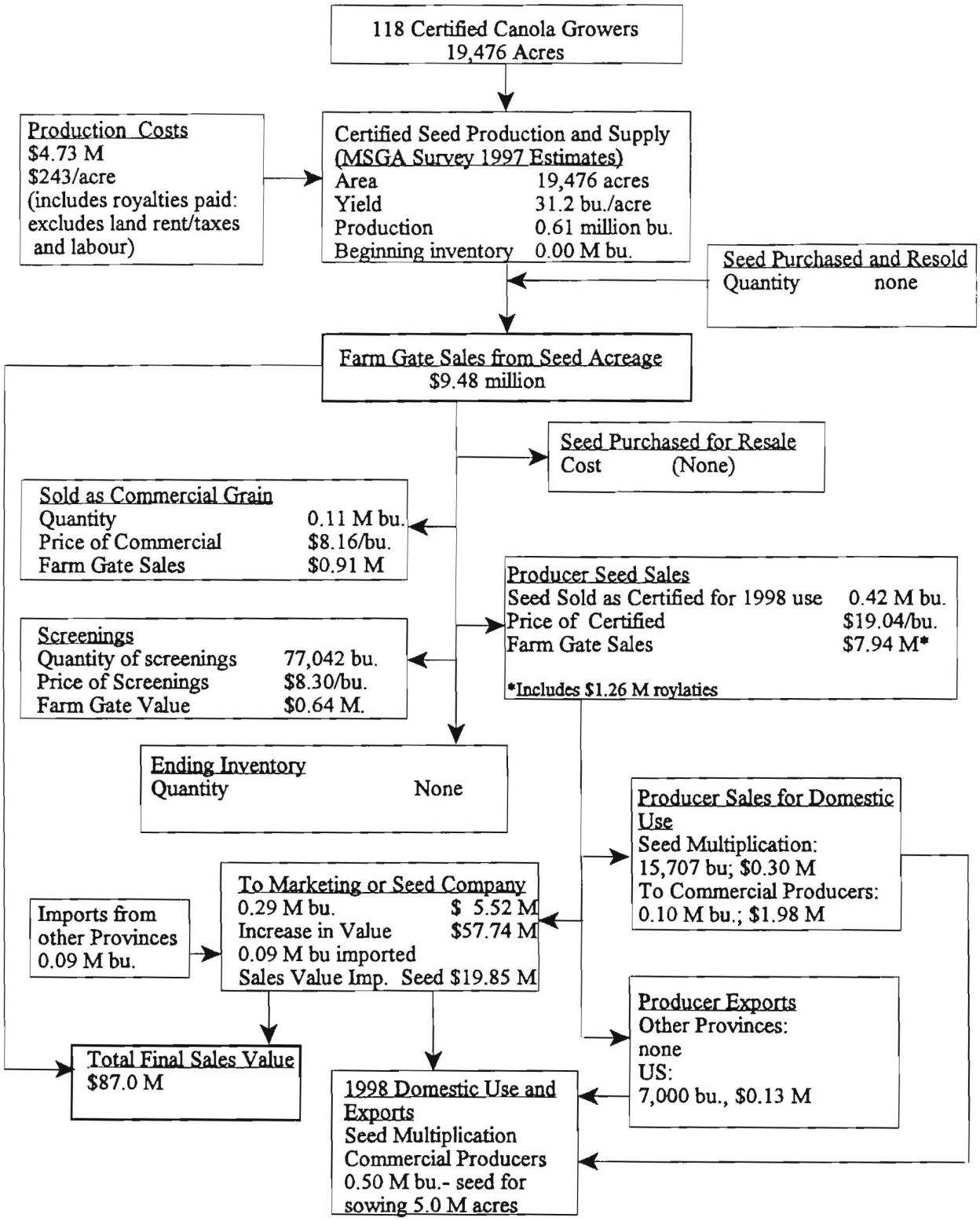

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Figure A1.8: Manitoba Pea Seed, 1997

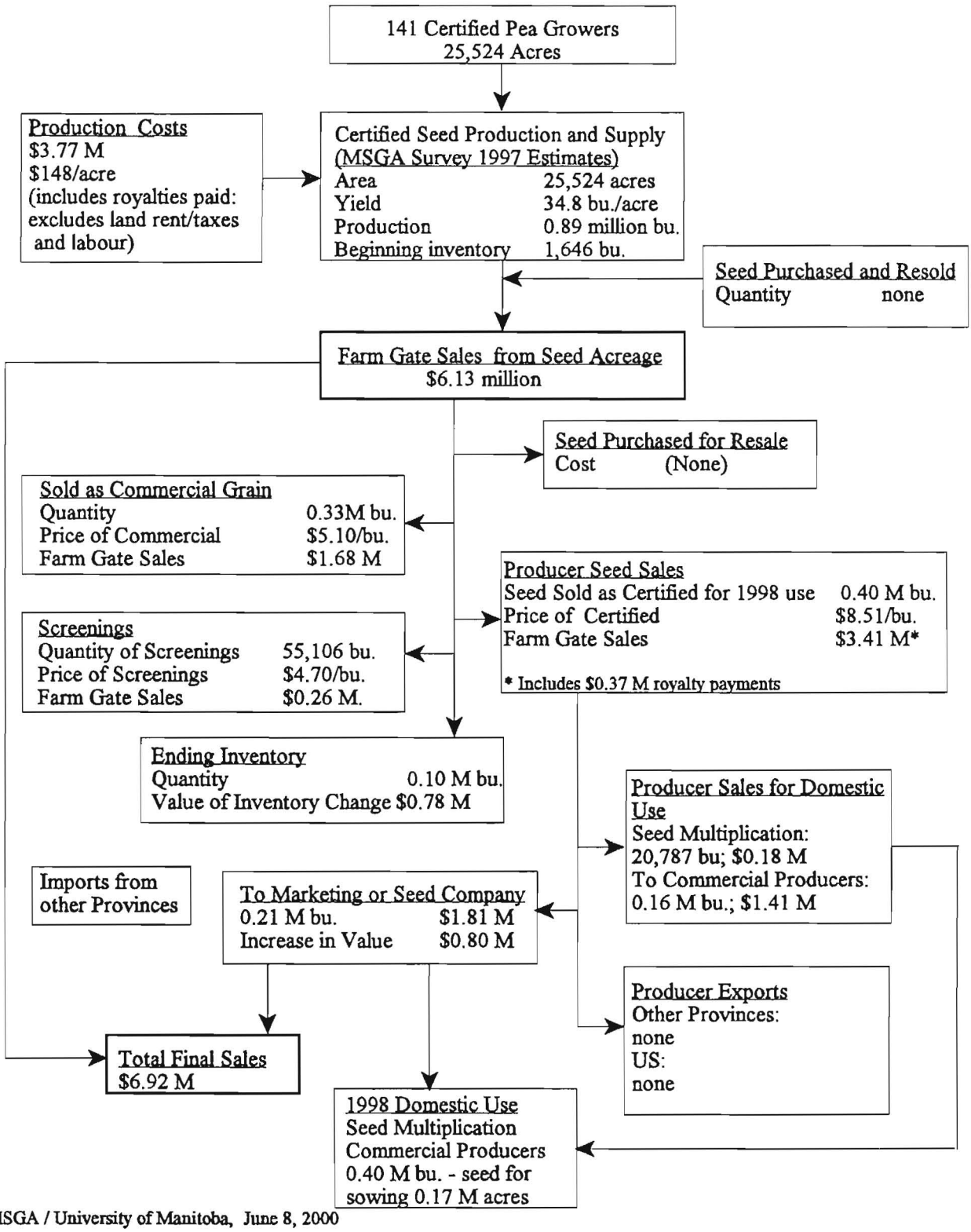

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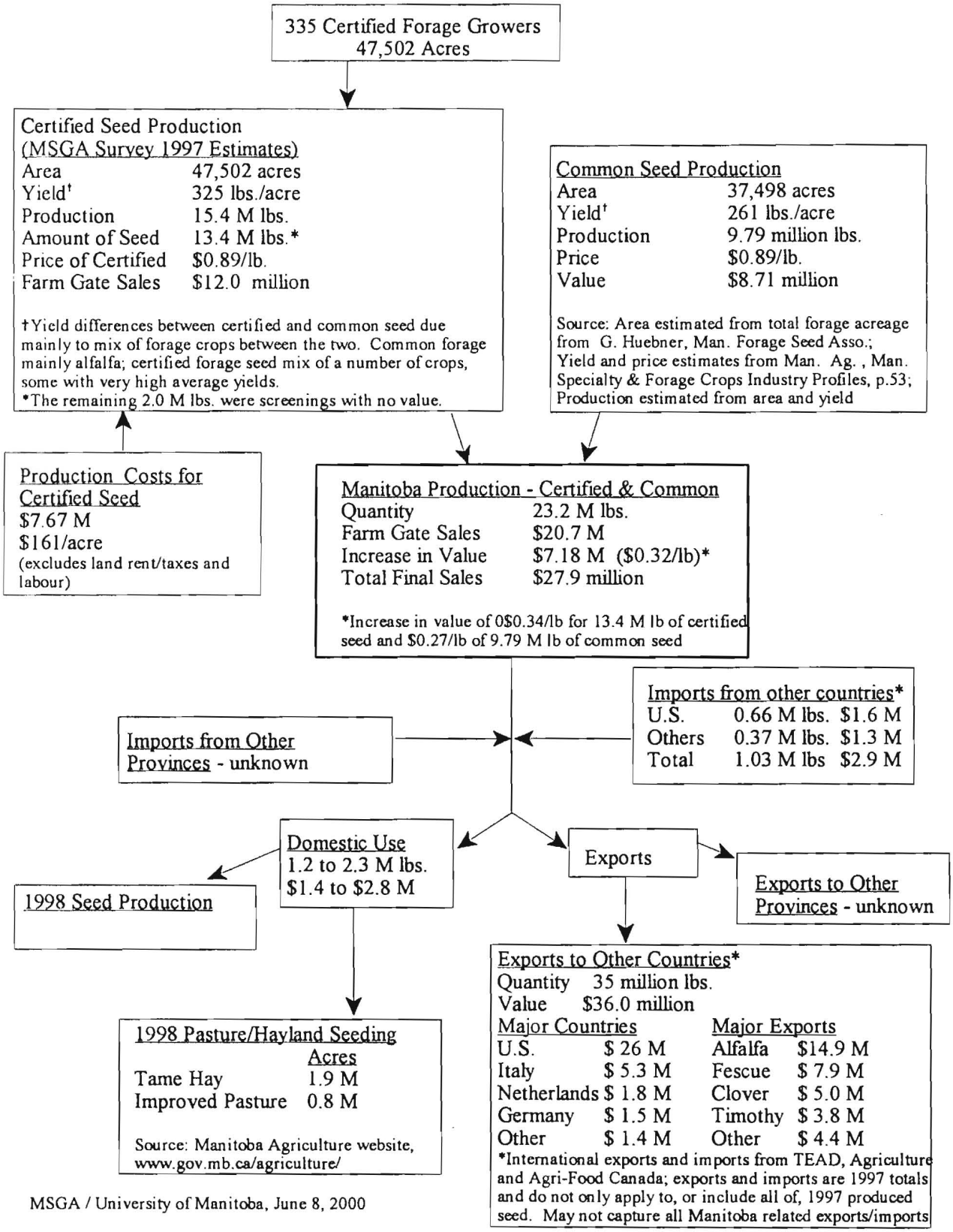
Figure A1.9: Manitoba Forage Seed, 1997



MSGA / University of Manitoba, June 8, 2000

Appendix 2:
Manitoba Commercial Crop Production, Acreage and Export Trends

Sources for Appendix 2:

Canada Grains Council, *Canadian Grains Industry Statistical Handbook 98*, Winnipeg, Manitoba.

Manitoba Agriculture, *Manitoba Agriculture Yearbook, 1997*, Program and Policy Analysis Branch.

Manitoba Agriculture, *Manitoba Grains & Oilseeds Industry Profiles 1997,* Program & Policy Analysis Branch.

Manitoba Agriculture, *Manitoba Specialty & Forage Crops Industry Profiles 1997*, Program & Policy Analysis Branch.

Trends in Commercial Crop Acreage, Production and Exports

Manitoba has a competitive advantage in international markets, associated with high quality products produced or originating from certified seed and sold in domestic and international markets. The pedigreed seed system, therefore, is an essential element contributing to the high quality, and thus value, of Manitoba's commercial crop. The 1997 Manitoba farm gate value of crop production for cereals, oilseeds, forage and specialty crops was $1.6 billion, down slightly from a high of $1.9 billion in 1996 (Table A2.1). Wheat and canola accounted for the highest proportion of value of production (29 percent and 32 percent, respectively). For the first time ever, the value of production for canola in 1997, at $524.5 million, was higher than for wheat, at $472.4 million. Value of production for wheat was an all-time high in 1996, at $713.4 million, and dropped by 34 percent between 1996 and 1997.

Prices play an important role in seed and commercial producers' production decisions. Prices for wheat and barley in international markets were at a 12 year cyclical low in 1998, having peaked in May 1996. Canola prices peaked in 1996/97, but remained strong in 1998. Recent economic problems in Asia have had additional negative impacts on grain prices. On the other hand, the low Canadian dollar relative to the US and other grain trading countries has had a positive impact on the competitiveness of Manitoba agricultural exports. The charts in this appendix illustrate the trends in acres planted to the various commercial crops for Manitoba and Canada, for 1988 to 1998. Although the distribution of acreage between the various crops have varied, total acreage planted to crops in Manitoba has changed little since the early 1980s, increasing from 10.9 million acres in 1981 to 11.6 million acres in 1996, or a 6.4 percent increase (Manitoba Agriculture 1997).

Acres planted to wheat have been declining in Manitoba and in Canada as a whole since the early 1990s, whereas acres planted to canola have been increasing. Wheat acres in Manitoba were at a high of 5.4 million acres in 1990 and dropped to 3.2 million acres by 1998. Canola acres in Manitoba were at an all time high in 1998 at 2.75 million acres. Barley acreage, which had been dropping since a high of 2.35 million acres in 1981, showed recovery in 1996, up to 1.55 million acres, but dropped again in 1997 and 1998 to 1.3 million acres.

Table A2.1: Manitoba's Farm Value of Production and Exports, 1996 and 1997[1]

Sector	1996 Value of Production	1996 Exports	1997 Value of Production	1997 Exports
	$ million			
Cereals				
Wheat (all wheats)	713.4	672.4	472.4	617.7
Unprocessed		669.5		610.7
Processed		2.9		7.0
Barley	249.2	88.7	178.6	64.1
Unprocessed		64.5		42.1
Processed		24.0		22.0
Oats	144.7	101.2	92.0	114.4
Unprocessed		79.0		88.3
Processed		22.2		26.1
Rye	10.0	8.66	9.2	7.3
Unprocessed		8.65		7.3
Processed		0.01		0.0
Oilseeds				
Canola	411.3	516.6	524.5	491.5
Unprocessed		238.3		284.6
Processed		278.3		206.9
Flax	120.0	134.2	124.9	160.7
Unprocessed		103.0		123.6
Processed		31.2		37.1
Forage				
Tame Hay	154.7	3.3	94.4	6.3
Alfalfa Pellets		2.2		0.4
Forage Seed	13.5	27.7	14.9	35.6
Pulses[2]				
Peas	28.9	37.8	33.5	73.8
Beans	23.9	18.7	26.4	14.0
Lentils	7.4	31.9	1.6	18.9
Specialty Crops[2]				
Buckwheat	5.4	3.1	3.3	4.8
Canary Seed	11.1	18.3	3.0	16.4
Grain Corn	20.3	1.3	19.2	1.3
Mustard	2.0	26.7	2.5	18.0
Sunflower	13.0	15.5	15.3	15.3
TOTAL	1,928.8	1,706.1	1,615.7	1,660.1

[1]Excludes mixed grains, fababeans, wild rice, fodder corn, straw and horticultural crops.

[2]Export values include processed and unprocessed forms.

Sources: *Manitoba Grains & Oilseeds Industry Profiles 1997, Manitoba Specialty & Forage Crops Industry Profiles 1997*, Manitoba Agriculture, Program & Policy Analysis

Flaxseed acres in Manitoba in 1997 and 1998, at close to 700,000 acres both years, were close to the long-term average. Oats acreage has been increasing in both Manitoba and all of Canada since the early 1990s, and was at 1.0 million acres in Manitoba in 1998. Oats acreage in Manitoba has been less than 1.0 million annually since the late 1970s, dropping to 270,000 acres in 1991. Dry peas acreage has also increased substantially in Manitoba and all of Canada since the early 1990s. Dry pea acreage in Manitoba was at 180,000 acres in 1988, dropped to 90,000 acres in 1990 and increased to 260,000 acres in 1998. For all of Canada, dry peas acreage jumped from close to 300,000 acres in 1990 to close to 3 million acres in 1998. While dry white bean acreage has shown an overall decline for all of Canada since 1990, white bean acreage has increased for Manitoba (Figures A2.27 and A2.28 are for dry white beans only and do not include colored beans). Total bean acreage (white and colored) was at a high in 1998 at 100,000 acres. While lentil acreage has shown an overall increase in Canada since the end of the 1980s, lentil acreage in Manitoba peaked at 160,000 acres in 1992 and dropped to 15,000 acres in 1998. Tame hay acreage has shown a gradual increasing trend in Manitoba and all of Canada over a number of years. Tame hay acreage in Manitoba was 1.9 million acres in 1998.

Exports of crops from Manitoba, for the same crops outlined in Table A2.1, in both processed and unprocessed form, totaled close to $1.7 billion in both of 1997 and 1996 (exports from Manitoba includes imports from other provinces). Wheat continues to account for the largest proportion of exports, $617.7 million in 1997, accounting for 37 percent of the total exports shown in Table A2.1, followed by canola, $491.5 million, accounting for 29.6 percent of exports. The value of wheat and canola exports both dropped a small amount (8 percent and 5 percent, respectively) in 1997 relative to 1996. Exports of wheat are mainly in unprocessed forms.

While exports of bulk canola increased between 1996 and 1997 by 19 percent, exports of processed canola (oil or meal) decreased by 25.6 percent. Flax seed exports increased between 1996 and 1997 in both unprocessed and processed form. Total flax exports from Manitoba increased by 19.7 percent between 1996 and 1997 (see Table A2.1). While canola's export value was approximately 58 percent from bulk unprocessed form and 42 percent processed form, flax exports are mainly in unprocessed form. The decline in exports of processed canola is a change from the trend. Domestic oil and meal production have been increasing as well as exports of oil and meal. Canola seed and oil are priced in international markets on a competitive basis with soybeans, soybean oil and palm oil. Canola and flaxseed food products have significant nutritional advantages relative to palm and soybean products.

Trends in exports of the major grain and oilseed crops for all of Canada are illustrated in Figures A2.33 to A2.39. Canadian exports of wheat have been declining since the early 1990's, showing the same trend as spring wheat acreage. Canadian exports of canola have been showing an increasing trend, although they peaked in 1994/95 and dropped in 1995 and 1996.

Manitoba exports of oats were $114.4 million in 1997, an increase of 13 percent from 1996. Canadian exports of oats have been increasing, but declined between 1996 and 1997. International livestock markets have been positive for hay and forage seed; forage seed accounts for the majority of the value of forage exports. Of the pulses, dry pea exports jumped from $37.8 million in 1996 to $73.8 million in 1997. Bean exports were $14.0 million in 1997, a 22 percent decrease from 1996, and lentil exports dropped by 41 percent between the two years. Exports of specialty crops declined slightly between 1996 and 1997.

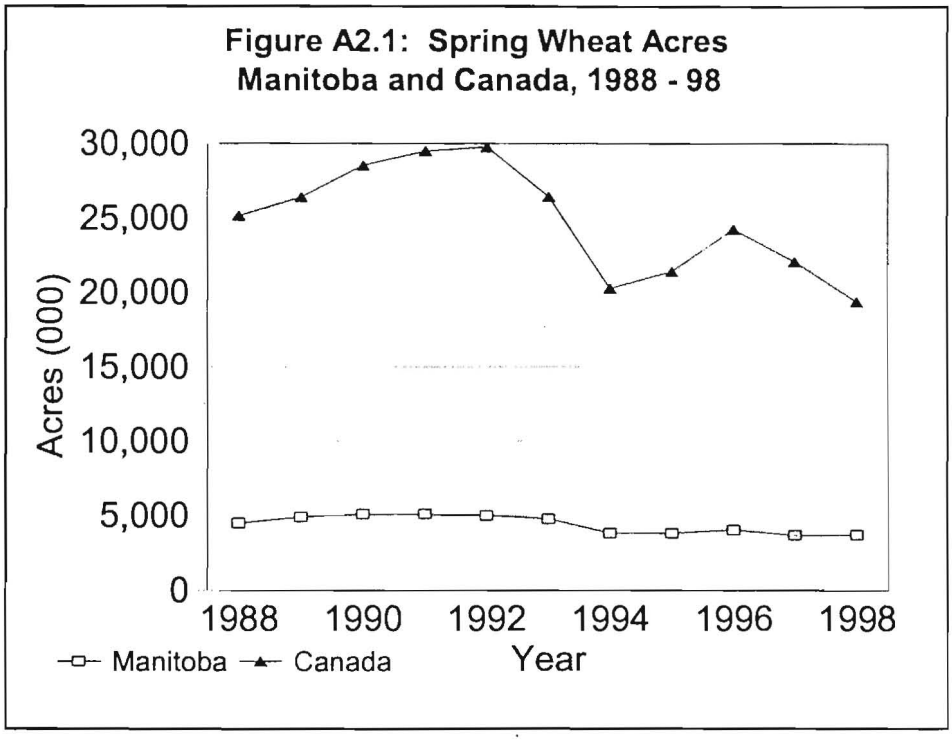


Figure A2.1: Spring Wheat Acres
Manitoba and Canada, 1988 - 98
30,000
25,000
20,000
15,000
10,000
5,000
0
Acres (000)
1988
1990
1992
1994
1996
1998
Year
Manitoba
Canada

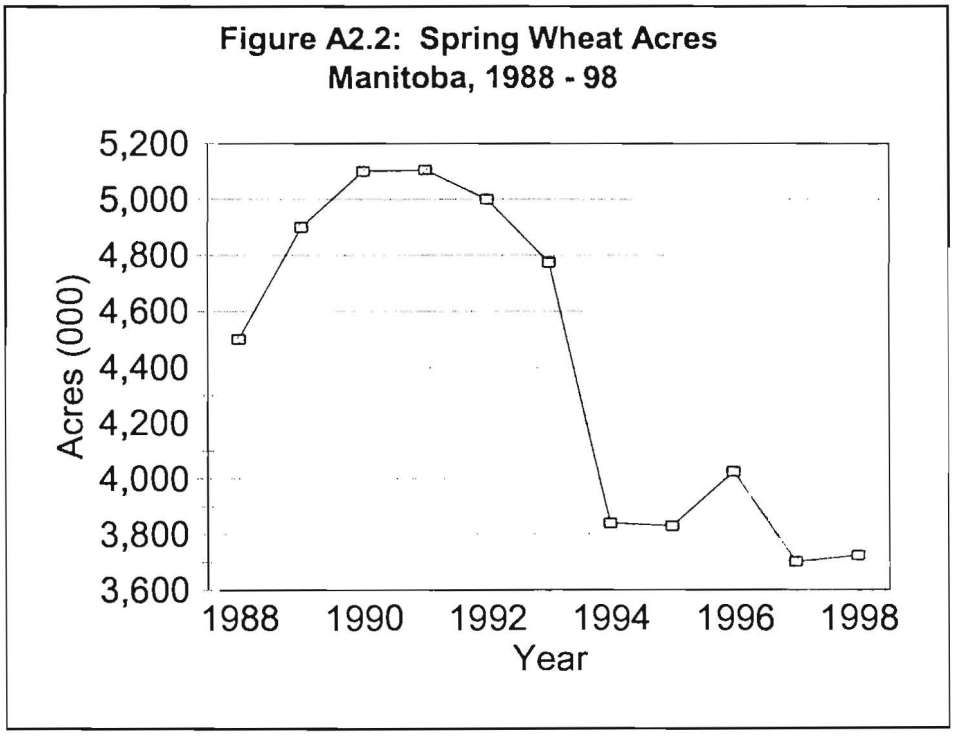


Figure A2.2: Spring Wheat Acres
Manitoba, 1988 - 98
5,200
5,000
4,800
4,600
4,400
4,200
4,000
3,800
3,600
Acres (000)
1988
1990
1992
1994
1996
1998
Year

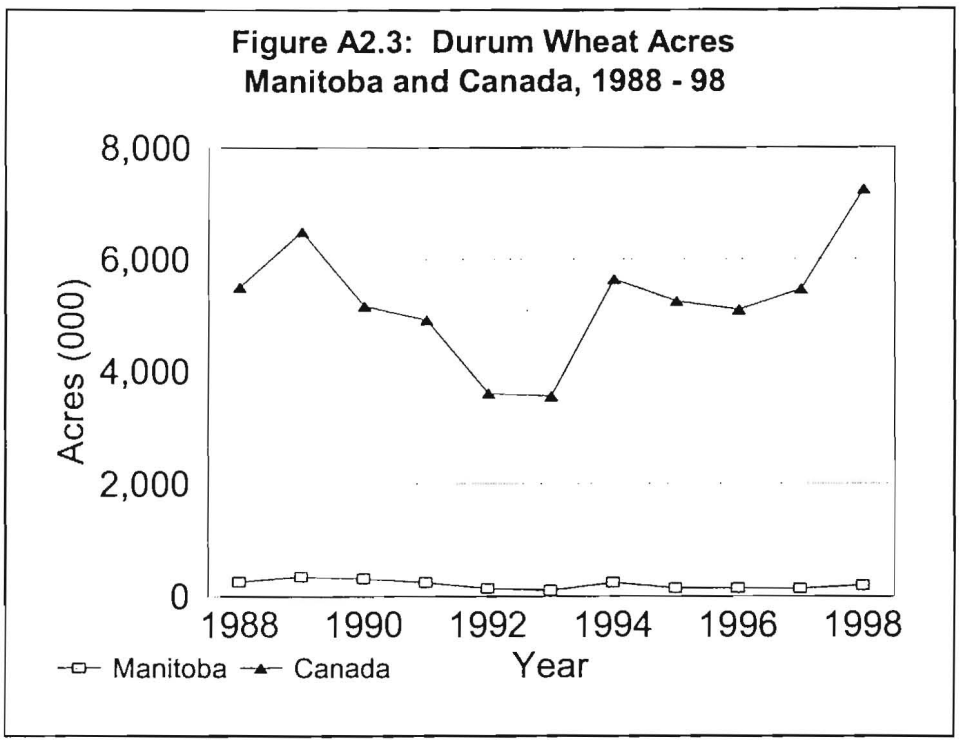


Figure A2.3: Durum Wheat Acres
Manitoba and Canada, 1988 - 98
8,000
6,000
4,000
2,000
0
Acres (000)
1988
1990
1992
1994
1996
1998
Year
Manitoba
Canada

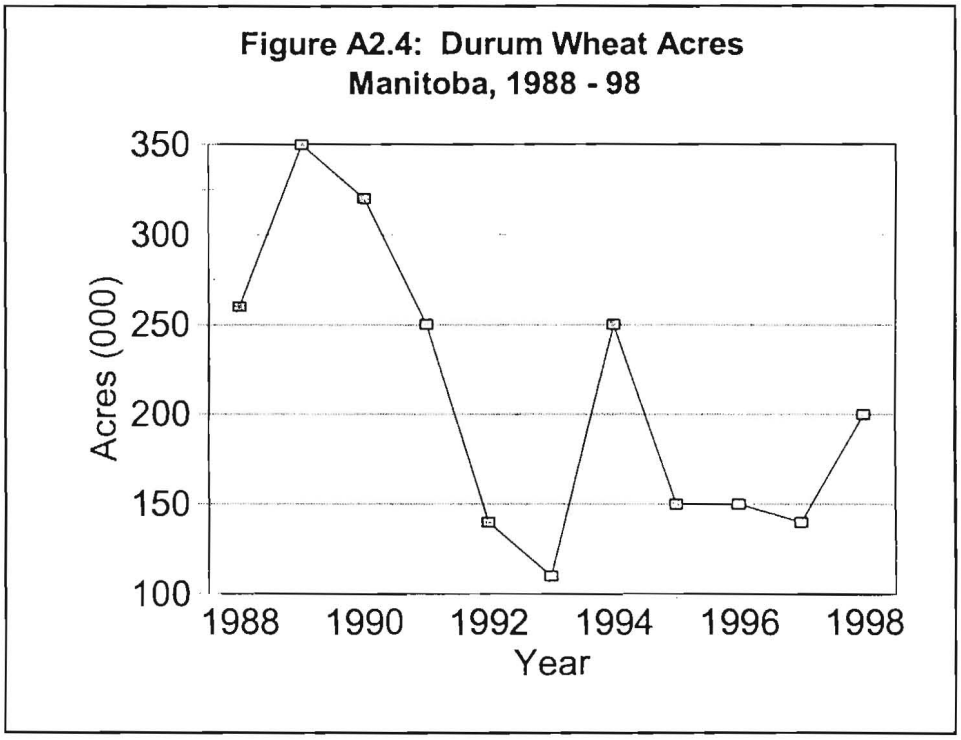


Figure A2.4: Durum Wheat Acres
Manitoba, 1988 - 98
350
300
250
200
150
100
Acres (000)
1988
1990
1992
1994
1996
1998
Year

Figure A2.5: Winter Wheat Acres
Manitoba and Canada, 1988 - 98

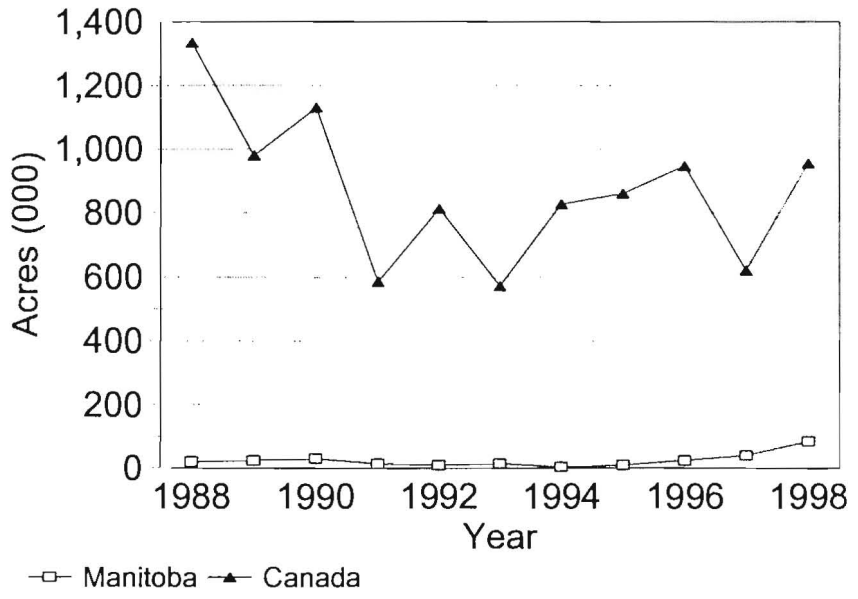


Figure A2.6: Winter Wheat Acres
Manitoba, 1988 - 98

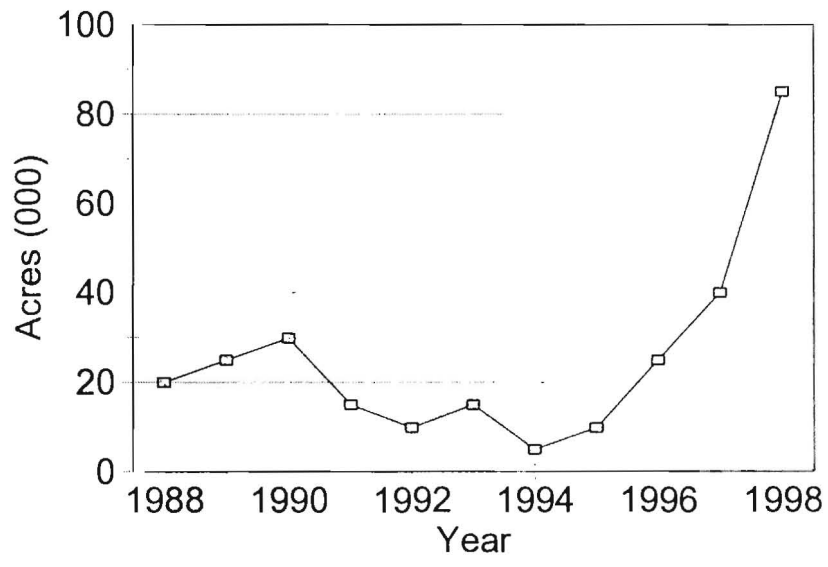


Figure A2.7: Barley Acres
Manitoba and Canada, 1988 - 98

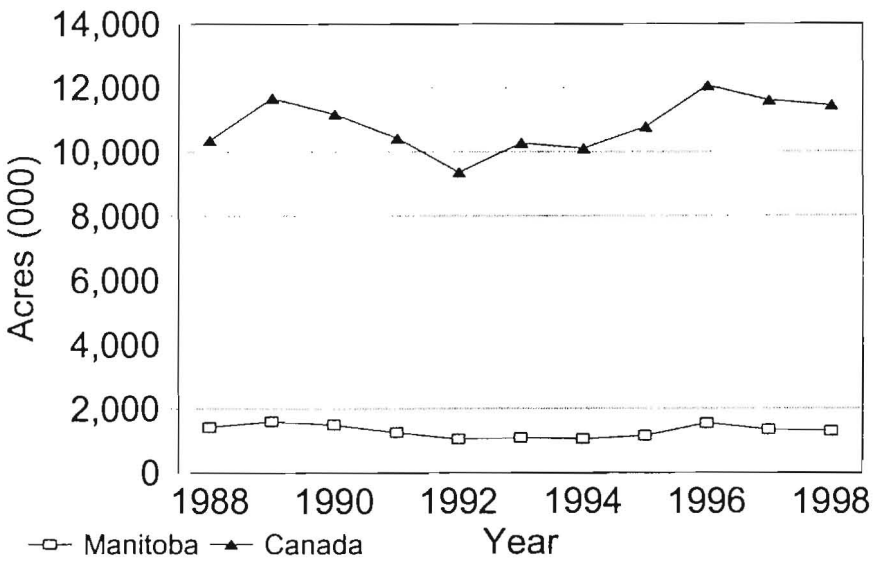
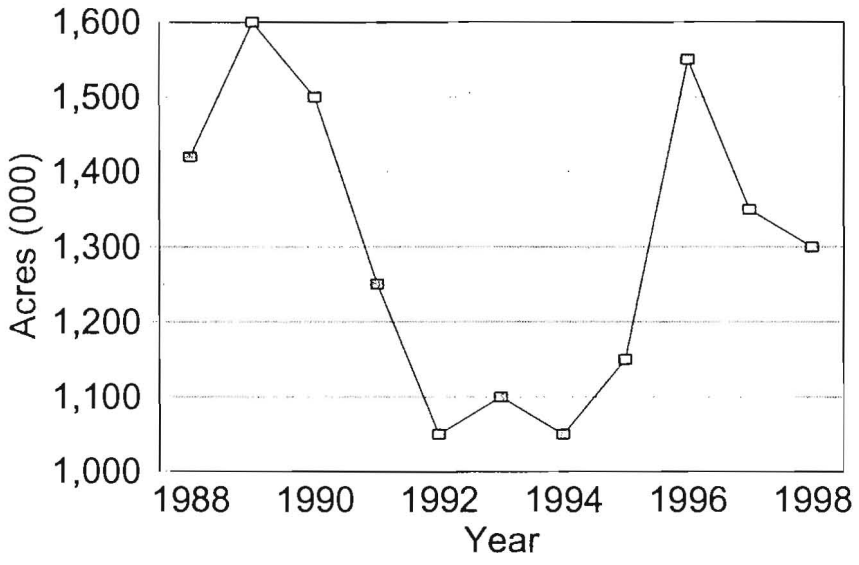


Figure A2.8: Barley Acres
Manitoba, 1988 - 98



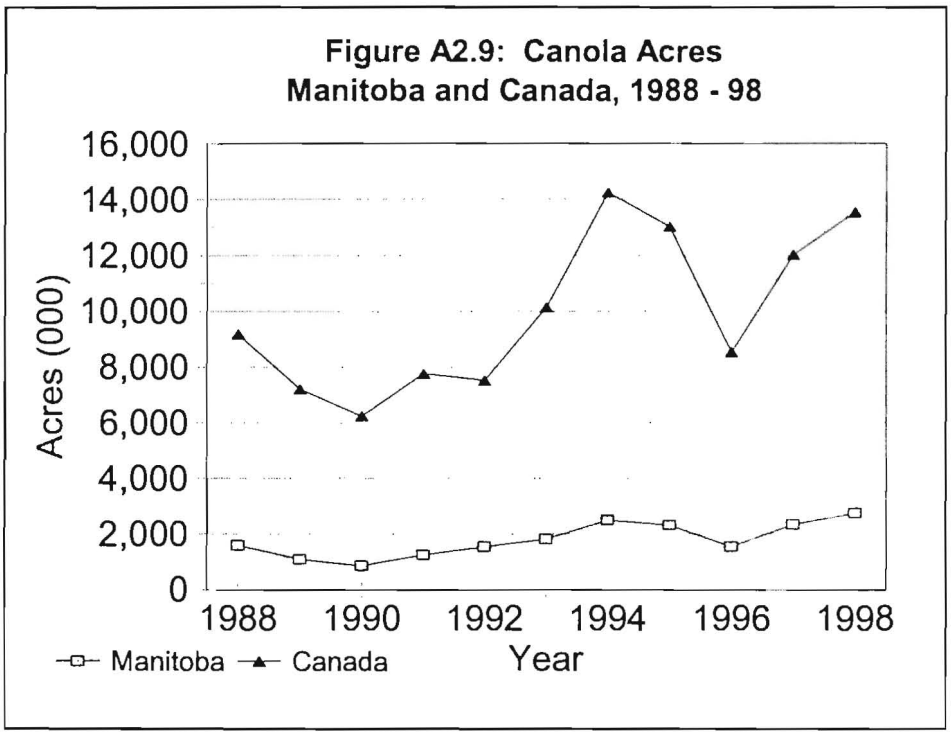


Figure A2.9: Canola Acres
Manitoba and Canada, 1988 - 98
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Acres (000)
1988
1990
1992
1994
1996
1998
Year
Manitoba
Canada

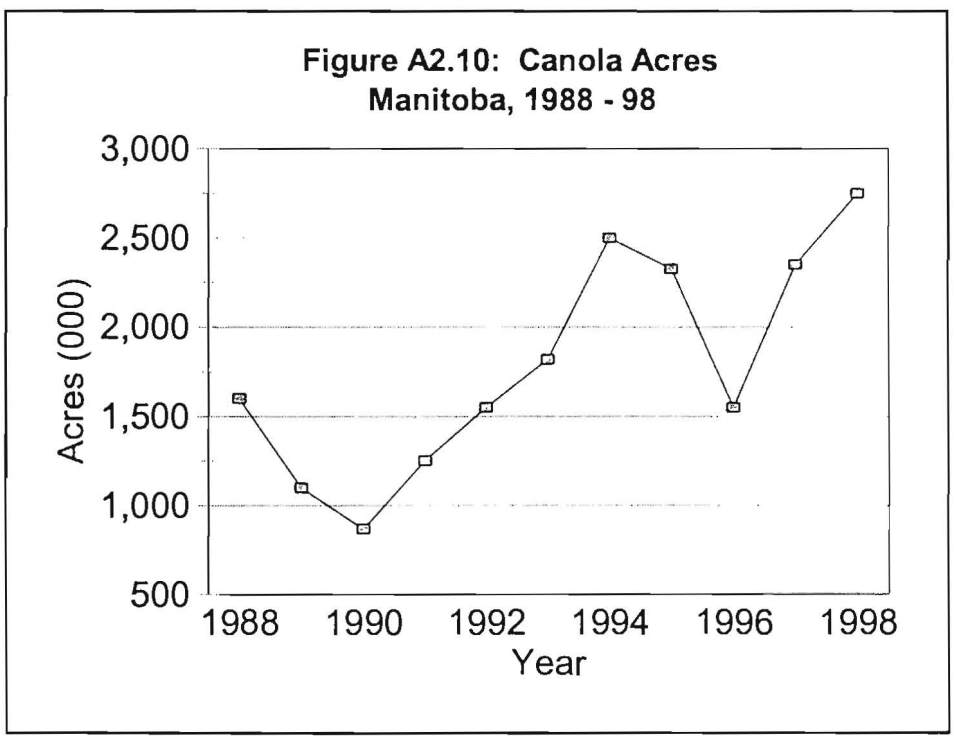


Figure A2.10: Canola Acres
Manitoba, 1988 - 98
3,000
2,500
2,000
1,500
1,000
500
Acres (000)
1988
1990
1992
1994
1996
1998
Year

Figure A2.11: Flaxseed Acres
Manitoba and Canada, 1988 - 98

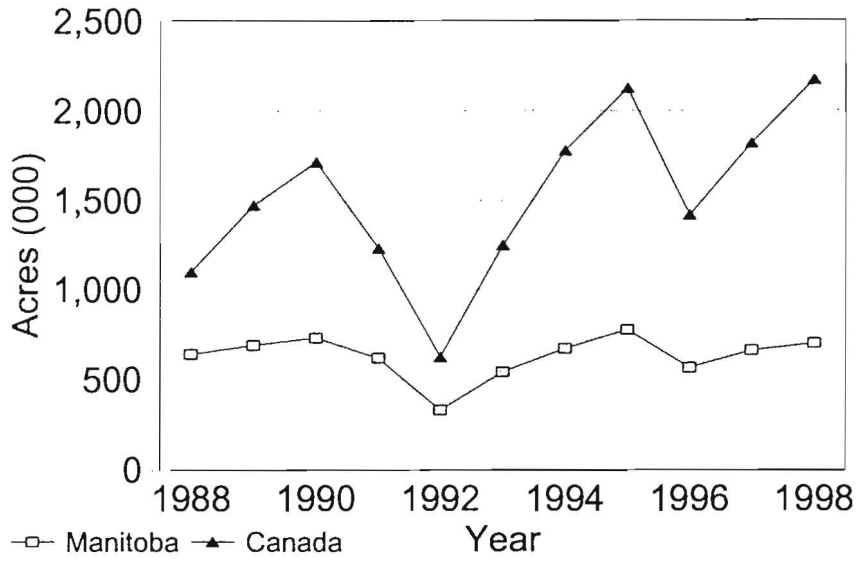


Figure A2.12: Flaxseed Acres
Manitoba, 1988 - 98

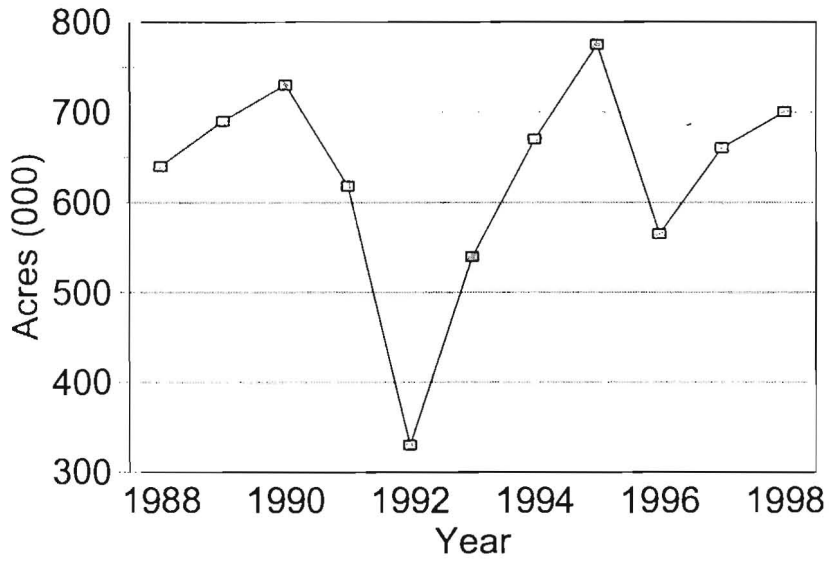


Figure A2.13: Oats Acres
Manitoba and Canada, 1988 - 98

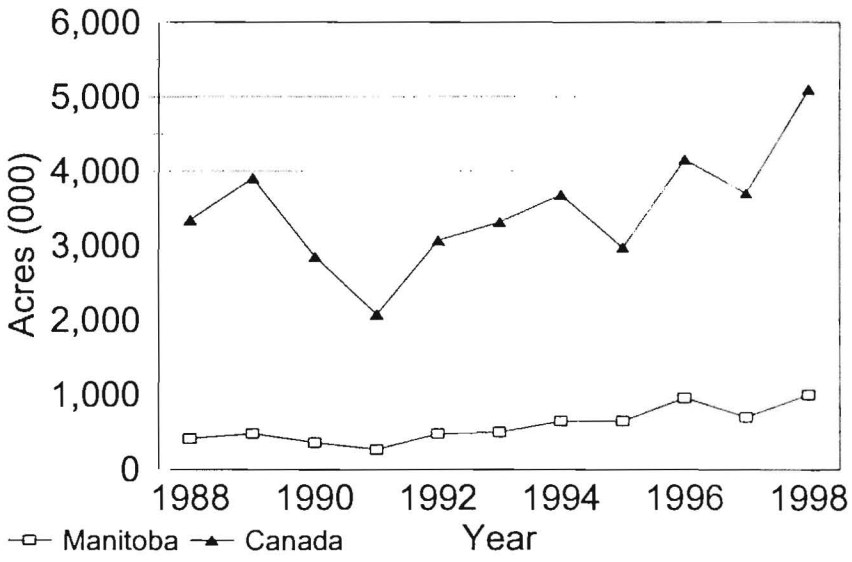


Figure A2.14: Oats Acres
Manitoba, 1988 - 98

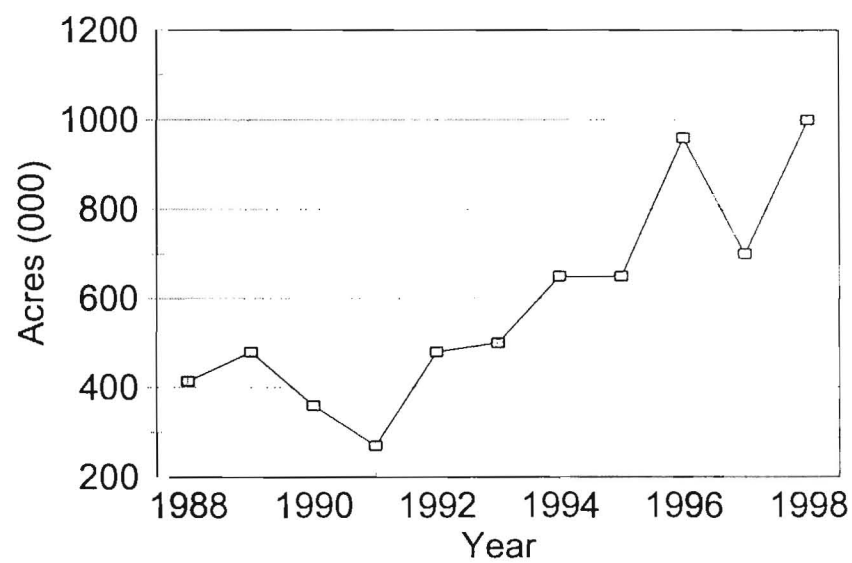


Figure A2.15: Rye Acres
Manitoba and Canada, 1988 - 98

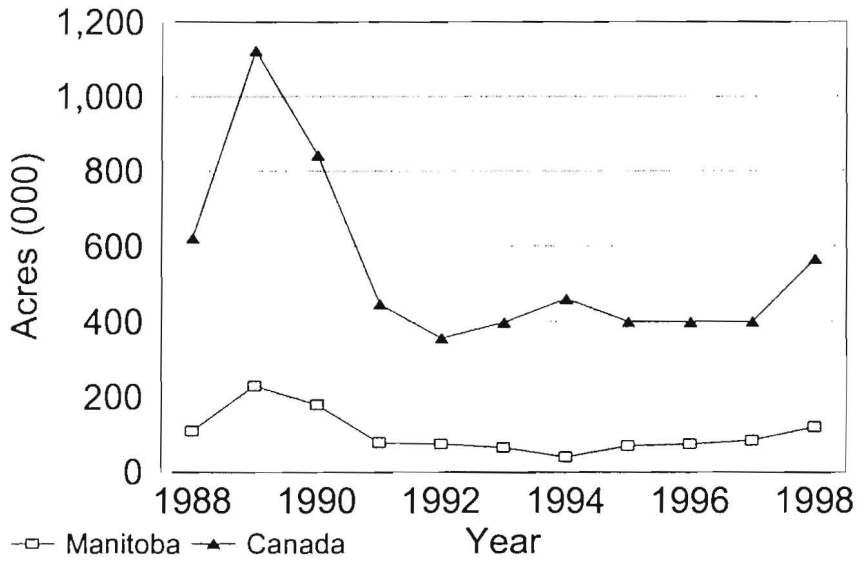


Figure A2.16: Rye Acres
Manitoba, 1988 - 98

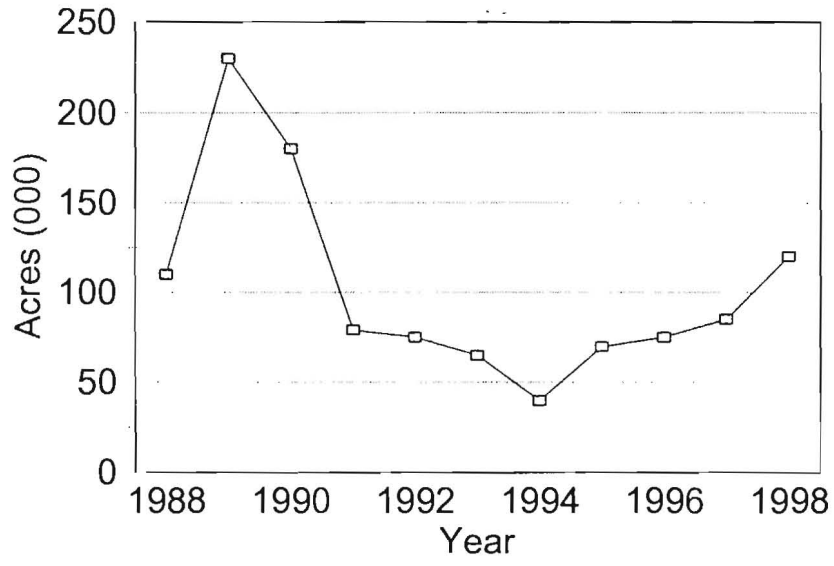


Figure A2.17: Mustard Seed Acres
Manitoba and Canada, 1988 - 98

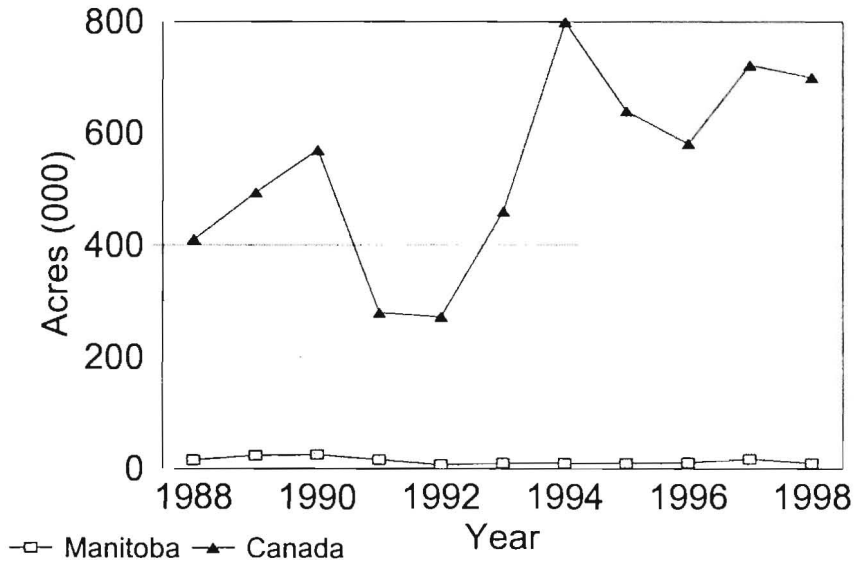


Figure A2.18: Mustard Seed Acres
Manitoba, 1988 - 98

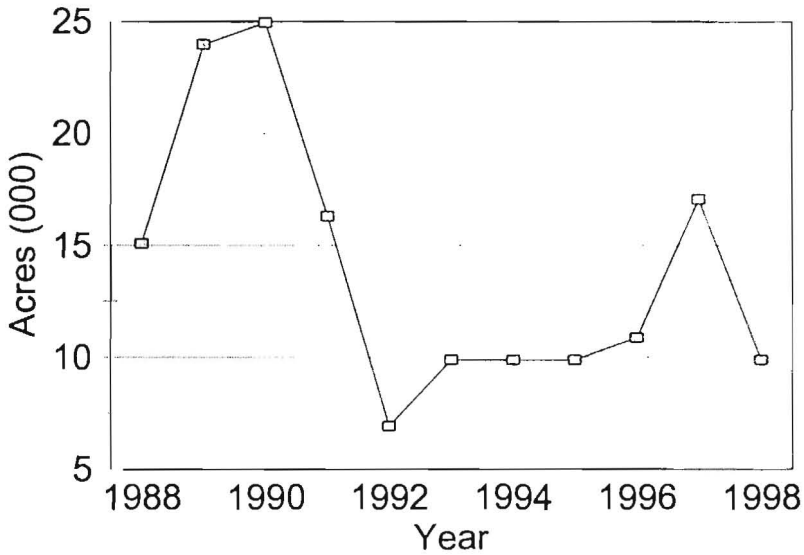


Figure A2.19: Canary Seed Acreage
Manitoba and Canada, 1988 - 1998

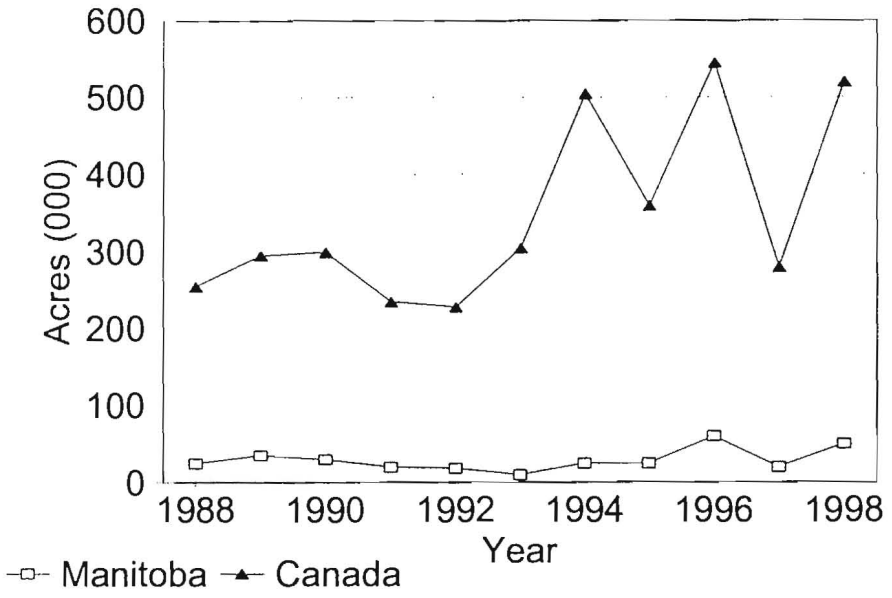


Figure A2.20: Canary Seed Acres
Manitoba, 1988 - 98

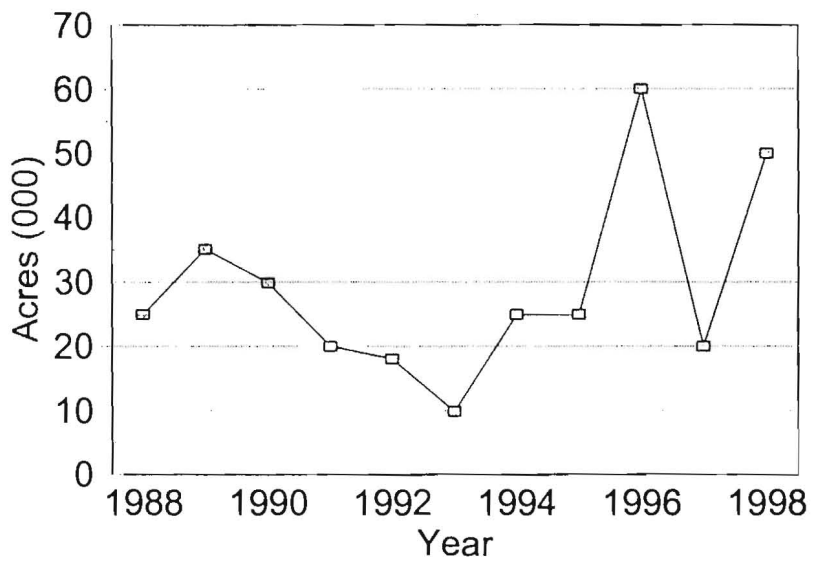


Figure A2.21: Sunflower Seed Acres
Manitoba and Canada, 1988 - 98

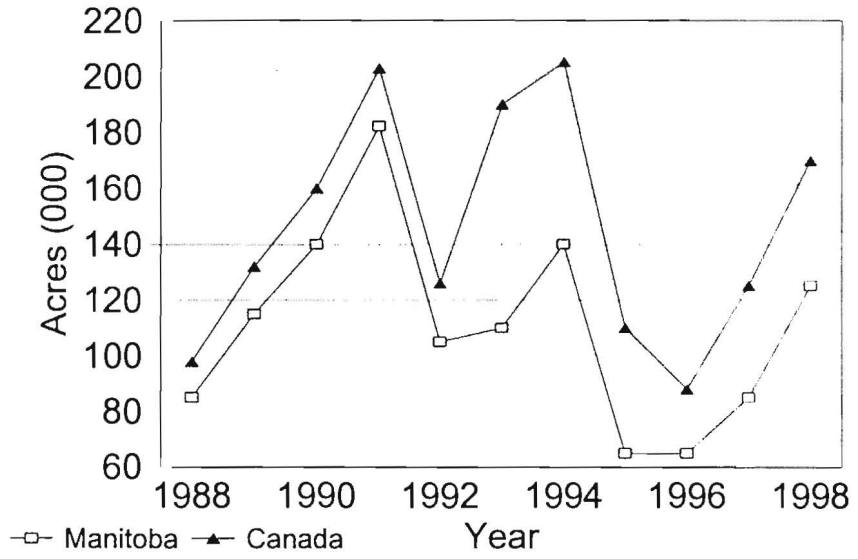


Figure A2.22: Sunflower Seed Acres
Manitoba, 1988 - 98

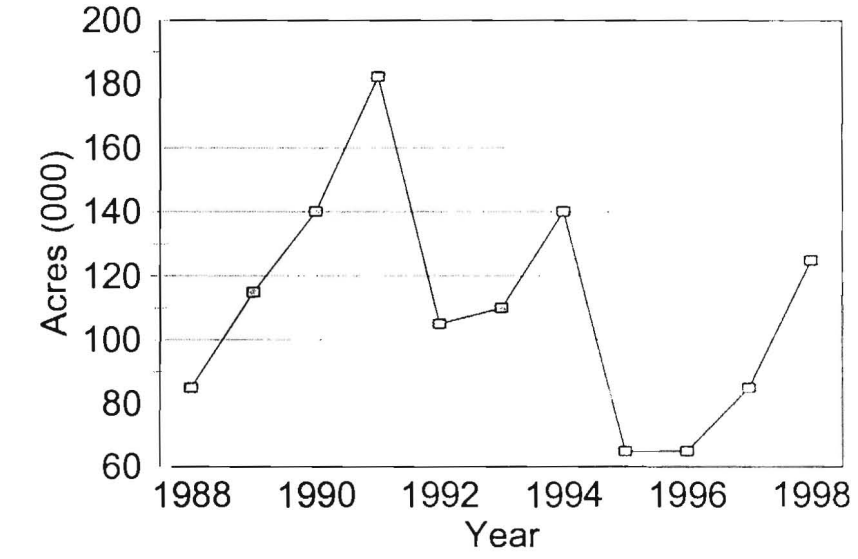


Figure A2.23: Buckwheat Acres
Manitoba and Canada, 1988 - 98

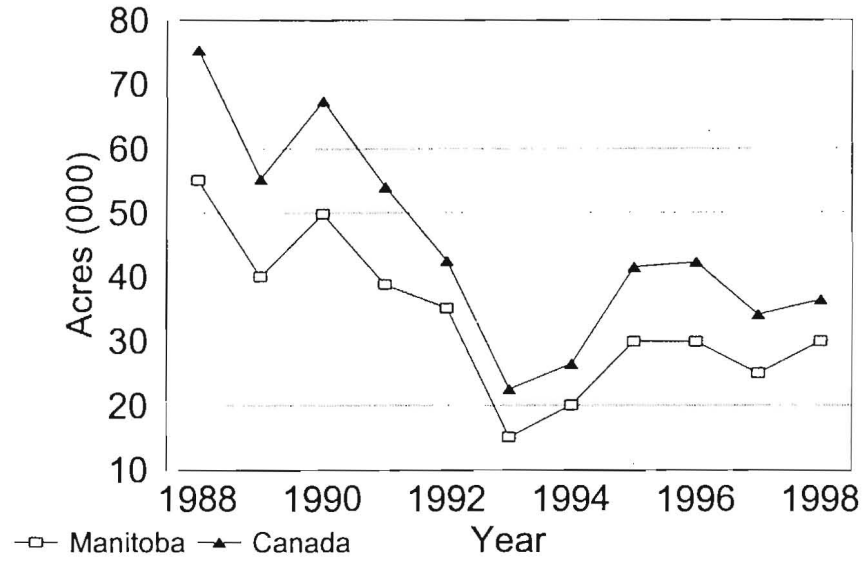


Figure A2.24: Buckwheat Acres
Manitoba, 1988 - 98

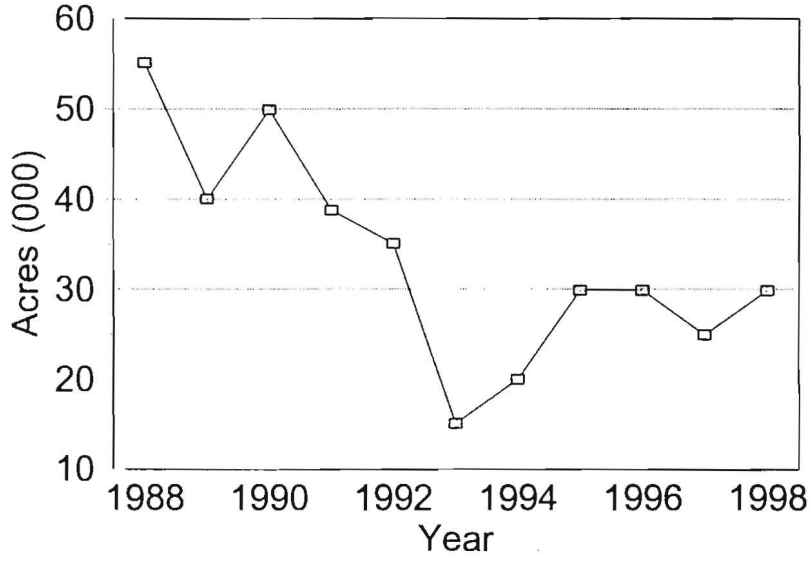


Figure A2.25: Dry Peas Acres
Manitoba and Canada, 1988 - 98

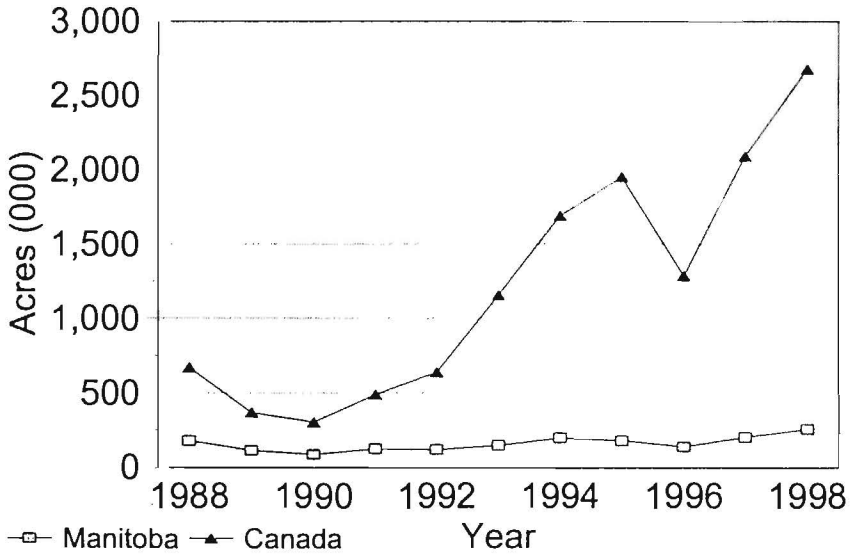


Figure A2.26: Dry Peas Acres
Manitoba, 1988 - 98

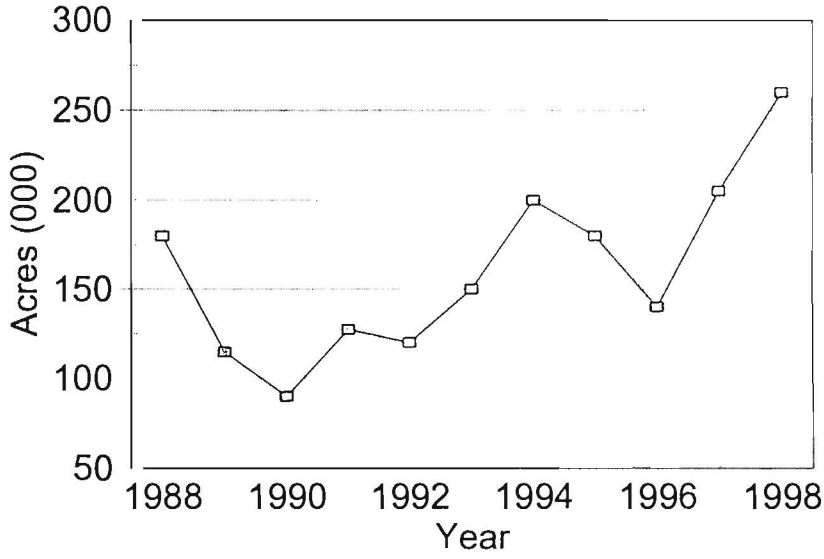


Figure A2.27: Beans, Dry White, Acres Manitoba and Canada, 1988 - 98

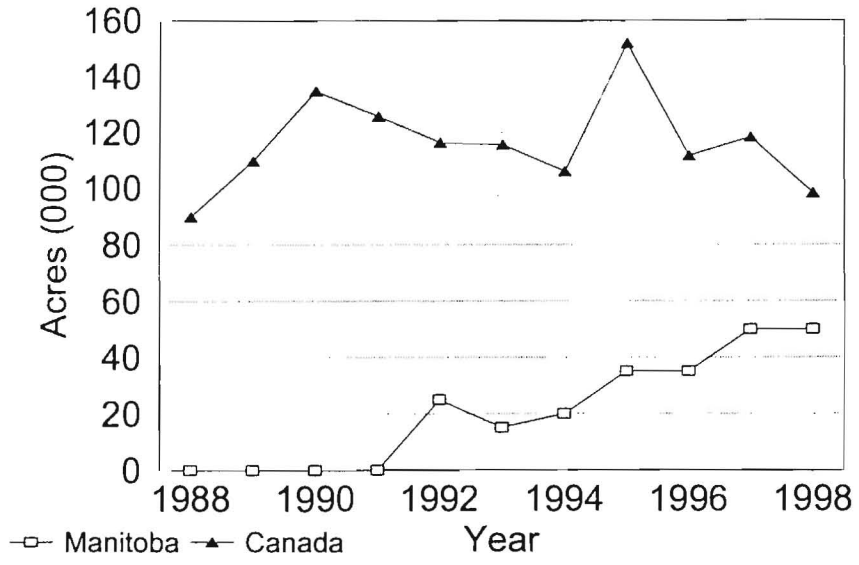


Figure A2.28: Beans, Dry White, Acres Manitoba, 1988 - 98

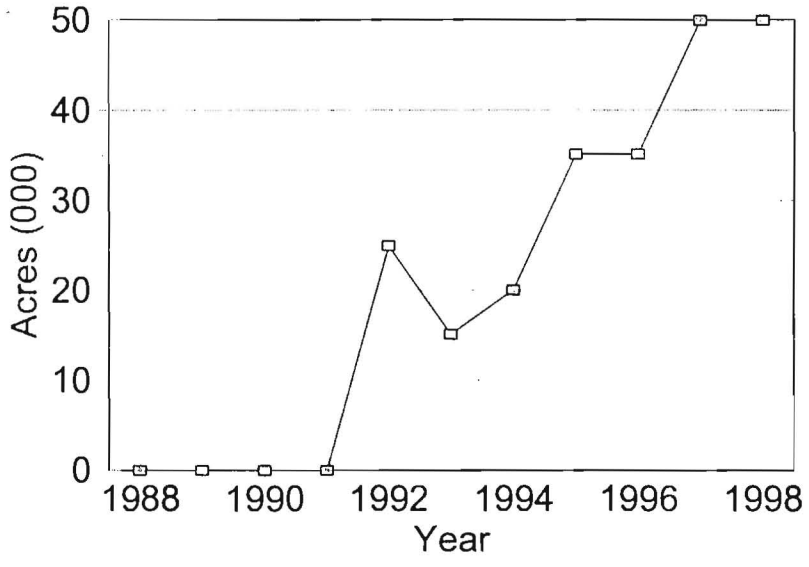


Figure A2.29: Lentils Acres
Manitoba and Canada, 1988 - 98

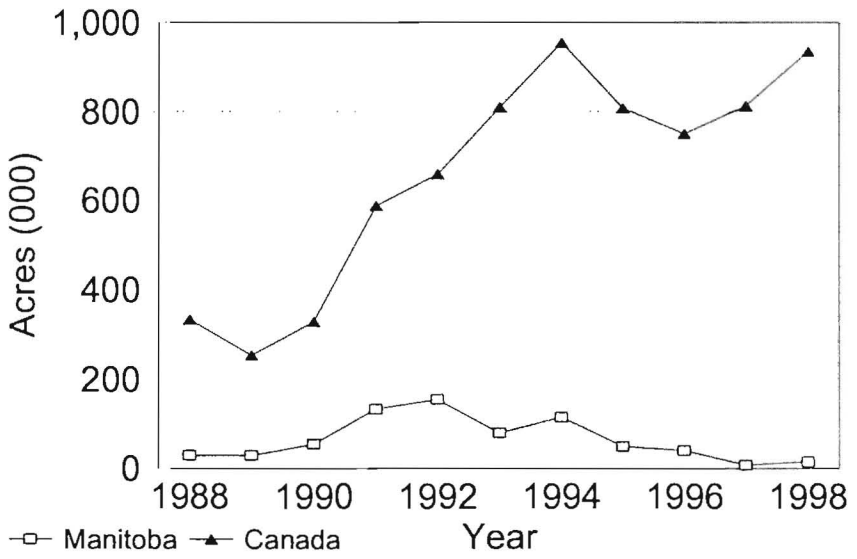


Figure A2.30: Lentils Acres
Manitoba, 1988 - 98

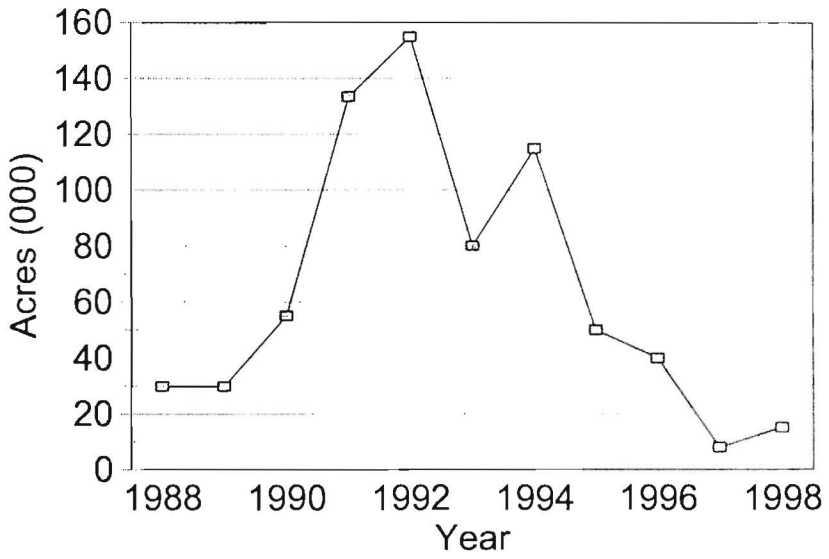


Figure A2.31: Tame Hay Acres
Manitoba and Canada, 1988 - 98

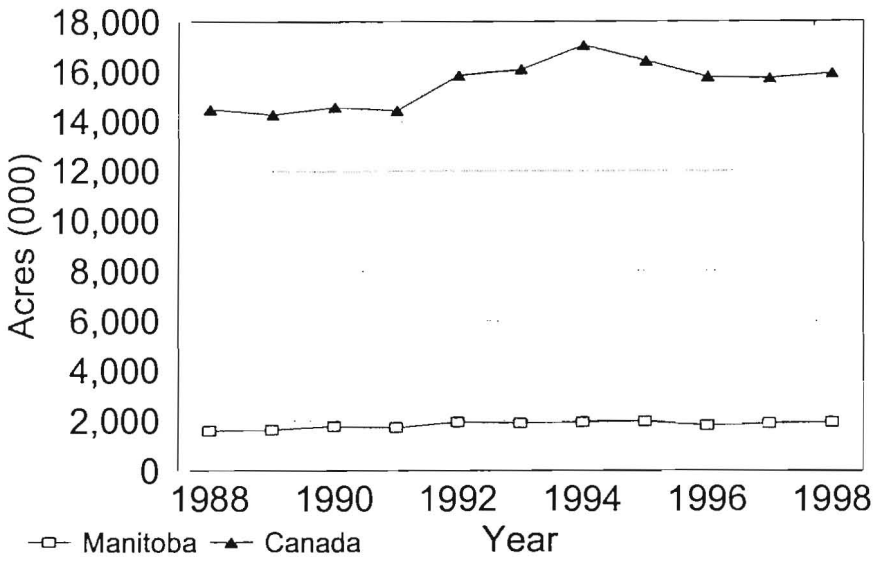


Figure A2.32: Tame Hay Acres
Manitoba, 1988 - 98

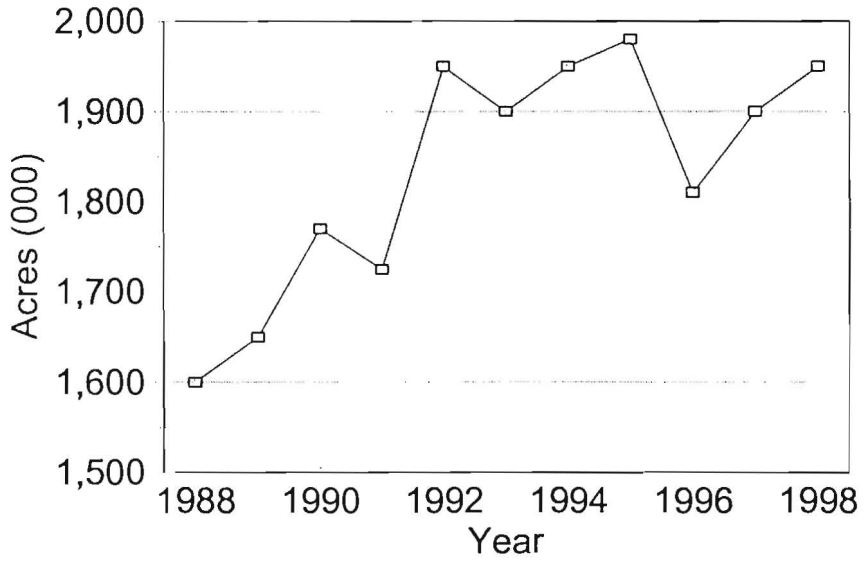


Figure A2.33: Canadian Bulk Exports of Wheat (excluding Durum), 1987 - 1997

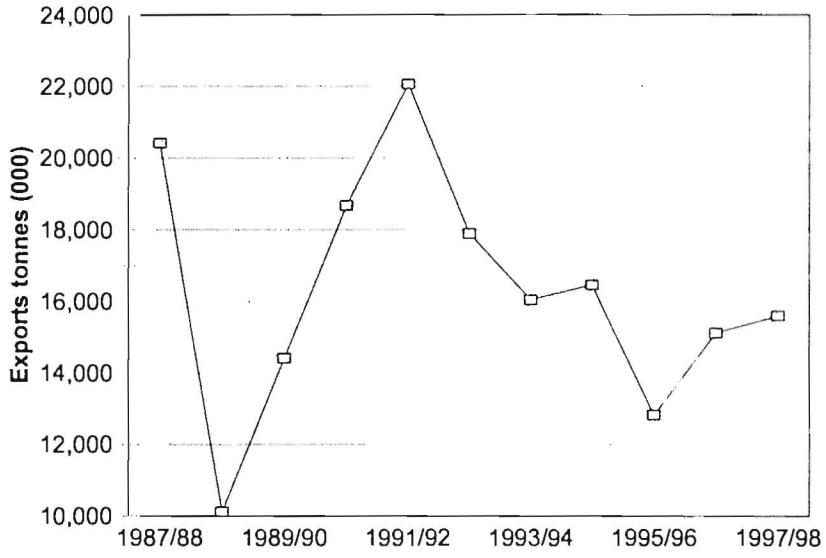


Figure A2.34: Canadian Bulk Exports of Durum Wheat 1987 - 1997

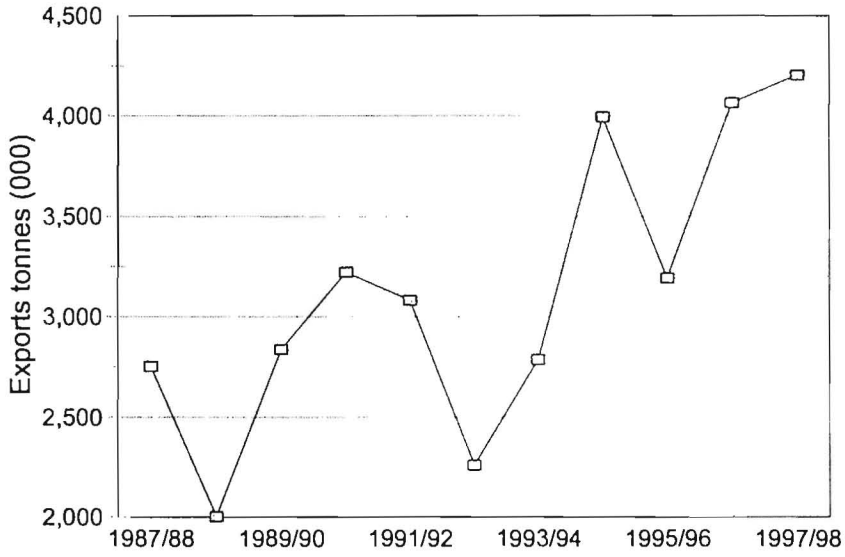


Figure A2.35: Canadian Bulk Exports of Barley 1987 - 1997

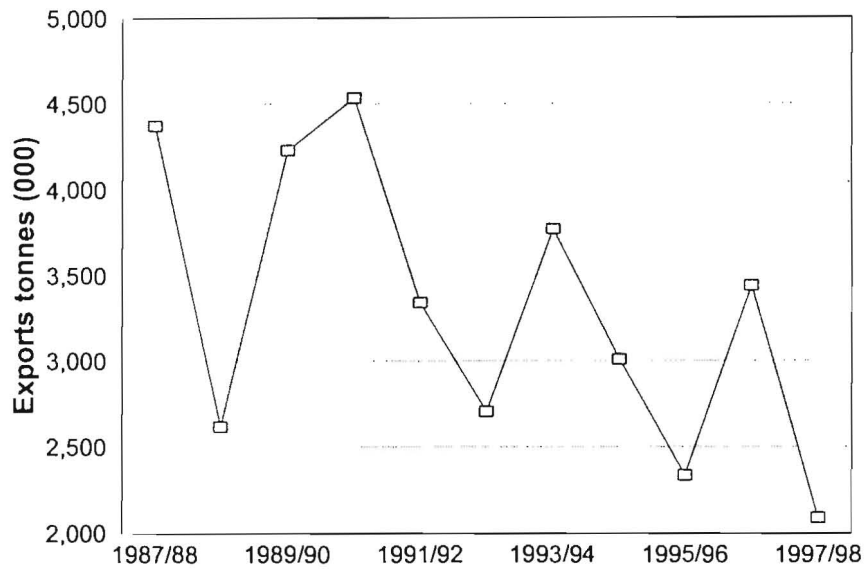


Figure A2.36: Canadian Bulk Exports of Oats 1987 - 1997

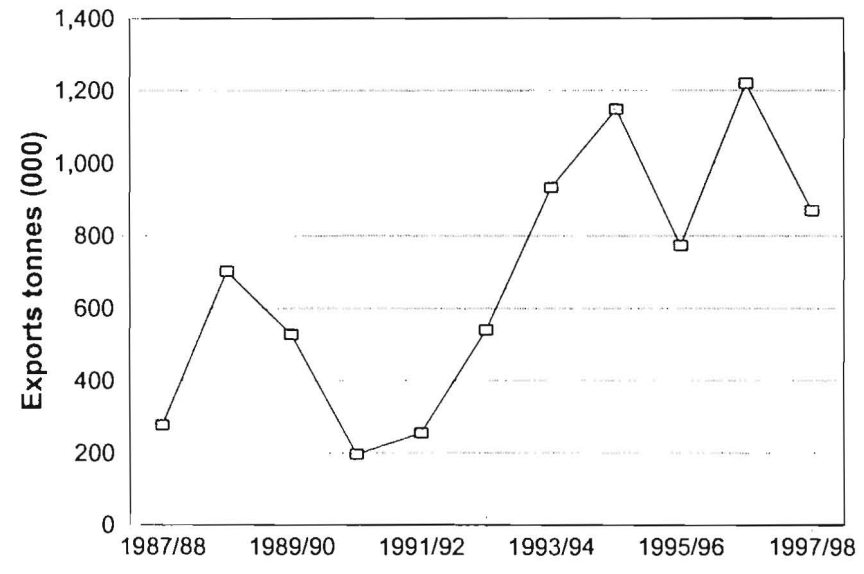


Figure A2.37: Canadian Bulk Exports of Rye 1987 - 1997

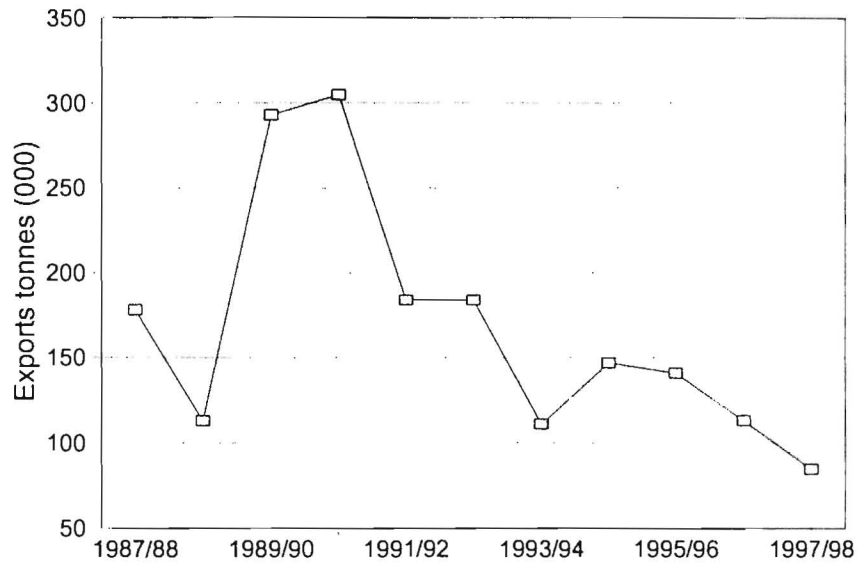


Figure A2.38: Canadian Exports of Canola, Oil and Meal, 1987 to 1997

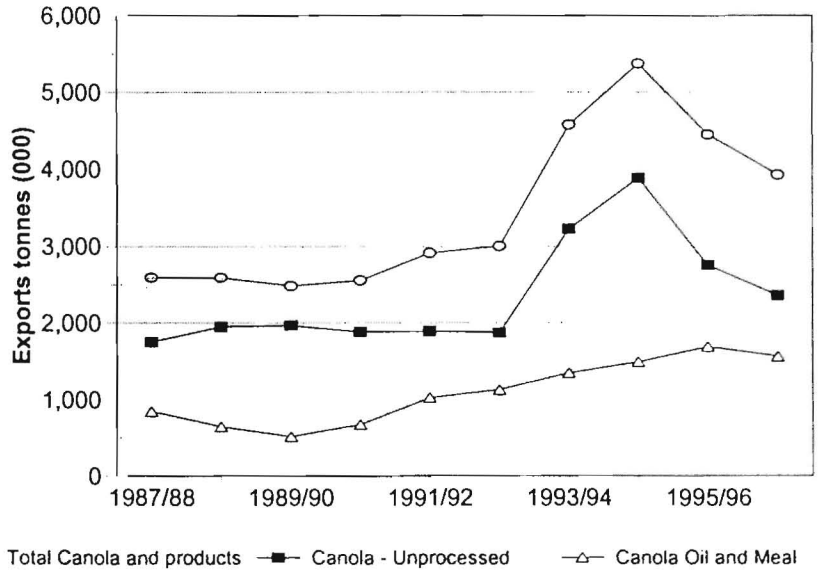
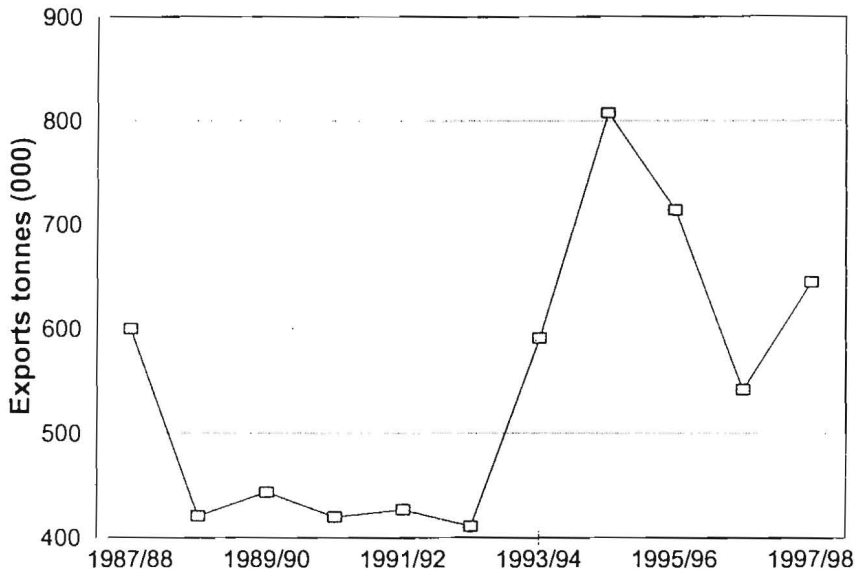


Figure A2.39: Canadian Bulk Exports of Flaxseed 1987 - 1997



Appendix 3: Survey Methodology, Grower Sales and Confidence Interval Estimation

A3 Introduction

The purpose of this project was to assess the economic impact of the certified seed industry on the Manitoba economy. One of the objectives of the study was to provide a prototype for other provincial seed associations. Because of the uniqueness of the study, the sampling and analysis procedures are documented below in some detail. Further information on the methodology used is available by contacting the Department of Agricultural Economics, University of Manitoba.

A survey was designed and distributed to growers, processors and companies whose activities were part of the seed industry. The growers were classified as either large or small with large growers being the top 30 percent of producers by acres for each crop type (Tables 19 and 19a, Grower Survey Results). The companies surveyed provided either services or equipment to seed growers and processors, or were involved in research activities related to the seed industry. This chapter explains the survey methodology, explaining the sample selection and data analysis methodology for both the Grower Survey and Industry Survey. Sample selection and responses by crop type are discussed. It was also desirable to examine some of the statistical properties of the survey estimates. For this reason, confidence intervals are calculated for the seed growers gross returns by crop.

This study required estimation of statistical properties for the grower survey data[1]. The first issue was determining an appropriate sample size. A unique situation existed in that the number of certified seed growers in the province and the varieties and acres of each variety grown by the each of the growers was known and available through the CSGA database. This allowed for the selection of a sample that would represent the entire population with estimated confidence intervals.

Analysis of the CSGA database revealed two factors important in selecting a sample. First, more large growers needed to be sampled than small growers due to greater variability in acreage and gross returns than "small" growers (Cochran, 1977, p102). Second, to achieve an estimate within five percent of the total for the population, it was estimated that 20 percent of the 861 growers would need to be surveyed in a stratified sample (Dr. B. Johnston and D. Treble, sample selection).

Using combined ratio estimation, gross returns for all certified seed growers were obtained for nine groups. Winter wheat was combined with other wheat as only two growers responded. To get a ratio estimate, the weighted acreage and the weighted gross returns were

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[1]B.Johnston, Statistics, University of Manitoba, provided advice with respect to sample selection. CSGA data files analysis was completed by D.Treble, Department of Agricultural Economics. L.Harper, Department of Agricultural Economics, completed confidence interval estimates with the assistance of B.Johnston.

calculated for the three groups (strata) and summed together. The weighted acreage was divided into the weighted gross returns to get the ratio estimate. The ratio estimate was then multiplied by the acres planted by all the certified seed growers for that particular crop type to give an estimate of gross returns.

To determine the confidence interval for the estimated gross returns, the variance of the estimate is calculated. The variance of the ratio is determined by the variance of the survey acres, the variance of the survey gross returns and a factor adjustment for the sample size. The square root of the variance of the estimated gross returns allows for the determination of the confidence interval at the 95 percent confidence level. (Cochran, 1977, p164)

The goal of the survey was to achieve confidence intervals with only a five percent margin of error at the 95 percent confidence level. As shown in section A3.3.2 this did not happen for all crop types. Durum, winter wheat and other wheat, barley and flax all had confidence intervals within five percent of the estimated gross returns, while CWRS wheat, special crops, canola and pulses had confidence intervals between 10 percent and 15 percent. Forage with a confidence interval close to 32 percent was the only crop type to have a confidence interval greater than 15 percent. The wide confidence interval for forages were due to the number of different types of forages each with a different price structure, contributing to a high estimated variance for forage's gross return estimate.

Seed cleaning and processing facilities were reported by 17 of the 57 large grower respondents and 6 of the 33 small grower respondents. Using the ratios of 17/57 for the large growers and 6/33 for the small growers, and multiplying these ratios by the 313 large growers and 548 small growers in the province, respectively, it was estimated there were 93 large growers and 100 small growers with processing facilities in the province. This gives a total of 193 growers/ processors.

A3.1 Grower Survey Sampling

A3.1.1 Grower Survey Sample Size

Initial analysis of the CSGA database indicated that to achieve an estimate within five percent of total grower acreage at the 95 percent confidence level, a sample of 20 percent stratified by acreage size would be needed, which is about 173 growers. Assuming that value added per acre is proportionately distributed across all growers, a sample response size of 200 was the target. Assuming a response rate of about 40 percent, a total of about 500 growers would need to be sampled to achieve the target sample response.

To obtain a reliable sample, analysis indicated that proportionately more large growers needed to be selected than small growers, as larger growers tend to exhibit more variability than smaller growers (Cochran, 1977, p102). Using a stratified sampling method, two populations for sampling were developed. Growers were separated into small or large producers based on the

number of acres they had in each of 10 crop types, with the large group comprising those growers in the top 30 percent of that crop type by acres. The 10 crop types were CWRS wheat, durum wheat, winter wheat, other wheat, barley, special crops, flax, canola, pulse crops and forages.[2] For example, if a grower grew pedigreed CWRS wheat, barley and canola in 1997, and if their CWRS wheat acreage was in the top 30 percent group, by size, then that producer was considered a large producer. This was regardless of whether the producer's barley or canola acreage was also in the top 30 percent (i.e. a producer could be chosen as large based on having one or more crops in the top 30 percent of their crop type). Thus a small producer would be a producer that was not in the top 30 percent for any of their crops grown in 1997. There were 305 large growers selected as those producing the top 30 percent by acres, and all of these producers were mailed surveys. There were actually 313 large growers but eight were not surveyed as they were incorrectly classified as small growers, thus the large group had a 97.4 percent sampling rate. The small growers were randomly selected from the remaining 548 at a sampling rate of 34 percent, giving 186 small growers that were mailed surveys. Thus a total of 491 questionnaires were sent out with a roughly 60/40 ratio of large to small growers (305/186).

Of the 305 surveys mailed to the large producer group, 57 responses were received, giving a response rate of 18.7 percent for this group, and of the 186 surveys mailed to the small producer group, 33 responses were received, giving a response rate of 17.4 percent for this group. These response rates were lower than the target 40 percent.

After the surveys were received further stratification of the growers occurred forming two sub groups for the large growers, Large #1 and Large #2. For a particular crop type the Large #1 group were selected as a large grower for that particular crop type, while the Large #2 were small for that crop but were selected as a large grower for a different crop type.

Follow-ups were made for respondents who returned incomplete surveys to obtain added information. Internal checks were made to ensure that volumes of grain quoted by each respondent added up correctly. If the respondent could not give the actual price then the weighted average for the group was used.

A3.1.2 Sample Selection and Responses by Crop Type

The following description of sample selection by crop is summarized in Table 19 of the Grower survey. As the total population of the large growers were sampled for each crop type, the results below are given as a response rate. For the small group, 34 percent were randomly sampled without stratification by crop type. Therefore the results for the small group are given as the percent of the population the responses represent, by crop type.

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[2]Other wheats include Canadian Western Extra Strong (CWES) and Canadian Prairie Spring (CPS). Special crops include oats, canary seed, buckwheat, mustard, rye, sunflowers and triticale. Pulse crops include peas, beans, lentils, fababeans and soybeans.

- From the 861 growers listed in the CSGA database, 122 were classified as Large #1 CWRS wheat growers with 22 responding, for a response rate of 18.0 percent. There were 208 small growers and 16 growers responded, representing 7.7 percent of all small CWRS wheat growers. There were also 12 Large #2 respondents.

- The CSGA database listed 11 Large #1 durum wheat growers of which five responded giving a response rate of 45.5 percent. There were eight small growers and 5 responded, representing 62.5 percent of all small durum growers. There were also 3 Large #2 respondents.

- There were five Large #1 winter wheat growers, and seven small growers. There were no responses from the Large #1 growers. The small growers had one respondent which represented 14.3 percent of the small growers. There was also 1 Large #2 respondent.

- There were 40 Large #1 other wheat growers and 10 respondents, giving a response rate of 25.0 percent. The were 47 small growers and five responses, representing 10.6 percent of all small other wheat growers. There were also 8 Large #2 respondents.

- There were 63 Large #1 barley growers and 97 small growers. The Large #1 growers had 11 respond at a rate of 17.5 percent. For the small growers, 12 growers responded representing 12.4 percent of the small growers. There were also 7 Large #2 respondents.

- There were 42 Large #1 special crops growers, and 51 small growers. The response rate for the Large #1 growers was 14.3 percent with six responding. For small growers 11 responded representing 21.6 percent of small special crops growers. There were also 5 Large #2 respondents.

- There were 64 Large #1 flax growers of which 13 responded giving a response rate of 20.3 percent for the group. The small growers had 13 of 89 growers respond representing 14.6 percent of the growers. There were also 12 Large #2 respondents.

- There were 35 Large #1 canola growers and 45 small growers listed in the CSGA database. For the Large #1 growers, five responded at a rate of 14.3 percent. The small growers had three respond, representing 6.7 percent of small canola growers. There were also 5 Large #2 respondents.

- There were 47 Large #1 pulses growers and 64 small growers. The Large #1 growers had seven respond, giving a response rate of 14.9 percent. The small growers had seven growers respond representing 10.9 percent of the small growers. There were also 7 Large #2 respondents.

- The CSGA database indicated that in 1997 there were 12 types of forage seed grown in Manitoba (Grower Survey Results, Table 20). The top types were Timothy (18,143

acres), Alfalfa (14,803.5 acres), Ryegrass (5,628.5 acres) and Trefoil (4,971.5 acres). Growers were divided into both large and small groups. The Large #1 group had an average of 172.78 acres per grower while the small group had an average of 60.24 acres per grower. There were 335 forage growers, with 116 in the large group, of which 101 were considered to be Large #1 growers. The remaining growers were considered small. These were sampled with a sampling rate of 34 percent selected randomly across the total group of 548 small growers, thus randomly selecting from the 219 small forage growers. The 17 Large #1 grower responses gave a response rate of 16.8 percent for the Large #1 growers. The 10 respondents of small forage growers represent 4.6 percent of the small population. There were also 3 Large #2 respondents.

A3.2 Grower Survey Data Analysis

The analysis of grower data was completed for large and small growers on a per acre basis weighted by MSGA total acres for each of the top ten crop types. This section describes the analysis of the grower survey as presented in the tables in the Grower Survey Results.

The price of seed sold on a per unit basis ($/bushel or $/pound) was obtained from the survey for each crop type by adding the value of seed sold for all growers and dividing by the total volume. This gave a seed price weighted by volume of sales. The same weighting technique was used to determine the value of royalties and the prices of screenings. The price of commercial grain was calculated similarly but weighted by volume of seed sold plus volume of commercial grain sold. This was done to take into account the estimated prices of commercial grain provided by growers who did not actually sell any of their grain commercially.

These weighted prices were used with volumes (Grower Survey Table 1) to obtain the gross returns by crop type for large and small growers. The data was then calculated on a per acre basis in Table 21 for Forages, Table 24 for pulse crops, Table 27 for special crops and Table 30 for the remaining seven crop types. Forages were subdivided into six different crops in Table 21. Pulses were subdivided into three different crops in Table 24. Special crops were subdivided into four different crops in Table 27. The per acre values (Tables 21, 24, 27 and 30) were then multiplied by the Manitoba CSGA database acres for large and small growers (Tables 20, 23, 26 and 29) to obtain provincial gross returns (Tables 22, 25, 28 and 31). Table 32 summarizes Manitoba totals.

A3.3 Confidence Intervals for the Gross Returns of Growers

A3.3.1 Combined Ratio Estimation

This section makes use of ratio estimation to estimate gross returns by crop for constructing confidence intervals. It is important to note that these ratio estimates are used only for construction of confidence intervals and were not used in other parts of the report, or in the Grower Survey Results. One aspect of the ratio estimation with three producer groups (Large #1,

Large #2 and Small), is the results can be compared to the Grower Survey Results. In the Grower Survey Results, gross returns were estimated in two ways, but in both cases the two large groups were estimated together. This in essence, means that gross returns were calculated by three slightly different methods. A comparison is made in Section A3.4. This section is concerned with the ratio estimation method and its use in constructing confidence intervals.

The ratio estimation makes use of stratified sample data in which the final estimate is a result of the weighting of each of the stratum by both the number of actual certified seed growers and the number of respondents for each crop type (Cochran, 1977, p168). The survey data was used in calculation of these ratio estimates.

The crop types from the survey data were: CWRS wheat, durum wheat, winter wheat, other wheat, special crops (oats, canary seed and rye being the most important), flax, canola, pulses (peas being the most important, and also including beans and lentils), and forages. In the calculation of the estimates of the gross returns, winter wheat was combined with other wheat as there were only two growers that responded (one in Large #2 and one in Small) leaving nine groups for which to estimate gross returns through ratio estimates.

For each group, there were three strata used in the confidence interval analysis. Large #1 were the large growers selected for that crop type, Large #2 were large growers selected for another crop type, and the Small group which contained only small growers.

The estimated gross return is illustrated for the CWRS wheat data in Table A3.1. Details on the methodology in this and the section below are available upon request from the Department of Agricultural Economics, University of Manitoba.

Table A3.1: Data Used for the Calculation of Gross Returns of CWRS Wheat

Strata	Total CSGA Acres	Survey Acres	CSGA Growers	Survey Growers	Survey Gross Returns
Large #1	74912.9	15933.38	122	22	$3,102,091.40
Large #2	12695.12	2240.64	75	12	$392,027.71
Small	27089.56	2213.55	208	16	$466,264.66

The ratio "***R***", the weighted gross return per acre, is calculated from two components, Y and X, where Y is the sum of the weighted Gross Returns for each strata, and is calculated as follows:

$$Y = ((122 \div 22) \times \$3,102,091.40) + ((75 \div 12) \times \$392,027.71) + ((208 \div 16) \times \$466,264.66) = \$25,1662,131.0475$$

and X is the sum of the weighted acreage for each strata and is calculated as follows:

X = ((122 ÷ 22) x 15,933.38) + ((75 ÷ 12) x 2,240.64) + ((208 ÷ 16) x 2,213.55) = 131,137.984545455 acres

R is calculated as Y divided by X to give 195.688008599866, which is the weighted gross return per acre for all survey respondents. The estimated gross returns is obtained by multiplying ***R*** by the sum of all acres planted by the certified seed growers (19.688008599866 x 114697.58) to give a value of $22,444,941 as the estimated gross return for CWRS wheat (Cochran,1977, p165). This is then done for each of the crop types and is given in Table A3.2.

A3.3.2 Calculation of Confidence Intervals

A 95 percent confidence interval means that we can say with 95 percent confidence that the computed range encompasses the true gross returns. Confidence intervals at the 0.95 confidence level were calculated to determine the range around the estimates in which the true gross returns for the industry would be expected.

The formula for calculating the combined ratio variance $V(\hat{Y}_{Rc})$ is:

$$V(\hat{Y}_{Rc}) = \Sigma \left((S_{yh}^2 + \boldsymbol{R}_i^2 S_{xh}^2 - (2 \cdot \rho_h \cdot \boldsymbol{R}_i \cdot S_{yh} \cdot S_{xh})) \times ((N_h^2 \cdot (1 - f_h)) \div n_h)\right)$$

where (Cochran, 1977, p 164):

$\hat{Y}_{Rc}$	- is the ratio estimate of gross returns
$V(\hat{Y}_{Rc})$	- is the variance of the estimate of gross returns
S_{yh}^2	- is the variance of the gross returns for strata h
S_{xh}^2	- is the variance of the acres for strata h
ρ_h	- is the correlation between acres planted and the gross returns for strata h
$\boldsymbol{R}_i$	- is the ratio estimate of the gross returns per acre for crop type i
S_{yh}	- is the standard deviation of the variance of the gross returns for strata h
S_{xh}	- is the standard deviation of the variance of the acres planted for strata h
N_h^2	- is the square of the total population in strata h
n_h	- is the total number of individuals sampled in strata h
f_h	- is a weighting factor obtained by dividing n_h by N_h
h	- represents a strata (Large #1, Large #2, or Small) within a particular crop type.

This estimated variance is then used with the estimated total gross returns (for CWRS wheat this is $22.445 million) to compute the 95 percent confidence interval.
The confidence interval for this study is computed as:

$$\hat{Y}_{Rc} - t_{\alpha/2}\left(\sqrt{V(\hat{Y}_{Rc})}\right) \leq \hat{Y}_{Rc} \leq \hat{Y}_{Rc} + t_{\alpha/2}\left(\sqrt{V(\hat{Y}_{Rc})}\right)$$

where $t_{\alpha/2}$ is a statistical term which depends on the sample size and the probability level used.

The greater the probability level used, then the larger will be the interval range and thus greater is the likelihood that the interval range encompasses the true gross returns for the population. Also, the greater the variation found in the sample estimate ($\hat{Y}_{Rc}$), the larger the confidence interval will be.

For the CWRS wheat example:

$\hat{Y}_{Rc}$ = \$22.445 million

$\sqrt{V(\hat{Y}_{Rc})}$ = \$1.435 million

$t_{\alpha/2}$ = 1.96

Therefore at the computed 95 percent confidence interval is:

$$P(\$22.445 - (1.96 \times \$1.435) \leq \$22.445 \leq \$22.445 + (1.96 \times \$1.435)) = 95\%$$

The true gross returns for the certified seed growers is expected to fall within plus or minus \$2.814 million of \$22.445 million at a 95 percent confidence level, or within 12.54 percent of the estimated gross returns.

A3.3.3 Confidence Intervals by Crop Type

Using a "combined ratio estimate," confidence intervals for the Gross Returns from the survey data were calculated for each of the crop types (Table A3.2). The confidence intervals were calculated at the $\alpha = 0.05$ level of confidence, which means that 95 times out of 100 repeated samples, the interval is expected to contain the true value of the gross returns for the certified seed growers. The results for each of the crop types are summarized below. Estimated gross returns are based on the ratio estimate.

Durum wheat, other wheat, barley and flax were the only four crop types to have a confidence interval within five percent of the estimated gross returns. Forages were within about 33 percent of the estimated gross return, and the remaining crop types between 10 percent and 15 percent. The wide confidence interval for forages would be the result of the higher variance for the gross return estimate for forages. This, in turn, is because of the number of different types of forages within the forage group (five major types and several minor types; see Tables 20 and 32, Grower Survey Results), with a high variation in prices between these different types.

Table A3.2: Confidence Intervals of Seed Producers' Farm Gate Sales, 1997, by Crop Type

Crop Type	Gross Returns	95% Confidence Intervals			
		± Value	± % of GR	Lower Limit	Upper Limit
	$ Millions				
CWRS Wheat	$22.445	$2.814	12.54%	$19.631	$25.258
Durum Wheat	1.384	0.035	2.56%	1.349	1.42
Other Wheat[1]	4.512	0.091	2.01%	4.422	4.603
Barley	7.492	0.096	1.29%	7.396	7.589
Special Crops	4.978	0.647	13.00%	4.331	5.625
Flax	7.694	0.088	1.10%	7.876	8.052
Canola	9.483	1.327	14.00%	8.155	10.81
Pulses	6.833	1.012	14.81%	5.821	7.845
Forages	13.882	4.406	31.74%	9.476	18.289

[1]Other Wheat includes winter wheat.

A3.4 Gross Return Calculation Methodology

As was mentioned in Section A3.3.1, construction of the confidence intervals for the various crop types made use of ratio estimates of gross returns for each of the crop types. One aspect of the ratio estimation with three producer groups (Large #1, Large #2 and Small), is that the results can be compared to the Grower Survey Results. In the Grower Survey Results, gross returns for the large producer group was not stratified into Large #1 and Large #2, as was done for the ratio estimates. Large #2 producers for a specific crop type (e.g CWRS wheat or pulses) are actually small producers for that crop type, but were categorized as a large producer because they were classified as a large producer for one or more other crops. Thus the ratio estimates stratified these two groups to determine if this made a significant difference from the gross returns for any of the crops as estimated in the Grower Survey Results.

The Grower Survey Results gross returns are estimated in two slightly different ways. In Table 1 and the Summary tables, gross returns were estimated as an aggregate whole for each of pulses, special crops and forages (Summary Tables). In Table 32 and the Tables that correspond to this table, gross returns are estimated by disaggregating each of these crop types into a number of subcategories. Special crops were disaggregated into oats, canary seed, rye and other special crops; pulses were disaggregated into peas and other special crops; and forages were

disaggregated into alfalfa, timothy, ryegrass, trefoil, fescue and other forages (see Grower Survey Results Table 32). This then essentially gives three different methods of estimating gross returns, which can be compared to determine if the estimates differ significantly when either the Large group is stratified, or when the crop types are stratified into their various crops.

The gross returns for the three methods are given in Table A3.3 for comparison purposes. Although the gross returns for Table 32 were estimated for the subcategories given above, these are added together to give a total for the crop types of special crops, pulses and forages. Also, winter wheat was estimated separately in the Grower Survey results, but was estimated with other wheats for the ratio estimate.

As is seen in Table A3.3 the gross returns by crop estimated in this manner are very similar to those in the Grower Survey Results (Table 32, Grower Survey Results), which indicates that putting the two large groups together for estimating the Grower Survey Results does not diminish the efficiency of the results in comparison to keeping the two large groups separate. The greatest difference is that the forage gross return for the aggregated estimates from Table A3.2 and Summary 5b of the Grower Survey results are 13.9 percent and 15.6 percent higher, respectively, than the disaggregated estimate (i.e. the sum of the individual forage estimates, Table 32).

A3.5 Industry Survey Results

An industry list of companies was defined with the assistance of the MSGA to include representation from the Manitoba Seed Industry past the farm gate. This list consisted of 70 companies that provide a variety of supplies and services to the certified seed growers, from marketing and processing to providing research and equipment sales. It is important to note that these 70 companies are not all of the companies providing value added activities past the farm gate for the certified seed industry in Manitoba. Unlike the seed growers, a complete list does not exist at this point, however the identified companies were felt to be representative of this component of the industry. The companies surveyed were from the private and public sectors. The public research groups included the University of Manitoba and Agriculture Canada as well as private institutions.

Table A3.3: Comparison of Three Methods of Calculation Growers' Crop Production Gross Return

Crop Type	(1) Gross Returns with Disaggregation of Crops within Crop Types[1]	(2) Gross Returns with Aggregation of Crops within Crop Types[2]	Percent Difference from (1)	(3) Gross Returns with Stratification of Large Producer Group[3]	Percent Difference from (1)
		---------- Millions of $'s ----------			
CWRS wheat	22.631	23.322	3.05%	22.445	-0.82%
Durum Wheat	1.348	1.34	-0.59%	1.384	2.67%
Other Wheat[4]	4.565	4.555	-0.22%	4.512	-1.16%
Barley	7.575	7.415	-2.11%	7.492	-1.10%
Special Crops	5.1135	5.13	0.32%	4.978	-2.65%
Flax	7.974	7.97	-0.05%	7.694	-3.51%
Canola	9.482	9.507	0.26%	9.483	0.01%
Pulses	6.4516	6.775	5.01%	6.833	5.91%
Forages	12.0057	13.675	13.90%	13.882	15.63%

[1]As calculated in Grower Survey Results, Table 32.
[2]As calculated in Grower Survey Results, Summary 5b.
[3]As calculated for ratio estimates Table A3.2

The 70 companies surveyed were placed into one of four categories: 1) seed sales, cleaning, processing and treatment (13 respondents); 2) custom services (3 respondents); 3) equipment sales (5 respondents); and 4) research (4 respondents). There were 25 respondents in total, giving a response rate of 35.7 percent. The 13 respondents of the seed companies represented 48.2 percent of the 27 seed companies.

The 27 companies labeled as seed companies included:

- Agricore
- Agritel
- AgrEvo
- Brett Young
- Cargill
- Cloutier Agra Seeds
- Dyck Seeds
- Hyland Seeds
- Imperial Seeds
- Interlake Forage Seeds
- Kletke Seeds

- Norcan Seeds
- Limagrain
- Monsanto
- Nordal Seeds
- Northstar
- Northrup King
- Performance Seeds
- Pioneer Grain
- Pioneer Hi-Bred Ltd
- Pickseed
- Promark/Wheat City
- Proven Seed
- Secan Association
- S.S. Johnson Seeds
- Value Added Seeds
- Advanta Seeds.

Total sales as estimated by the survey was $106 million for 1997 for the 13 seed companies that responded.

Information from the responses was used in combination with the Grower Survey Results to estimate the impact of seed companies on the total sales, as given in Table 2.1. Industry data was also used to estimate an aggregate value for seed company GDP, employment and wages (Table 3.2). The procedures are summarized below and in the notes to Table 3.2. Research expenditures and employment are separated out for seed companies as well as well as research institutions in Table 3.2. Industry data is also used in the SWOTS analysis in Chapter 4.

Seed company sales estimates were made using a combination of sources, including the estimated amount of seed sold to seed companies by the growers, the sale prices of individual crops by seed companies as estimated by the industry survey and personal communication with the various companies, crop insurance data of canola varieties and their corresponding acres grown by commercial growers in 1998, and various Manitoba Agriculture estimates.

For crops other than canola and forages, the value of the seed sold to seed companies by the growers and as estimated by the grower survey was multiplied by an average 44 percent mark-up value, with the average mark-up percentage estimated from the industry survey responses.

Sales values for canola and forages, because of the nature of their markets, were much more complicated to estimate. As seen in Table 2.2, seed growers sell a much higher proportion of their canola seed and forage seed to companies, 70 percent and 100 percent, respectively, than for most of the other crops. The complication with canola arises due to the extent of the processing that is done to the seed by the companies. Estimates were obtained from various companies for the costs of the processing and the sales value of the treated seed, in order to

derive a value added from the differences between sales values and commodity purchases. In addition, Manitoba seed growers produced more canola seed in 1997 than could be used in Manitoba in 1998, indicating some was exported. Companies indicated that the seed was treated in Manitoba, thus the value added from processing and sales of this seed would accrue to Manitoba. Also, some seed was imported into Manitoba, and it was similarly assumed that the seed was purchased by the companies from outside of Manitoba and processed here, thus the value of the treatments would also accrue to Manitoba.

The difficulty with forages was that common forage seed appears to be an important component of the forage seed industry, but the extent of common forage seed production and sales is largely unknown and was not determined through the grower survey. Common forage seed acres were estimated through the difference between the estimated total acres of forage seed crops, as obtained from the Manitoba Forage Seed Association (G. Huebner, personal communication), and the known acres of pedigreed forage seed. Production was estimated by multiplying this by 1997's average yield of forage seed as given by Manitoba Agriculture in *Manitoba Specialty & Forage Crops Industry Profiles*. The farm gate price of certified forage seed was estimated through the industry survey results, and the farm gate price of common forage seed was obtained through the above Manitoba Agriculture source. Both prices turned out to be the same in 1997 ($0.89 per pound). Thus, farm gate sales for both was estimated as production multiplied by price. Producers indicated that all of their pedigreed forage seed was purchased by companies (except a small amount of screenings that had no value), and because only 5 to 10 percent of the seed is used domestically, it was assumed that all of the common forage seed was also purchased by seed companies. The company sales value for the certified and common forage seed was estimated from a weighted sales price (weighted by volume) for each of certified and common forage seed, as calculated from the industry survey results. The cost of the seed (i.e. the farm gate value) is deducted from this sales value in Table 2.1 so that when farm gate sales value and seed company sales values are added to give total sales values, the value of the seed is not double counted.

A further difficulty with forage seed was that the level of exports and imports for the province could not be estimated. The quantity and value of international imports and exports of forage seed were available from Agriculture Canada (TEAD, Market and Industry Services Branch). International imports of forage seed into Manitoba were small, but exports from Manitoba in 1997 far exceeded production, which meant there was a net import of forage seed from other provinces. However, figures are not available regarding the amount of trade of forage seed between provinces.

As seen by Table 2.1, canola and forage, and in particular canola, contribute the majority of the value to seed company sales, and thus, any errors in estimating the values for these two crops will have the most impact on the accuracy of seed company sales estimation. However, the methods used above were those that were felt to be the most reliable use of the information available.