Alberta 2006 Specialty Crop Report






Acknowledgments

The Statistics and Data Development Unit of Alberta Agriculture, Food and Rural Development (AAFRD) wishes to thank all of the producers who participated in the Alberta 2005 Specialty Crop Survey conducted in the winter of 2005/2006. Without their cooperation and assistance, this report would not have been possible.

Many AAFRD staff members have made significant contributions to the successful completion of this report. Those staff include Chuanliang Su of Statistics and Data Development Unit, Charlie Pearson of Market and Consumer Analysis Unit, Nabi Chaudhary of Economics Unit, and Manjula Bandara, Forrest Scharf, Judy Webber, Shauna Pow, Judy Tokuda, Valerie Catinot, Julie Lecombe, Kwesi Ampong-Nyarko, John Brown, Jill De Mulder, Zhixiong Zhang, and April Jiao of Agriculture Research Division.

Maureen Wenger of M. C. Wenger Consulting was contracted to help conduct the Alberta 2005 Specialty Crop Survey. Additionally, several staff members of the Statistics and Data Development Unit, including Grant Sorenson, Gail Atkinson, Guangzhi Liu, Marion Harry, and Marian Elson, have provided valuable assistance to the report. Our thanks go to all these individuals and others who have contributed to the report.

Contacts

For additional information relating to the various sections of this report, please do not hesitate to contact the subject area specialist referenced under each section.

This report is also available on the Internet at:

http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd11117

For additional copies of this report, please contact:
Alberta Agriculture, Food and Rural Development
Economics and Competitiveness Division
Statistics and Data Development Unit
#302, 7000-113 Street
Edmonton, Alberta
T6H 5T6
Phone: (780) 427-4011

Table of Contents

Acknowledgments/Contacts i

Table of Contents ii

List of Figures iii

List of Tables iv

Section 1 – Alberta 2005 Specialty Crop Survey 1
Subject Area Specialist – Chuanliang Su (780) 422-2887

Purpose of Survey/Methodology 1

Survey Results 3

Area, Yield and Production in Alberta 3

Specialty Crops in Western Canada 4

Specialty Crops by Census Division in Alberta 9

Dry Peas 9

Mustard Seed 10

Lentils 11

Dry Beans 12

Chickpeas 13

Section 2 – Market Outlook for Selected Specialty Crops 17
Subject Area Specialist – Charlie Pearson (780) 422-4053

Section 3 – Economics of Specialty Crop Production 21
Subject Area Specialist – Nabi Chaudhary (780) 422-4054

Section 4 – New Crop Development
Special Crops Program (CDC North – Edmonton) 26
Subject Area Specialist – Kwesi Ampong-Nyarko (780) 415-2316

Special Crops Program (CDC South – Brooks) 34
Subject Area Specialist – Manjula Bandara (403) 362-1355

List of Figures

Figure 1 - Specialty Crop Seeded Area, Alberta and Canada 3

Figure 2 - Harvested Area of Selected Specialty Crops, Western Canada 4

Figure 3 - Per centage Distribution of Specialty Crop Seeded Acreage, Alberta ... 5

Figure 4 - Alberta Census Divisions, ID, MD and Counties Map 6

Figure 5 - 2005 Harvested Area of Dry Peas by Census Division 9

Figure 6 - 2005 Harvested Area of Mustard Seed by Census Division 10

Figure 7 - 2005 Harvested Area of Lentils by Census Division 11

Figure 8 - 2005 Harvested Area of Dry Beans by Census Division 12

Figure 9 - 2005 Harvested Area of Chickpeas by Census Division 13

Figure 10 - Yellow Edible Pea Prices 17

Figure 11 - Large Seeded (Laird) Lentil Prices 17

Figure 12 - Kabuli Chickpea Prices 18

Figure 13 - Canary Seed Prices 18

Figure 14 - Brown Mustard Seed Prices 19

Figure 15 - Oriental Mustard Seed Prices 19

Figure 16 - Yellow Mustard Seed Prices 20

List of Tables

Table 1 – Alberta 2005 Specialty Crops 5

Table 2 - Alberta 2005 Specialty Crops by Census Division 7

Table 3 - Alberta 2004 Specialty Crops by Census Division 8

Table 4 - Alberta Specialty Crops Historical Series 14

Table 5 – Western Canada Specialty Crops Area and Production 16

Table 6 – Production Costs and Returns for Dry Peas, Dark Brown Soil Zone, 2005 23

Table 7 - Production Costs and Returns for Dry Beans, Dark Brown Soil Zone, 2005 24

Table 8 – Production Costs and Returns, Desi and Kabuli Chickpeas, 2005 25

Table 9 - Commercial Hemp Production in Alberta and Canada, 1998-2005 30

Table 10 - Effect of Variety and Plant Density on Biomass and Grain Yield of Hemp, CDCN, 2005 31

Table 11 - Effect of Variety and Plant Density on Biomass and Grain Yield of Hemp, Alpac, 2005 32

Table 12 - Seed Yield of Different Flax Varieties and Type at Four Locations in Alberta, 2005 33

Alberta 2005 Specialty Crop Survey

Chuanliang Su

Purpose of Survey

To address some of the data and information needs of the specialty crop industry in Alberta, the Statistics and Data Development (SADD) Unit conducts an annual Specialty Crop Survey. Now into its twenty-third year, the survey captures data on area, yield and production for specialty crops grown in the province.

Data gathered from the survey are used primarily to generate related provincial and sub-provincial estimates. In turn, these estimates are used to validate some of the Alberta estimates generated by Statistics Canada, as well as to provide industry and other stakeholders with benchmark statistics for some of the "new" and emerging crops.

Methodology

The Alberta Specialty Crop Survey, which is provincial in scope, collects data through a non-probability sampling procedure. In December 2005, survey questionnaires were mailed out to 3,315 specialty crop producers across the province. The questionnaires specifically asked survey participants to provide information on the type of specialty crop grown, area (seeded and harvested acres), yield and production for the year 2005. Survey participants were informed that participation in the survey was voluntary. Moreover, all individual responses would be kept confidential under the provisions of the Federal Statistics Act, as well as under the Provincial Freedom of Information and Protection of Privacy (FOIP) Act, by which the SADD Unit is governed and operates. As of March 23, 2005, a total of 814 questionnaires were returned. Of this total 716 were usable and partly formed the basis in the generation of the Alberta 2005 specialty crop estimates.

Survey responses received were reviewed for data completeness, validated and entered into an electronic database. The data was then subject to some computerized analyses, the results of which were rolled up into group summaries, to preserve data confidentiality of individual survey respondents. In turn, the group summaries, in conjunction with consultations with industry, published sources (e.g. Statistics Canada) and Alberta Agriculture, Food and Rural Development (AAFRD) subject area/provincial specialists were used to generate the provincial and sub-provincial (Census Division) estimates, where appropriate.

It cannot be over emphasized that extensive consultation is done with AAFRD's subject area/provincial specialists and industry, in the derivation of the provincial/sub-provincial estimates. Subject area/provincial specialists are acknowledged for their useful information and valuable insights on crop conditions and yields, particularly when attempting to firm up some of the sub-provincial estimates generated from the survey.

Likewise, administrative data showing yield and crop area grown under private contracts also tend to add value to some of the estimates.

It should be noted that the derived estimates are subject to error. Some of the possible causes of error include data coding, data entry and tabulation. Nonetheless, we believe that the statistics published in this report are reliable estimates for Alberta.

Survey Results

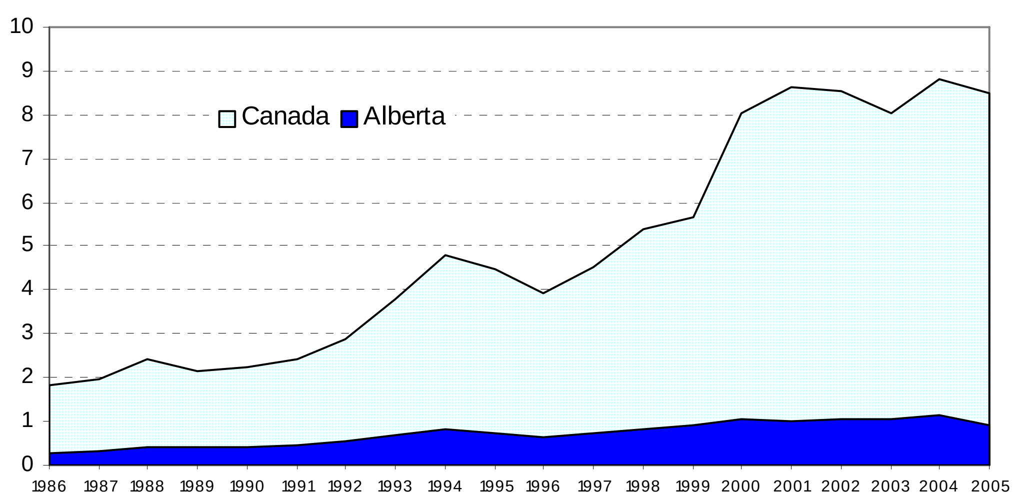
Area, Yield and Production in Alberta

Alberta producers planted fewer acres of specialty crops in 2005. Total provincial seeded area, excluding potatoes and forage seeds, was estimated at 0.90 million acres (see Figure 1), down 20 per cent from 1.13 million acres in 2004. The reduction in acreage can largely be attributed to fewer acres in dry peas and mustard seed. Of the total seeded area in 2005, nearly 0.81 million acres or 89 per cent were harvested for grains. To offer some perspective, shown in Figure 3 (see page 5) is the per centage distribution of specialty crop seeded acreage by crop type in 2005.

In general, growing conditions were favorable during the 2005 crop season, resulting in above average yields for most specialty crops grown on dryland. However, poor weather conditions in the fall significantly reduced crop quality.

In 2005, dry peas produced an average yield of 42.8 bushels per acre, or about nine per cent higher than in 2004, and about 19 per cent above the 10-year average. The provincial average yield of mustard seeds was estimated at 915 pounds per acre, slightly higher than the 2004 yield of 902 pounds per acre, and 23 per cent above the 10-year average. For chickpeas, the provincial average yield was a record 1,442 pounds per acre and up 14 per cent from 2004. It should be noted that due to cool, damp conditions, there were disease problems with dry beans, impacting yields in 2005. The provincial average yield for dry beans was estimated at 2,020 pounds per acre, in line with 2004, but down five per cent from the 10-year average.

Figure 1 - Specialty Crop Seeded Area, Alberta and Canada 1986-2005 (million acres)



Source: Statistics Canada and Alberta Agriculture, Food and Rural Development

Specialty Crops in Western Canada

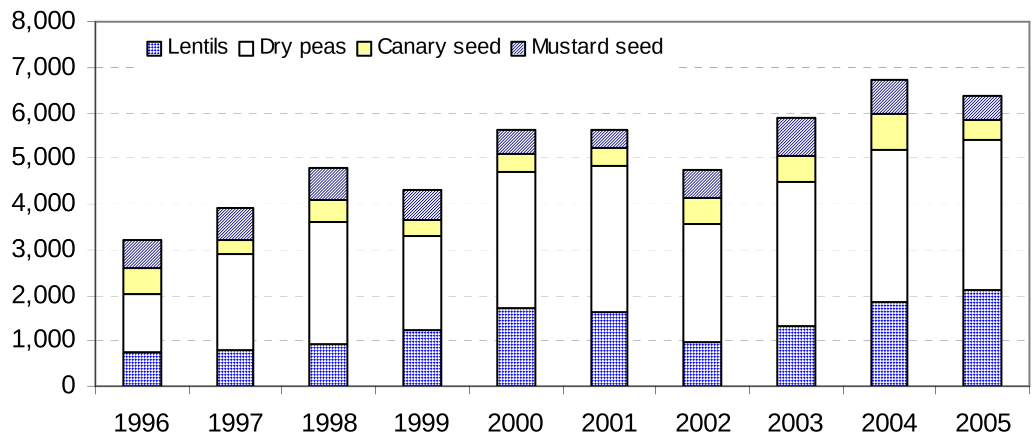
Based on the Statistics Canada November Estimate of Production of Principal Field Crops, 2005, and results of the Alberta 2005 Specialty Crop Survey, total seeded area of specialty crops in Western Canada dropped significantly from 2004. Total harvested area also decreased, but to a lesser extent, due to fewer abandoned acres. With reduced harvested area and lower yields for some specialty crops, total production was down in 2005, when compared to a year earlier.

In 2005, total seeded area of specialty crops declined for all of the provinces in Western Canada, when compared to 2004. For Western Canada, total seeded area in 2005 was estimated at 7.88 million acres, with Saskatchewan accounting for 77 per cent of the total or 6.06 million acres. About 12 per cent of the total seeded area was in Alberta, while 11 per cent was in Manitoba. Only a small acreage of specialty crops was planted in British Columbia. The total harvested area in Western Canada in 2005 was 7.40 million acres, or about two per cent lower than the 7.54 million acres in 2004.

The four major specialty crops grown in Western Canada in 2005 were dry peas, lentils, canary seed and mustard seed, and accounted for 83 per cent of the total seeded area. More specifically, dry peas remained the largest specialty crop in Western Canada, with a total seeded area of 3.38 million acres. It also represented 43 per cent of the total seeded area of specialty crops in Western Canada. Lentils was next, with seeded acres totaling 2.18 million or 28 per cent of the Western Canada total, while mustard seed and canary seed represented seven per cent and six per cent, respectively.

The total harvested area of the four major specialty crops in Western Canada is shown in Figure 2. Statistics on seeded area and production of selected specialty crops are presented in Table 5 (see page 16).

Figure 2 - Harvested Area of Selected Specialty Crops Western Canada ('000 acres)

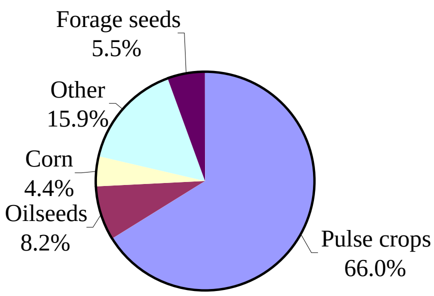


Source: Statistics Canada and Alberta Agriculture, Food and Rural Development

Table 1 Alberta 2005 Specialty Crops

		Seeded Area (acres)	Harvested Area (acres)	Yield (per acre)	Production (tonnes)
Pulse crops	Dry peas, green	132,000	127,000	48.3 bu	166,942
	Dry peas, yellow	420,000	400,000	41.2 bu	448,509
	Dry peas, other	3,000	3,000	25.6 bu	2,090
	Total dry peas	**555,000**	**530,000**	**42.8 bu**	**617,541**
	Chickpeas	30,000	30,000	1,441.7 lbs	19,618
	Dry beans	57,000	50,000	20.2 cwt	45,841
	Fababeans	4,000	4,000	-	-
	Lentils	24,000	20,000	1,562.5 lbs	14,175
Oilseeds	Brown mustard	14,500	14,500	808.0 lbs	5,314
	Yellow mustard	48,000	43,000	880.0 lbs	17,164
	Oriental mustard	17,500	17,500	1,090.0 lbs	8,652
	Total mustard	**80,000**	**75,000**	**915.0 lbs**	**31,130**
	Sunflowers	3,500	3,500	-	-
Corn	Grain corn	-	-	-	-
	Silage corn	45,000	35,000	14.3 ton	453,638
Other	Potatoes (1)	56,000	51,500	344.0 cwt	803,598
	Triticale	65,000	20,000	43.0 bu	21,845
	Canary seed	6,000	6,000	1,200.0 lbs	3,266
	Sugar beets (2)	34,600	33,700	19.9 tonne	668,141
Forage seeds(3)	Alfalfa seed	10,806	10,050	270.0 lbs	1,231
	Alsike clover	1,582	-	-	-
	Brome grass	9,233	9,215	355.0 lbs	1,484
	Red fescue	12,551	12,526	595.0 lbs	3,381
	Red clover	400	-	-	-
	Timothy	10,027	9,024	335.0 lbs	1,371
	Other	10,758	-	-	-

Figure 3 - Per centage Distribution of Specialty Crop Seeded Acreage, Alberta, 2005
(Total area: 1,015,457 acres)



Source: Alberta 2005 Specialty Crop Survey, AAFRD

Except for:

(1) Statistics Canada, Canadian Potato Production by Province, January 2005
(2) Alberta Sugar Beet Growers' Marketing Board
(3) Canadian Seed Growers' Association - Inspected Pedigreed Acres of Grass and Legume Seed; Yield estimates are generated from the Alberta 2005 Specialty Crop Survey, including pedigreed and common seeds

cwt - hundredweight (hundred pounds)
ton = 2,000 lbs   tonne = 1.1023 tons = 2,204.6 lbs
- Not available

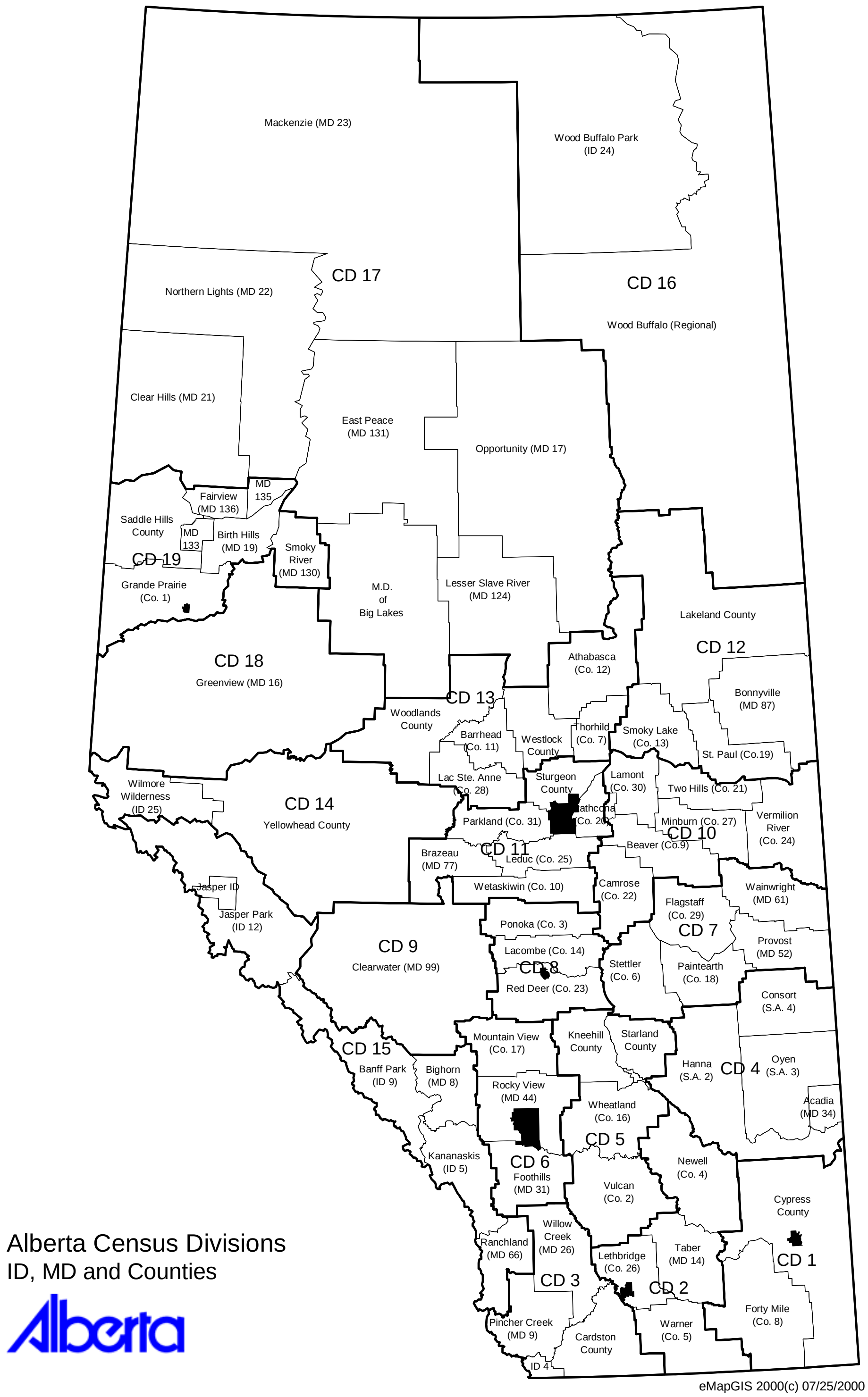

Mackenzie (MD 23)
Wood Buffalo Park (ID 24)
CD 17
CD 16
Northern Lights (MD 22)
Wood Buffalo (Regional)
Clear Hills (MD 21)
East Peace (MD 131)
Opportunity (MD 17)
MD 135
Fairview (MD 136)
Saddle Hills County
MD 133
Birth Hills (MD 19)
Smoky River (MD 130)
CD 19
Grande Prairie (Co. 1)
M.D. of Big Lakes
Lesser Slave River (MD 124)
Lakeland County
CD 12
Athabasca (Co. 12)
CD 18
Greenview (MD 16)
CD 13
Bonnyville (MD 87)
Woodlands County
Barrhead (Co. 11)
Westlock County
Thorhild (Co. 7)
Smoky Lake (Co. 13)
St. Paul (Co.19)
Wilmore Wilderness (ID 25)
Lac Ste. Anne (Co. 28)
Sturgeon County
Lamont (Co. 30)
Two Hills (Co. 21)
CD 14
Yellowhead County
Strathcona (Co. 20)
Parkland (Co. 31)
Minburn (Co. 27)
Vermilion River (Co. 24)
CD 10
Beaver (Co.9)
Brazeau (MD 77)
CD 11
Leduc (Co. 25)
Jasper ID
Wetaskiwin (Co. 10)
Camrose (Co. 22)
Wainwright (MD 61)
Jasper Park (ID 12)
Flagstaff (Co. 29)
Ponoka (Co. 3)
CD 7
CD 9
Lacombe (Co. 14)
Provost (MD 52)
Clearwater (MD 99)
CD 8
Stettler (Co. 6)
Paintearth (Co. 18)
Red Deer (Co. 23)
Consort (S.A. 4)
Mountain View (Co. 17)
Kneehill County
Starland County
CD 15
Banff Park (ID 9)
Bighorn (MD 8)
Hanna (S.A. 2)
CD 4
Oyen (S.A. 3)
Rocky View (MD 44)
Acadia (MD 34)
Wheatland (Co. 16)
CD 5
Kananaskis (ID 5)
CD 6
Foothills (MD 31)
Newell (Co. 4)
Vulcan (Co. 2)
Cypress County
Willow Creek (MD 26)
Ranchland (MD 66)
Taber (MD 14)
CD 1
Lethbridge (Co. 26)
CD 3
CD 2
Forty Mile (Co. 8)
Pincher Creek (MD 9)
Warner (Co. 5)
Cardston County
ID 4
Alberta Census Divisions
ID, MD and Counties
eMapGIS 2000(c) 07/25/2000

Figure 4

Table 2 Alberta 2005 Specialty Crops by Census Division

C.D.	Dry Peas	Mustard	Lentils	Dry Beans	Chickpeas
Harvested Area (acres)					
1	57,743	5,950	5,101	32,581	18,079
2	56,697	28,900	6,593	16,560	10,445
3	17,145	3,898	-	-	-
4	24,002	18,403	7,145	-	1,476
5	106,357	16,344	1,160	858	-
6	11,857	1,505	-	-	-
7	77,422	-	-	-	-
8	9,062	-	-	-	-
9	-	-	-	-	-
10	80,183	-	-	-	-
11	11,689	-	-	-	-
12	12,882	-	-	-	-
13	10,322	-	-	-	-
17	22,413	-	-	-	-
18	5,329	-	-	-	-
19	26,897	-	-	-	-
Alberta	**530,000**	**75,000**	**20,000**	**50,000**	**30,000**
Yield Per Acre					
	(bushels)	**(pounds)**	**(pounds)**	**(cwt)**	**(pounds)**
1	34.6	798.6	-	20.7	-
2	40.3	895.2	1,434.0	19.6	1,620.4
3	44.5	813.3	-	-	-
4	35.0	894.2	-	-	-
5	42.5	1,122.4	-	-	-
6	43.2	-	-	-	-
7	42.3	-	-	-	-
8	50.9	-	-	-	-
9	-	-	-	-	-
10	47.9	-	-	-	-
11	42.5	-	-	-	-
12	58.1	-	-	-	-
13	61.0	-	-	-	-
17	41.0	-	-	-	-
18	-	-	-	-	-
19	51.7	-	-	-	-
Alberta	**42.8**	**915.0**	**1,562.5**	**20.2**	**1,441.7**
Production (tonnes)					
1	54,369	2,155	-	30,569	-
2	62,254	11,735	4,288	14,724	7,677
3	20,779	1,438	-	-	-
4	22,879	7,465	-	-	-
5	123,008	8,321	-	-	-
6	13,949	-	-	-	-
7	89,204	-	-	-	-
8	12,565	-	-	-	-
9	-	-	-	-	-
10	104,443	-	-	-	-
11	13,505	-	-	-	-
12	20,382	-	-	-	-
13	17,128	-	-	-	-
17	25,008	-	-	-	-
18	-	-	-	-	-
19	37,839	-	-	-	-
Alberta	**617,541**	**31,130**	**14,175**	**45,841**	**19,618**

Note: Totals may not add up due to rounding or insufficient data for generating estimates for some census divisions.
cwt - hundredweight (hundred pounds) - Not available
Source: Statistics Canada; and Alberta Agriculture, Food and Rural Development (AAFRD)

Table 3 Alberta 2004 Specialty Crops by Census Division

C.D.	Dry Peas	Mustard	Lentils	Dry Beans	Chickpeas
	Harvested Area (acres)				
1	74,719	16,427	4,480	26,082	6,943
2	73,145	32,586	7,208	20,318	2,893
3	43,643	9,656	-	-	-
4	28,665	32,296	4,661	-	1,355
5	117,510	23,437	1,652	600	3,810
6	25,463	3,501	-	-	-
7	81,104	9,498	-	-	-
8	14,700	-	-	-	-
9	-	-	-	-	-
10	102,588	600	-	-	-
11	22,289	-	-	-	-
12	9,629	-	-	-	-
13	17,453	-	-	-	-
17	22,534	-	-	-	-
18	-	-	-	-	-
19	21,558	-	-	-	-
Alberta	**655,000**	**128,000**	**18,000**	**47,000**	**15,000**
	Yield Per Acre				
	(bushels)	**(pounds)**	**(pounds)**	**(cwt)**	**(pounds)**
1	28.2	876.1	-	23.4	-
2	45.4	904.5	1,394.4	18.1	1,373.0
3	41.4	833.5	-	-	-
4	30.8	759.0	-	-	-
5	45.0	1,034.4	-	-	-
6	40.4	-	-	-	-
7	39.0	-	-	-	-
8	41.5	-	-	-	-
9	-	-	-	-	-
10	38.9	-	-	-	-
11	46.3	-	-	-	-
12	48.0	-	-	-	-
13	42.4	-	-	-	-
17	24.2	-	-	-	-
18	-	-	-	-	-
19	31.1	-	-	-	-
Alberta	**39.2**	**902.0**	**1,372.0**	**20.2**	**1,267.0**
	Production (tonnes)				
1	57,370	6,528	-	27,660	-
2	90,470	13,370	4,559	16,651	1,802
3	49,158	3,651	-	-	-
4	24,050	11,119	-	-	-
5	143,884	10,996	-	-	-
6	28,010	-	-	-	-
7	85,989	-	-	-	-
8	16,614	-	-	-	-
9	-	-	-	-	-
10	108,585	-	-	-	-
11	28,099	-	-	-	-
12	12,588	-	-	-	-
13	20,150	-	-	-	-
17	14,869	-	-	-	-
18	-	-	-	-	-
19	18,240	-	-	-	-
Alberta	**698,073**	**52,375**	**11,202**	**43,107**	**8,621**

Note: Totals may not add up due to rounding or insufficient data for generating estimates for some census divisions.
cwt - hundredweight (hundred pounds) - Not available
Source: Statistics Canada; and Alberta Agriculture, Food and Rural Development (AAFRD)

Specialty Crops by Census Division in Alberta

The following section presents estimates of area, yield and production at the Census Division level for dry peas, mustard seed, lentils, dry beans and chickpeas. Please note that Census Division estimates were generated from a small sample, therefore, caution should be exercised when interpreting and using the data. Also for reference, the Alberta Census Division and municipality map is shown on page 6 – Figure 4.

Dry Peas

In 2005, total seeded area of dry peas in Alberta was estimated at 555,000 acres, of which 530,000 acres were harvested (see Table 1). Due to favorable crop growing conditions, the provincial average yield of dry peas reached 42.8 bushels per acre, just shy of the record yield of 42.9 bushels per acre in 1999. The provincial average yield was 39.2 bushels per acre in 2004 and 35.9 bushels per acre for the 10-year average. Total production of dry peas in 2005 was estimated at 617,541 tonnes, down 12 per cent from the record production of 698,073 tonnes in 2004. The lower production was due to a large reduction in harvested area, which negated the impact of a near record yield.

Although dry peas are grown primarily on dryland across the province, higher acreage of dry peas is concentrated in central and northeastern Alberta, particularly in Census Divisions 5 (Drumheller area), 7 (Provost area) and 10 (Vermilion area) - see Tables 2 and 3. These three Census Divisions (5, 7 and 10) when combined accounted for nearly 50 per cent of the provincial total harvested area in 2005. Just to mention, yields of dry peas were varied across the province.

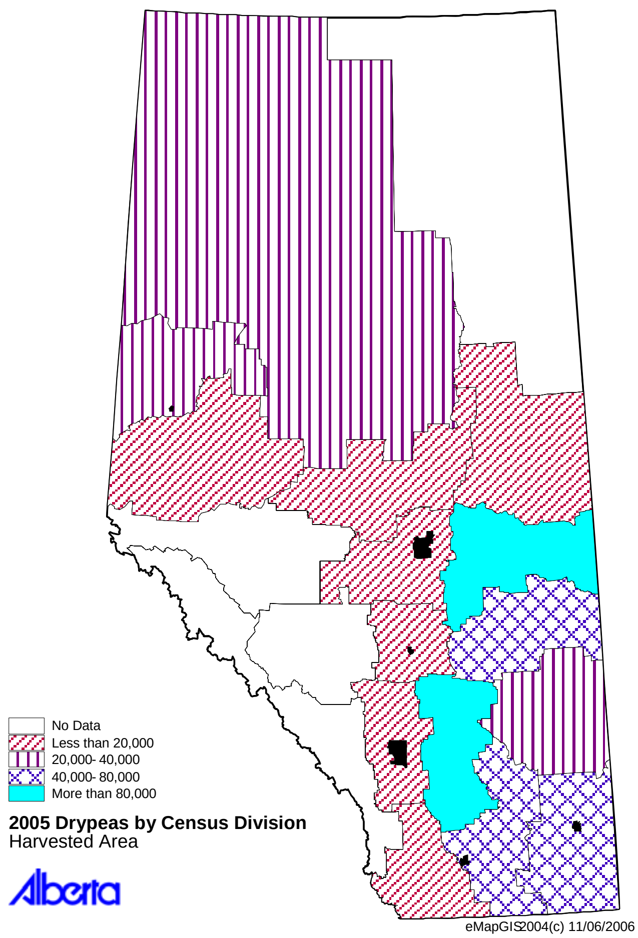


Figure 5

Mustard Seed

In 2005, a total of 80,000 acres were seeded to mustard seed in Alberta, of which 75,000 acres were harvested (see Table 1). The provincial average yield of mustard seed reached 915 pounds per acre, marginally higher than the 2004 yield of 902 pounds per acre, and 23 per cent above the 10-year average of 745 pounds per acre. Mustard seed is grown primarily on dryland in southern Alberta, where moisture reserves were adequate for most of the 2005 crop season.

Total provincial production of mustard seed was estimated at 31,130 tonnes, or about 41 per cent below the record production of 52,375 tonnes in 2004, and six per cent lower than the 10-year average of 33,062 tonnes. The lower 2005 production was due to a large reduction in harvested area.

Of the three types of mustard seed produced in Alberta, yellow mustard continued to dominate in 2005, accounting for 58 per cent of the provincial total harvested acreage, while oriental and brown mustard represented 23 per cent and 19 per cent, respectively.

In 2005, about 93 per cent of the provincial total harvested area was in Census Divisions 1, 2, 4 and 5 (see Table 2). Additionally, yields varied significantly across the province. For example, Census Division 1 had the lowest yield of 799 pounds per acre in the province, while the highest yield of 1,122 pounds per acre was reported in Census Division 5.

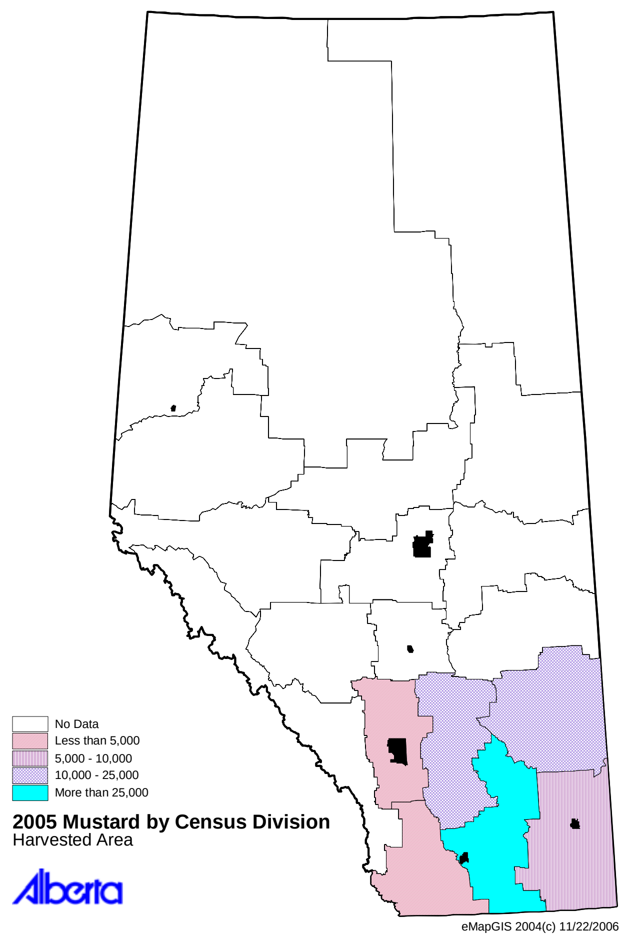


Figure 6

Lentils

Total seeded area of lentils in Alberta in 2005 was estimated at 24,000 acres, of which 20,000 acres were harvested (see Table 1). Due to favorable crop growing conditions, the provincial average yield of lentils in 2005 reached a record high 1,563 pounds per acre. This was 14 per cent higher than in 2004, and 52 per cent above the 10-year average.

Total production of lentils was estimated at 14,175 tonnes in 2005, up 27 per cent from 2004, and 60 per cent higher than the 10-year average. The higher production in 2005 was attributed mainly to the record yield.

Lentils are grown in southern Alberta. In 2005, about 94 per cent of the provincial total harvested area was in Census Divisions 1, 2 and 4 (see Table 2).

There is limited lentil acreage under irrigation in the province, based on information from the Irrigation Branch of Alberta Agriculture, Food and Rural Development.

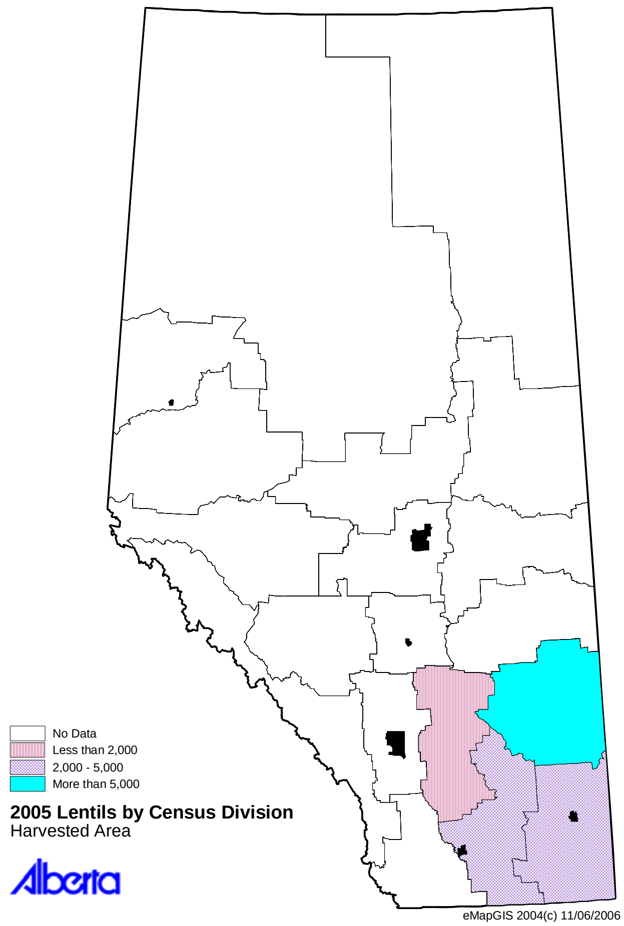


Figure 7

Dry Beans

In 2005, total seeded area of dry beans in Alberta was estimated at 57,000 acres, of which 50,000 acres were harvested (see Table 1). The provincial average yield of dry beans was estimated at 2,020 pounds per acre, unchanged from 2004, and about five per cent below the 10-year average. Due to cool, damp conditions, there were disease problems with dry beans, impacting yields in 2005.

Total production of dry beans in 2005 was estimated at 45,841 tonnes, or six per cent higher than in 2004, and the 10-year average. The higher production in 2005 was due to an increase in harvested area.

Dry beans are grown mostly under irrigation in southern Alberta. In 2005, Census Divisions 1 and 2 jointly accounted for 98 per cent of the provincial total harvested area (see Table 2).

In general, over 80 per cent of total dry bean area in Alberta is irrigated, according to information from the Irrigation Branch of Alberta Agriculture, Food and Rural Development. Additionally, dry beans are grown under contract in Alberta.

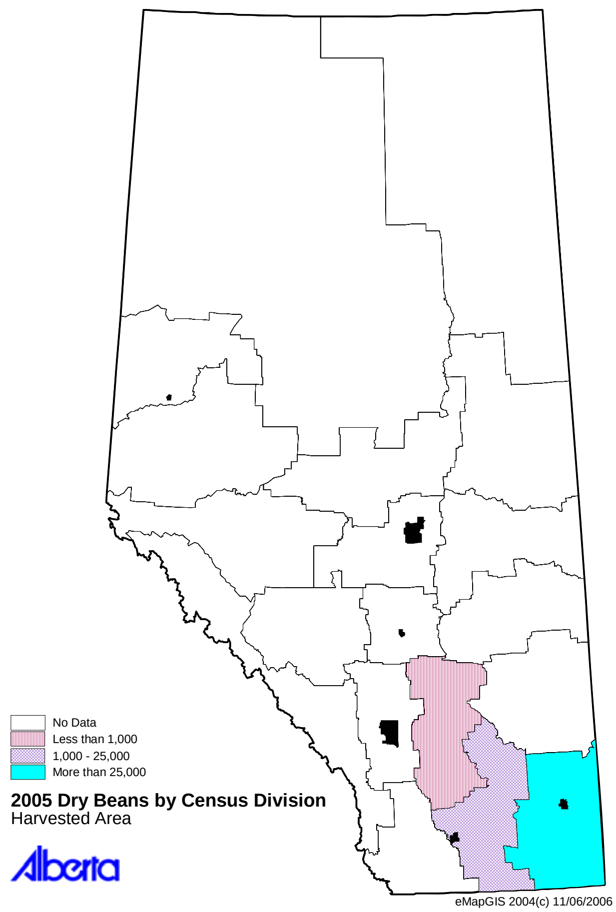


Figure 8

Chickpeas

Total seeded and harvested area of chickpeas in Alberta in 2005 doubled to 30,000 acres from a year earlier (see Table 1). The provincial average yield of chickpeas in 2005 reached a record 1,442 pounds per acre, up 14 per cent from a year earlier. The record yield can be attributed to favorable crop growing conditions in the southeastern parts of the province.

Total production of chickpeas was estimated at 19,618 tonnes, more than double the 2004 production of 8,621 tonnes. The higher production was due to a combination of an increase in harvested area and the record yield.

Chickpeas are grown in the southeastern parts of Alberta. In 2005, about 95 per cent of the provincial total harvested area was in Census Divisions 1 and 2 (see Table 2).

Chickpeas is a relatively new crop in the Prairies. Producers in Alberta started growing chickpeas in the late 1990's. Only small amounts of chickpeas in Alberta are grown under irrigation, according to information from the Irrigation Branch of Alberta Agriculture, Food and Rural Development.

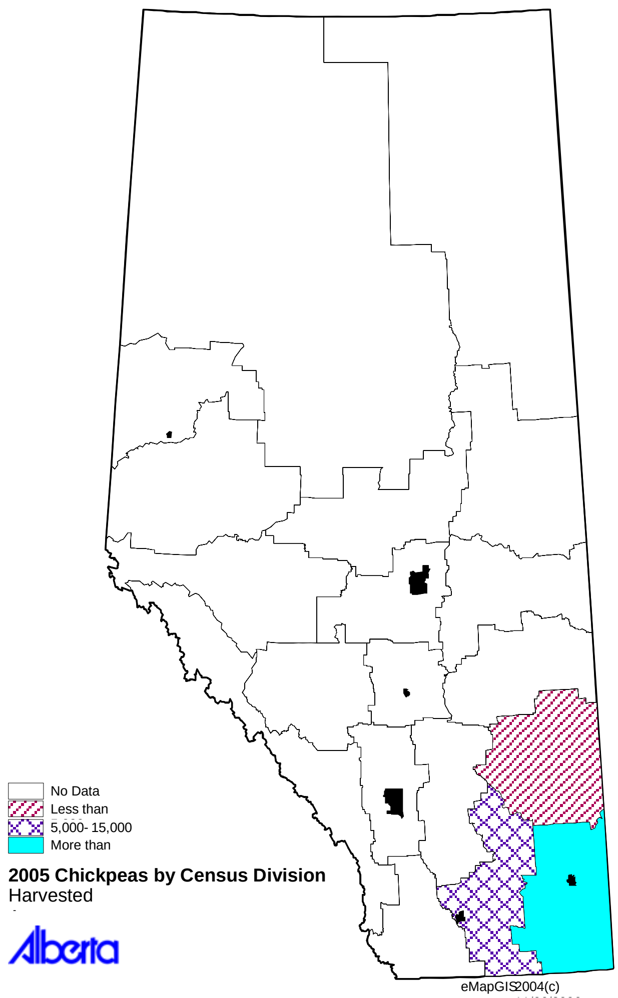


Figure 9

Table 4 Alberta Specialty Crops Historical Series

		1996	1997	1998	1999	2000	2001	2002*	2003*	2004*	2005*
Alfalfa Seed (1)											
Inspected area	(acres)	10,355	10,376	12,069	16,461	17,117	15,381	12,709	11,292	10,345	10,050
Yield	(lbs/acre)	265	300	425	200	525	385	265	550	370	270
Production	(tonnes)	1,245	1,412	2,327	1,493	4,076	2,686	1,528	2,817	1,736	1,231
Buckwheat											
Harvested area	(acres)	850	400	400	400	-	-	-	-	-	-
Yield	(bu/acre)	-	-	-	-	-	-	-	-	-	-
Production	(tonnes)	-	-	-	-	-	-	-	-	-	-
Canary Seed											
Harvested area	(acres)	25,000	10,000	20,000	10,000	10,000	4,000	7,000	10,000	10,000	6,000
Yield	(lbs/acre)	960	810	950	1,400	1,100	775	520	900	1,040	1,200
Production	(tonnes)	10,900	3,700	8,600	6,400	5,000	1,400	1,651	4,082	4,717	3,266
Corn for Grain											
Harvested area	(acres)	2,600	4,000	5,000	10,000	10,000	3,000	-	-	-	-
Yield	(bu/acre)	96.2	100.0	90.0	80.0	110.0	86.7	-	-	-	-
Production	(tonnes)	6,400	10,200	11,400	20,300	27,900	6,600	-	-	-	-
Corn Silage											
Harvested area	(acres)	10,000	15,000	15,000	15,000	30,000	30,000	30,000	30,000	35,000	35,000
Yield	(tons/acre)	19.5	12.0	20.0	13.3	17.0	16.0	16.0	16.7	18.6	14.3
Production	(tonnes)	176,900	163,300	272,200	181,400	462,700	435,400	435,453	453,606	589,701	453,638
Fababeans											
Harvested area	(acres)	200	1,000	2,000	-	-	3,000	2,500	2,000	5,000	4,000
Yield	(lbs/acre)	1,300	2,000	2,500	-	-	1,700	1,450	-	2,600	-
Production	(tonnes)	120	900	2,300	-	-	2,300	1,644	-	5,897	-
Dry Beans											
Harvested area	(acres)	25,000	35,000	45,000	47,000	45,000	59,000	40,000	52,000	47,000	50,000
Yield	(cwt/acre)	18.0	22.9	22.2	20.0	21.3	22.3	20.5	25.6	20.2	20.2
Production	(tonnes)	20,400	36,300	45,400	42,700	43,500	59,700	37,195	60,300	43,107	45,841
Dry Peas											
Harvested area	(acres)	280,000	385,000	500,000	455,000	640,000	570,000	440,000	605,000	655,000	530,000
Yield	(bu/acre)	40.4	40.3	35.9	42.9	35.6	32.6	19.6	30.8	39.2	42.8
Production	(tonnes)	307,500	421,800	488,000	530,800	620,500	506,200	234,324	507,865	698,073	617,541
Lentils											
Harvested area	(acres)	20,000	25,000	15,000	22,000	32,000	15,000	12,000	15,000	18,000	20,000
Yield	(lbs/acre)	845	732	1,180	1,245	684	722	900	1,013	1,372	1,563
Production	(tonnes)	7,700	8,300	8,000	12,400	9,900	5,000	4,899	6,891	11,202	14,175
Mustard Seed											
Harvested area	(acres)	85,000	145,000	110,000	90,000	50,000	50,000	80,000	135,000	128,000	75,000
Yield	(lbs/acre)	753	769	795	1,100	606	373	603	634	902	915
Production	(tonnes)	29,000	50,600	39,700	44,800	13,800	8,500	21,888	38,825	52,375	31,130
Safflower											
Harvested area	(acres)	800	-	12,000	5,000	3,000	1,000	-	2,500	3,200	-
Yield	(lbs/acre)	760	-	1,020	900	625	750	-	1,215	-	-
Production	(tonnes)	700	-	1,400	2,000	900	300	-	1,378	-	-

Source: Statistics Canada; and Alberta Agriculture, Food and Rural Development (AAFRD) - Not available

(1) Inspected pedigreed acres are from Canadian Seed Growers' Association; yield and production data are from the Alberta Specialty Crop Survey.

* - Data are from the Alberta Specialty Crop Survey, AAFRD.

Table 4 Alberta Specialty Crops Historical Series (Cont'd)

		1996	1997	1998	1999	2000	2001	2002*	2003*	2004*	2005*
Sugar Beets (2)											
Harvested area	(acres)	33,463	33,124	41,132	44,522	42,017	28,457	27,754	27,389	35,000	33,700
Yield	(tonnes/ac	20.22	19.64	23.32	18.86	21.90	18.38	15.22	22.93	21.20	19.90
Production	(tonnes)	676,611	650,423	959,310	839,773	920,252	523,110	422,389	628,081	740,508	668,141
Sunflowers											
Harvested area	(acres)	2,000	5,000	5,000	5,000	5,000	5,000	2,000	3,000	5,000	3,500
Yield	(lbs/acre)	1,675	1,400	1,900	1,600	2,240	1,250	1,500	-	800	-
Production	(tonnes)	1,500	3,200	4,300	3,600	5,100	2,800	1,361	-	1,814	-
Triticale											
Harvested area	(acres)	15,000	15,000	50,000	60,000	50,000	20,000	35,000	40,000	25,000	20,000
Yield	(bu/acre)	33.3	36.7	38.0	53.3	41.0	37.0	50.0	33.8	44.0	43.0
Production	(tonnes)	12,700	14,000	48,300	81,300	52,100	18,800	44,452	34,343	27,941	21,845
Potatoes											
Harvested area	(acres)	31,000	30,500	32,200	42,300	47,700	57,300	55,800	61,000	57,000	51,500
Yield	(cwt/acre)	268.0	290.0	295.0	290.0	310.0	315.0	280.0	330.0	350.0	344.0
Production	(tonnes)	376,900	401,200	430,900	556,400	670,700	818,700	708,700	913,200	904,918	803,598

Source: Statistics Canada; and Alberta Agriculture, Food and Rural Development (AAFRD) - Not available

(2) Alberta Sugar Beet Growers, Annual Report

* - Data are from the Alberta Specialty Crop Survey, AAFRD.

Table 5 Western Canada Specialty Crops Area and Production

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Mustard Seed					**Seeded Area ('000 acres)**						
Alberta	100.0	90.0	145.0	110.0	100.0	50.0	60.0	95.0	140.0	135.0	80.0
Saskatchewan	550.0	490.0	560.0	580.0	585.0	465.0	330.0	600.0	675.0	640.0	445.0
Manitoba	10.0	11.0	17.0	10.0	7.0	10.0	20.0	30.0	25.0	8.0	-
Western Canada	660.0	591.0	722.0	700.0	692.0	525.0	410.0	725.0	840.0	783.0	525.0
					Production ('000 tonnes)						
Alberta	51.1	29.0	50.6	39.7	44.8	13.8	8.5	21.9	38.8	52.4	31.1
Saskatchewan	190.6	196.9	186.5	195.5	259.7	185.1	91.2	125.2	176.9	250.4	170.3
Manitoba	2.6	4.9	6.3	3.4	1.9	3.3	5.1	10.0	10.4	2.7	-
Western Canada	244.3	230.8	243.4	238.6	306.4	202.2	104.8	157.1	226.1	305.5	201.4
Sunflowers					**Seeded Area ('000 acres)**						
Alberta	5.0	2.0	5.0	5.0	5.0	5.0	5.0	3.5	3.0	5.0	3.5
Saskatchewan	40.0	25.0	35.0	40.0	65.0	25.0	20.0	30.0	70.0	40.0	30.0
Manitoba	75.0	63.0	85.0	125.0	140.0	155.0	155.0	210.0	220.0	170.0	200.0
Western Canada	120.0	90.0	125.0	170.0	210.0	185.0	180.0	243.5	293.0	215.0	233.5
					Production ('000 tonnes)						
Alberta	4.3	1.5	3.2	4.3	3.6	5.1	2.8	1.4	-	1.8	-
Saskatchewan	18.4	15.7	14.3	21.3	35.4	12.4	8.1	17.2	23.6	8.6	11.7
Manitoba	43.5	37.7	47.6	86.2	82.9	101.8	92.9	136.1	124.7	44.0	77.6
Western Canada	66.2	54.9	65.1	111.8	121.9	119.3	103.8	154.7	148.3	54.4	89.3
Lentils					**Seeded Area ('000 acres)**						
Alberta	40.0	20.0	25.0	20.0	25.0	32.0	20.0	15.0	15.0	18.0	24.0
Saskatchewan	735.0	690.0	780.0	900.0	1,210.0	1,660.0	1,720.0	1,470.0	1,350.0	1,900.0	2,160.0
Manitoba	50.0	40.0	8.0	15.0	16.0	35.0	10.0	0.0	4.0	7.0	-
Western Canada	825.0	750.0	813.0	935.0	1,251.0	1,727.0	1,750.0	1,485.0	1,369.0	1,925.0	2,184.0
					Production ('000 tonnes)						
Alberta	21.5	7.7	8.3	8.0	12.4	9.9	5.0	4.9	6.9	11.2	14.2
Saskatchewan	381.9	373.8	365.2	465.9	702.6	888.1	557.9	351.9	510.3	948.9	1,263.8
Manitoba	28.5	21.0	5.3	5.9	8.8	16.1	3.4	0.0	2.7	0.8	-
Western Canada	431.9	402.5	378.8	479.8	723.8	914.1	566.3	356.8	519.9	960.9	1,278.0
Dry Peas					**Seeded Area ('000 acres)**						
Alberta	465.0	290.0	385.0	510.0	470.0	660.0	610.0	650.0	635.0	700.0	555.0
Saskatchewan	1,350.0	900.0	1,500.0	1,900.0	1,520.0	2,240.0	2,550.0	2,350.0	2,440.0	2,575.0	2,695.0
Manitoba	180.0	145.0	205.0	260.0	105.0	155.0	150.0	200.0	135.0	150.0	120.0
Western Canada	2,025.0	1,345.0	2,097.0	2,680.0	2,104.0	3,065.0	3,320.0	3,205.0	3,220.0	3,430.0	3,375.0
					Production ('000 tonnes)						
Alberta	412.3	307.5	421.8	488.0	530.8	620.5	506.2	234.3	507.9	698.1	617.5
Saskatchewan	868.2	729.4	1,158.1	1,613.8	1,623.4	2,072.4	1,366.2	963.5	1,469.6	2,476.6	2,414.0
Manitoba	147.0	132.0	178.3	225.9	92.0	160.5	146.1	176.9	137.4	160.0	62.5
Western Canada	1,454.7	1,173.0	1,762.3	2,336.8	2,251.9	2,864.3	2,023.0	1,378.2	2,124.4	3,338.2	3,099.8
Canary Seed					**Seeded Area ('000 acres)**						
Alberta	10.0	25.0	10.0	20.0	15.0	10.0	5.0	10.0	10.0	10.0	6.0
Saskatchewan	330.0	520.0	250.0	450.0	340.0	360.0	360.0	600.0	550.0	840.0	450.0
Manitoba	25.0	70.0	20.0	50.0	15.0	40.0	55.0	100.0	60.0	30.0	20.0
Western Canada	365.0	615.0	280.0	520.0	370.0	410.0	420.0	680.0	620.0	880.0	476.0
					Production ('000 tonnes)						
Alberta	4.5	10.9	3.7	8.6	6.4	5.0	1.4	1.7	4.1	4.7	3.3
Saskatchewan	137.9	240.0	102.1	201.8	152.0	148.6	101.2	140.6	183.7	284.4	219.3
Manitoba	12.2	33.7	9.2	24.9	7.6	17.2	11.3	32.7	31.8	11.4	7.9
Western Canada	154.6	284.6	115.0	235.3	166.0	170.8	113.9	175.0	219.6	300.5	230.5

Source: Statistics Canada; and Alberta Agriculture, Food and Rural Development (AAFRD)   - Not available

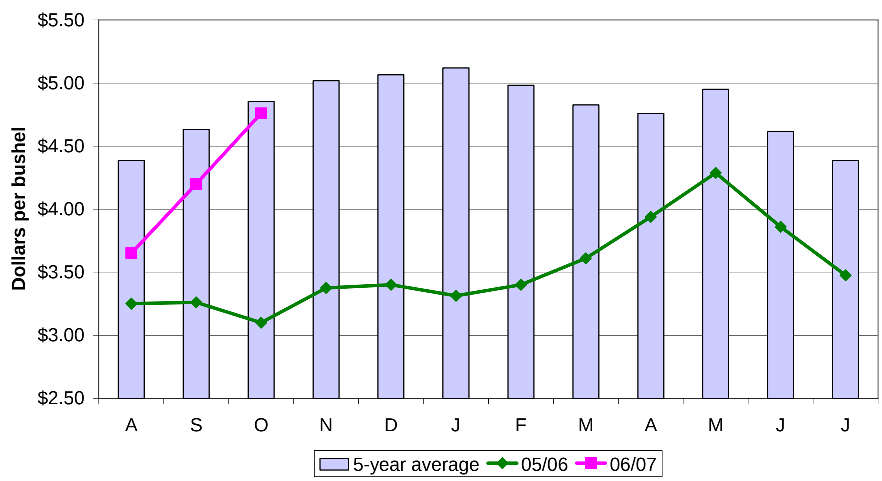
Market Outlook for Selected Specialty Crops

Charlie Pearson

Field Peas

Prices for human consumption peas (both green and yellow) were in the range of $3.00 to $4.00 per bushel over the 2005/06 crop year. A combination of factors, including larger pulse crops in Southeast Asia, a higher valued Canadian dollar relative to the US dollar, and expensive ocean freight rates, pressured prices of edible field peas lower than the five-year average.

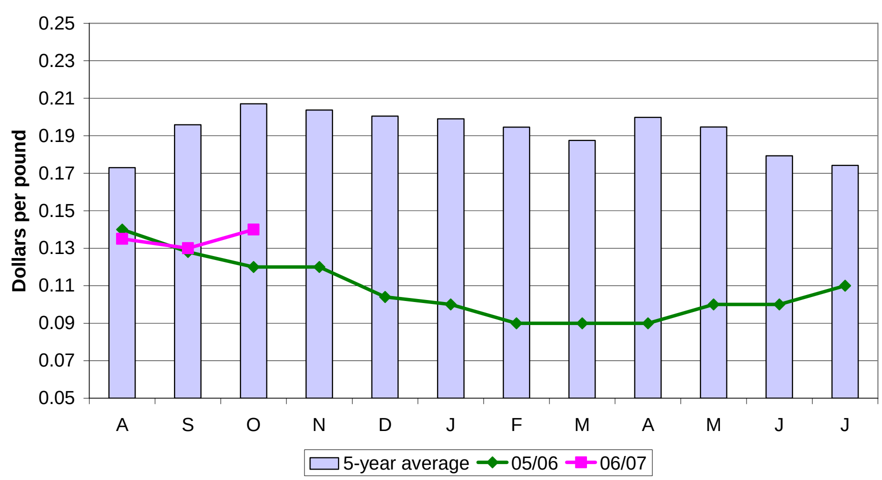
Figure 10 - Yellow Edible Pea Prices (August to July)



Lentils

The major factor in the 2005/06 lentil market was large Canadian and world lentil supplies. High Canadian production reduced prices in 2005/06, to a range of 9 to 12 cents per pound for top quality large seeded variety lentils, well below the five-year average.

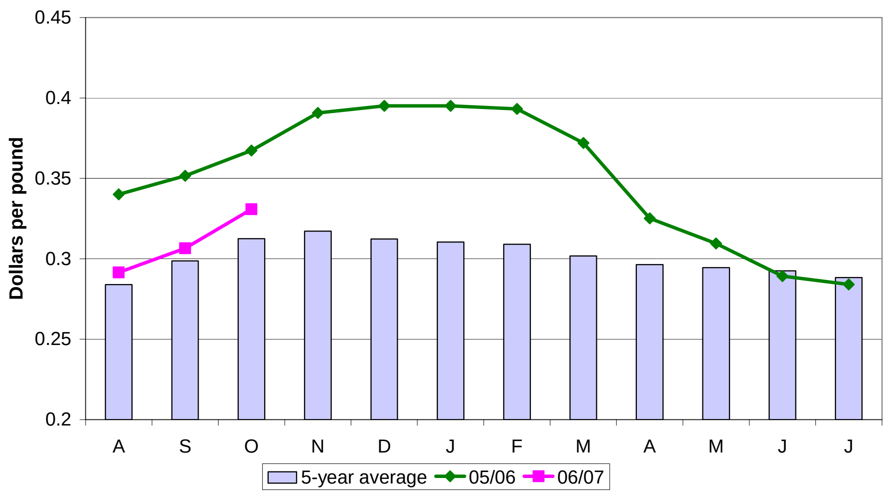
Figure 11 - Large (Laird) Lentil Prices (August to July)



Chickpeas

World chickpea production has been stable in a range of 6.4 to 6.9 million tonnes over the last several years. The Indian sub-continent produces the vast majority of this crop, accounting for 85 to 90 per cent of total world production. Canadian chickpea production in 2005 was estimated to be 104,000 tonnes, more than double the level in 2004. Kabuli chickpeas maintained a healthy premium over the five-year average for the large high quality varieties during 2005/06. Prices for kabuli chickpeas ranged from 35 to 39 cents per pound for the 9 mm size.

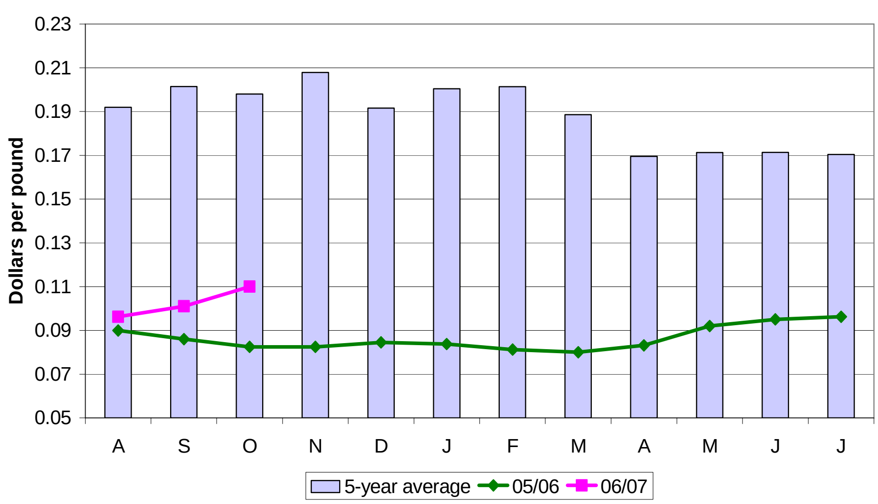
Figure 12 - Kabuli Chickpea Prices (August to July)



Canary Seed

Prices for canary seed dropped over the past winter, to a range of 8 to 9 cents per pound. Canadian canary seed production was estimated to be 230,500 tonnes in 2005, down 23 per cent from 2004.

Figure 13 - Canary Seed Prices (August to July)



Mustard Seed

Mustard seed prices were in the range of 10 to 12 cents per pound for all classes (yellow, oriental and brown) during 2005/06, well below their five-year averages. Canadian mustard production in 2005 was estimated to be 201,400 tonnes, down more than 34 per cent from 2004.

Figure 14 - Brown Mustard Seed Prices (August to July)

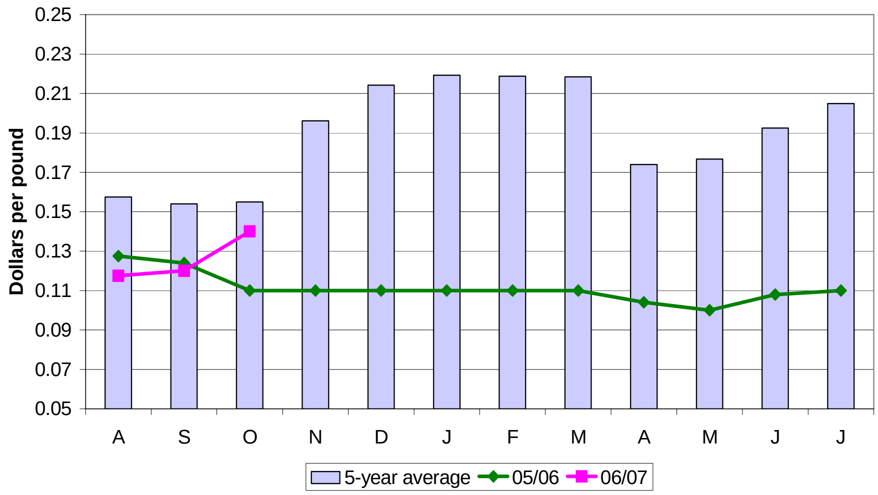


Figure 15 - Oriental Mustard Seed Prices (August to July)

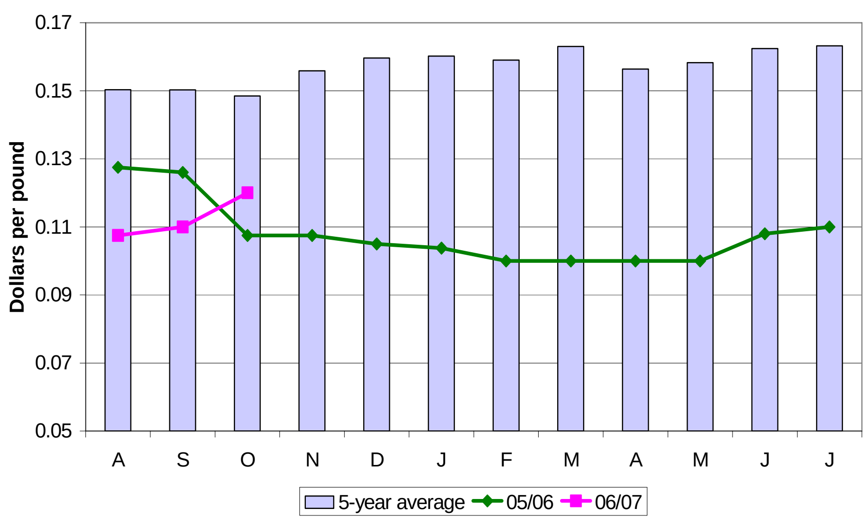
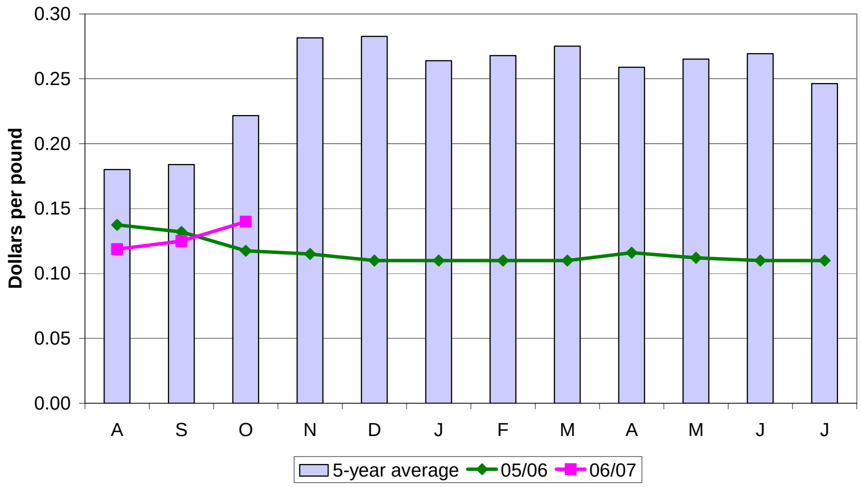


Figure 16 - Yellow Mustard Seed Prices (August to July)



Economics of Specialty Crop Production

Nabi Chaudhary

Costs and returns for crops, livestock, and several other enterprises have been monitored in the province in an extensive way since the 1960's. These studies have been viewed as an important tool for assisting producers in their cropping decisions and the federal and provincial governments in developing policies and programs for different farm enterprises. Where information gaps existed in other provinces, results from these studies have served as the basis to fill those gaps.

The Economics Unit (formerly known as Production Economics Branch) in the Economics and Competitiveness Division of Alberta Agriculture, Food and Rural Development has been conducting economic studies on various farm enterprises for the last several decades. Since the early nineties, much greater emphasis has been placed on developing costs and returns data on specialty and/or alternative crops for farm diversification purposes.

Volatile markets for traditional cereals and oilseeds have forced producers to seriously look into diversifying their operations into new and emerging specialty crops. As mentioned above, results from these studies have been very helpful to primary producers when making cropping decisions. Furthermore, individual producers have also used the results from these studies to compare costs and returns and profitability margins of their farms with the group averages from the respective areas in order to develop better management practices. Agri-businesses and other stakeholders have used the results of the economic studies for feasibility purposes.

During the last ten to thirteen years, area under special crops has increased significantly in Alberta. Dry peas acreage has almost quadrupled since 1991. It reached at its highest level to 650,000 acres in 2001. In 2002, seeded area for dry peas remained at the same level as in 2001. However, in 2003 seeded area declined marginally by over two per cent from the previous year to 635,000 acres. Because of the droughts in 2001 and 2002, there was a considerable decrease in the area harvested for dry peas. Harvested area in 2002 was 440,000 acres (67 per cent of the seeded area) compared with 570,000 acres (88 per cent of seeded area) in 2001. In 2003, harvested area for dry peas was 605,000 acres (95 per cent of the seeded area).

In 2004, seeded area for dry peas was estimated at 700,000 acres, an increase of about 15 per cent over 2003. Harvested area for peas was at 655,000 acres (94 per cent of seeded area). Yield per acre for peas was about 13 per cent higher when compared with the last 10 years average and 17 per cent higher over in 2003. In 2005, seeded area for dry peas decreased by 21 per cent to 555,000 acres over in 2004. Harvested area in 2005 was almost 96 per cent of the seeded area. The average yield for the 2005 dry peas was nine per cent higher over the previous year and by about 22 per cent higher than the last five years average.

Dry beans and lentils production in Alberta has considerably fluctuated over the last decade or so. Dry beans area in Alberta peaked to 60,000 acres in 2002. For the 2002 dry beans crop, area harvested was just about two-thirds of the seeded area. In 2003, seeded area for dry beans decreased by about 13 per cent from the previous year. Dry beans seeded area further decreased by about eight per cent from the previous year to 48,000 acres in 2004. Please note that most of the dry beans are grown under contract on irrigated land in southern Alberta.

Area under lentils has also fluctuated from a high of 40,000 acres in 1994 to a low of 15,000 acres in 2002. In 2003, area under lentils was at 15,000 acres, lowest area during the last 10 years. In 2004, lentil area in the province increased by over 18 per cent over the previous year to about 18,000 acres. In 2005, area seeded to lentils increased by almost 33 per cent to 24,000 acres, however, harvested area increased by only 11 per cent over the previous year. Average yield per acre was 14 per cent higher compared to 2004.

In the late nineties there was a considerable interest in chickpeas (known as the new Cinderella crop on the Prairies – desi and kabuli) production. Chickpeas were a huge crop in Saskatchewan from 1999 to 2001, occupying almost one million acres. In Alberta, acreage under chickpeas was about 100,000 acres in 2001, almost double from the previous year. However, in 2002, area under chickpeas decreased drastically to the 2000 level to 50,000 acre, primarily due to drought and disease problems. In 2003, area under this crop further declined by half to 25,000 acres. Decline in production area under chickpeas continued into 2004. Seeded area under this crop dropped to a record low level of just about 15,000 acres. In 2005, area under chickpeas doubled to 30,000 acres. For the 2005 crop, average yield per acre increased by 14 per cent from a year earlier. As mentioned above, these dramatic declines in acreage of chickpeas can be attributed to drought, diseases, world demand and improved production prospects of major importing countries.

Producer interest in other specialty crops such as caraway, buckwheat, coriander, borage, herbs and spices, and other emerging specialty crops continues to grow.

Tables 6, 7 and 8 provide estimates of production costs and returns for dry peas, dry beans and chickpeas (desi and kabuli), respectively.

Table 6 Production Costs and Returns for Dry Peas
Dark Brown Soil Zone, 2005

	$ per acre	$ per bushel
Revenue per Acre		
Yield per Acre (bushels)	40	
Expected Market Price/Acre ($)	3.50	
(a) Gross Revenue per Acre	**140.00**	**3.50**
Costs per Acre ($)		
Seed and Seed Cleaning	26.35	0.66
Fertilizer Rates: 2N 16P 1K 3S	7.29	0.18
Chemicals	28.10	0.70
Hail/Crop Insurance Premiums	7.55	0.19
Trucking and Marketing	1.65	0.04
Fuel	10.54	0.26
Repairs - Machinery & Buildings	7.95	0.20
Utilities & Miscellaneous Expenses	11.77	0.29
Custom Work & Labour	7.20	0.18
Operating Interest Paid	2.85	0.07
Unpaid Labour	3.90	0.10
(b) Variable Costs	**115.20**	**2.88**
Taxes, License & Insurance	10.30	0.26
Equipment & Building - Depreciation	19.50	0.49
Paid Capital Interest	5.45	0.14
(c) Capital Costs	**35.25**	**0.89**
(d) Total Production Costs (b+c)	**150.45**	**3.76**
Gross Margin	**14.50**	**0.36**
Return to Investment (a-d+capital interest)	**-5.00**	**-0.13**
Return to Equity (a-d)	**-10.45**	**-0.26**

Note: Returns per acre would vary with yield and price.

Source: Alberta Agriculture, Food and Rural Development

Table 7 Production Costs and Returns for Dry Beans
Dark Brown Soil Zone, 2005

	$ per acre	$ per pound
Revenue per Acre		
Yield per Acre (lbs)	2050	
Expected Market Price/Acre ($)	0.18	
(a) Gross Revenue per Acre	**369.00**	**0.18**
Costs per Acre ($)		
Seed and Seed Cleaning	28.20	0.01
Fertilizer Rates: 2N 16P 1K 3S	74.88	0.04
Chemicals	88.65	0.04
Hail/Crop Insurance Premiums	10.25	0.01
Trucking and Marketing	7.95	0.00
Fuel	43.70	0.02
Repairs - Machinery & Buildings	50.20	0.02
Utilities & Miscellaneous Expenses	13.16	0.01
Custom Work & Labour	10.45	0.01
Operating Interest Paid	2.96	0.00
Unpaid Labour	92.50	0.05
(b) Variable Costs	**422.90**	**0.21**
Cash/Crop Share Rent	0.00	0.00
Taxes, License & Insurance	30.50	0.01
Equipment & Building - Depreciation	66.80	0.03
Paid Capital Interest	9.85	0.00
(c) Capital Costs	**107.20**	**0.05**
(d) Total Production Costs (b+c)	**530.10**	**0.26**
Gross Margin	**-84.40**	**-0.04**
Return to Investment (a-d+capital interest)	**-151.25**	**-0.01**
Return to Equity (a-d)	**-161.10**	**-0.02**

Note: Returns per acre would vary with yield and price.

Source: Alberta Agriculture, Food and Rural Development

Table 8 Production Costs and Returns

Desi and Kabuli Chickpeas, 2005

	Desi Chickpeas	Kabuli Chickpeas
Revenue Per Acre		
Estimated Yield per Acre (lbs)	935	1150
Price per Pound ($)	0.13	0.28
(a) Gross Revenue per Acre ($)	**121.55**	**322.00**
Costs per Acre ($)		
Variable Costs per Acre		
Seed	21.85	51.45
Fertilizer	13.17	14.32
Chemicals	15.55	20.50
Machinery Expenses (Fuel & Repair)	19.94	19.94
Custom Work & Hired Labour	6.55	6.55
Utilities & Miscellaneous	8.52	9.15
Interest on Variable Expenses	2.12	2.85
(b) Total Variable Costs	**87.70**	**125.06**
Other Costs per Acre		
Building Repair	1.95	1.95
Property Expenses, Insurance & License	5.65	5.65
Machinery & Building Depreciation	17.65	17.65
Machinery & Building Investment	12.45	12.45
Labour & Management	15.75	15.75
(c) Total Other Costs	**53.45**	**53425**
(d)TOTAL PRODUCTION COSTS (b+c)	**141.15**	**178.51**
RETURNS PER ACRE ($)		
Return Over Variable Expenses (a-b)	33.85	196.94
Return Over Total Production Costs (a-d)	-19.60	143.49

Note: Returns per acre would vary with yield and price.

Source: Alberta Agriculture, Food and Rural Development

New Crop Development

Crop Diversification Centre North

Kwesi Ampong-Nyarko, John Brown, Jill De Mulder, Nabi Chaudhary,
Zhixiong Zhang and April Jiao

The relatively high growth rate of various segments of the nutritional and natural health products market is attracting pharmaceutical and chemical and food processing companies, which are increasingly requiring good sources of raw materials and ingredients. Global companies are interested in sourcing innovative products. Developing and supplying such products represents a significant opportunity for Alberta farmers and companies.

Project 1 *Rhodiola rosea* Commercialization in Alberta

Rhodiola rosea L (synonyms: *Sedum rosea, Sedum rhodiola*) is a popular plant in traditional medical systems in Eastern Europe and Asia. It is an adaptogen and has a reputation for improving mood, alleviating depression, enhancing work performance, eliminating fatigue, and preventing high altitude sickness. *Rhodiola rosea* is a circumpolar species of cool temperate and sub-arctic regions of the northern hemisphere and is expected to be well adapted to Alberta.

The project seeks to build the foundation for the cultivation, processing and commercialization of *Rhodiola rosea* in Alberta within the shortest possible time. The activities are (1) identification of market opportunities and potential buyers, (2) collection and examination of germplasm from across the world to decide which plants might be the best for commercial development, (3) development of basic agronomic techniques for *Rhodiola rosea* cultivation in Alberta, (4) development of capacity for determining the authenticity and quality of the rhizome as well as methods for quantitative analysis of some of the biologically active compounds, (5) distribution of foundation seedling stocks of *Rhodiola rosea* to build capacity and capability, (6) development of a draft information package on growing guidelines for *Rhodiola rosea* based on the literature and experience gained from project, (7) compilation of health claim dossier for *Rhodiola rosea.*

Identification of market opportunities and potential buyers

Currently there are over 46 companies worldwide using *Rhodiola rosea* in their products. There are also over 30 companies listed as ingredient suppliers for *Rhodiola rosea*. Over 75 per cent of ingredients are for extracts and concentrates. Whole, cut and powder form of *Rhodiola rosea* accounted for less than 25 per cent of the listings.

Collection and evaluation of *Rhodiola rosea* germplasm from across the world

In order to identify and select superior varieties adapted to Alberta conditions, the project assembled 10 European ecotypes of *Rhodiola rosea* and is growing them in a replicated trial. These ecotypes will be positively identified by taxonomist and through High Performance Thin- Layer Chromatography fingerprinting.

Development of basic agronomic techniques for *Rhodiola rosea* cultivation

As a wild crafted plant, all the basic cultivation and agronomic practices for high yield and optimum bioactive levels are unknown. Field experiments were initiated under rain-fed conditions in 2004 at CDC North Edmonton, Fairview and Cremona. The objectives were: (1) to establish optimum plant density and spacing to maximize yield and bioactives, (2) establish non-chemical weed control options for growing economically *Rhodiola rosea*, (3) assessment of response of Rhodiola rosea to N, P, and K organic fertilizers to yield, (4) establish the time to economic root maturity of *Rhodiola rosea* in Alberta. We successfully adapted a seed germination protocol for hard to germinate *Rhodiola rosea* seeds. The initial observations suggest that plants are well adapted with 100% winter survival in the first year. No yield data will be available until harvest in the third or fourth year. However, based on observations from plants we received from local growers, yield of 4 tons/ha by the third year is achievable.

In controlled environment studies we determined *Rhodiola rosea's* growth response to temperature and photoperiod. This information will be used to map out the suitable zones for growing *Rhodiola rosea* in Alberta beyond its natural habitat. Growth effects of temperature and photoperiod were evident, and there were significant interactions among treatments. At short day lengths (12 h) the plants became dormant and formed the highest number of resting buds, the least number of leaves, and the smallest leaf area, which gave the least biomass. The number of resting buds decreased as the daylight increased from 12 h until it reached a minimum at 18 h. The differences in biomass between 16h (35.8 g) and 18h (167.7 g) were dramatic. *Rhodiola rosea* had the best growth under long photoperiod (18 h) and low temperatures confirming the plants preference for high latitude conditions. In general, highest growth rate occurred in long days and low temperatures. Optimal growth was is at a temperature of 18°C, and with and 18 h photoperiod.

Experimental analysis of characteristic marker compounds in *Rhodiola rosea* grown in Alberta

The purpose of this study was to evaluate the compounds in Alberta cultivated *Rhodiola rosea* to confirm its botanical purity and environmental suitability before commercialization. A chromatographic method for the analysis of chemicals characteristic of the *Rhodiola rosea* plant structures was developed. Six characteristic chemicals provide very strong mass spectral signals. The rhizome sample contains proportionately more salidroside than the crown. The crown contains proportionately more rosarin, rosavin, rosin, rosiridin. The leaf material contains relatively little of the characteristic chemicals. There are substantial differences in the chemical profiles that can be attributed to either age or location.

Distribution of foundation seedling stocks of Rhodiola rosea to build capacity and capability

The goal is to have 160 hectares of *Rhodiola rosea* growing in Alberta by 2009. In order to attain enough planting material, seedlings raised at Crop Diversification Centre North (CDC North) were distributed to selected growers for planting under their own management. Seeds harvested from these plants will contribute to the volume of planting material needed to achieve our goals. In January to May of 2005 a total of 572,488 seedlings were raised at CDC North. The project introduced 15 acres of *Rhodiola rosea* into the Province by distributing 350,00 seedlings to 33 progressive growers in Barrhead, Baytree, Beaverlodge, Berwyn, Bizanson, Bluesky, Bonnyville, Cremona, Edmonton, Grimshaw, High Prairie, Hythe, Manning, Markerville, Morinville, Nanton, Neerlandia, Oyen, Peace River, Rocky Mountain House and Pincher Creek.

Project 2 Agronomic improvement/cost of production related to winter survival of *Echinacea angustifolia*

The size of the Alberta *Echinacea angustifolia* industry is estimated to be around 28 hectares with an estimated production of 18,899 kg in 2005. The objective in commercial medicinal plant production is to produce high biomass yields per hectare with high marker compound content. However, specific information about production cost and yield under both traditional and organic production of *E. angustifolia* is virtually non-existent in Alberta. In 2005 we harvested our *Echinacea* plant density and spacing trial. The objective was to determine the optimum plant density for field grown *Echinacea*. The mean plant survival at the end of four growing seasons was 13,750 plants ha^{-1} (per hectare) only 6% survival rate. The 94% loss was attributed to winterkill. The average dry root yield was 339 kg ha^{-1}. Based on average root size of 28.23 g and plant survival rate of 75% the potential root yield of *E. angustifolia* is estimated to be 2000 kg ha^{-1}. A two–year old *E. angustifolia* crop with better survival rate with average root size of 10 g per plant yielded 297 kg ha^{-1}. This suggests that a shorter duration crop (two-years) could be one of the options for managing winterkill and to increase profitability.

The field survival of *E. angustifolia* to winter freezing is poorly understood because most field reports have been based on a single location experiencing a single winter minimum air temperature. In 2005 we started a study to understand the factors contributing to winter survival of *E. angustifolia*. We are assessing the winter survival of *E. angustifolia* across a range of winter minimum air temperatures occurring in experimental plantings and in pots from November 2005 to April 2006. Monitoring of farmers fields will be initiated on 15 farms in Alberta in winter of November 2006 to April 2007.

We have on going experiment to develop agronomic practices to reduce winterkill. Treatments we are looking at include (1) covering plots with straw in October after freeze up, (2) ridge up plants before freeze up, (3) covering plots with tree bark mulch in

October after freeze up, (4) applying the osmoprotectant Glycinebetaine. This study will be completed in April 2007

Development of Good Agricultural Practices for *Echinacea*

We are assessing the response of *Echinacea* to N, P, and K and various organic sources of fertilizer to yield and echinacoside content. Organic fertilizer management options are being developed for E. angustifolia. We will also determine how fertility levels contribute to increased levels of bioactives. In addition we will establish the monthly distribution pattern of bioactives in *Echinacea* roots to establish the best time to harvest. The study initiated in 2004 will be completed in October 2006.

Project 3 Preliminary Agronomic Evaluation of Special Crops

We continued with our observation on the adaptation of several special crops (cereals, pseudocereals, grain legumes, forages, oilseeds, aromatic, spice, medicinal). This also served as a demonstration plot at CDC North. In 2004, we grew yarrow (*Achillea millefolium*), arnica (*Arnica chamissonis*), mustard (*Brassica hirta*), caraway (*Carum carvi*), quinoa (*Chenopodium quinoa*), buckwheat (*Fagopyrum esculentum*), Jerusalem artichoke (*Helianthus tuberosus*), woad (*Isatis tinctoria*), angelica (*Angelica archangelica*), borage (*Borago officinalis*), burdock (*Arctium lappa*), catnip (*Nepeta cataria*), chicory (*Cichorium intybus*), Chinese milkvetch (*Asrtagalus membranaceus*), elecampane (*Inula helenium*), feverfew (*Tanacetum parthenium*), goldenseal (*Hydrastis canadensis*), marshmallow (*Althaea officinalis*), milk thistle (*Silybum marianum*), stinging nettle (*Urtica dioica*), St. Johnswort (*H ypericum perforatum*) and valerian (*Valeriana officinalis*).

Project 4 Development of crop management practices for hemp

It appears that interest in producing industrial hemp has re-emerged. In 2005, the area licensed for industrial hemp production increased almost three folds to 9,725 hectares over in 2004. In Alberta, increase in the area for hemp production was about 43 per cent in 2005 over the area in 2004. Quite a few small hemp processors have emerged over the years and are making a significant headway in developing new hemp products. There is a renewed interest in hemp being used for medicinal, pulp and fiber purposes. In Alberta, work is well underway at Alberta Research Council (ARC) and Alberta Agriculture, Food and Rural Development (AAFRD) to evaluate hemp as a potential source of producing pulp and fiber.

Table 9: Commercial Hemp Production in Alberta and Canada, 1998–2005

Year	Production area Alberta (Ha)	Production area Canada (Ha)	Per cent in Alberta
1998	38	2,371	1.59
1999	745	14,031	5.31
2000	306	5,487	5.58
2001	113	1,316	8.59
2002	123	1,530	8.04
2003	153	2,733	5.61
2004	639	3,531	18.09
2005	916	9,725	9.42

Source: Health Canada

Objectives:

1. Provide comparative information on varieties best adapted to Alberta.
2. Develop optimum agronomic practices to produce and harvest hemp.
3. Determine optimal procedures for stand establishment.
4. Determine optimum time of harvesting to optimize biomass yield and fibre quality.
5. Establish cost of hemp at farm and at plant gate and economic comparison with other conventional crops and straw.

Field experiments were conducted under rain-fed conditions in 2005 at CDC North and Alpac Mill site near Boyle. A randomized complete block design was used with four replications. The treatments consisted of factorial combination of 5 varieties (Fasamo, Uso14, Uso31, CRAG, Finola), two plant densities (150 and 250 plants m^{-2}). Inter row spacing was 20 cm. At CDC North the experiment was planted on 12 May 2005 and was planted on 27 May at Alpac. The plants were harvested at seed maturity (September 21 2005 at Edmonton and September 19 2005 at Alpac). Data collected at each site-included soil, precipitation, temperature, maximum and minimum temperatures, stand emergence and final stand at harvest, flowering dates, stem diameter, plant height at flowering, THC content at 75-80 days post planting stem yield and grain yield.

There were no significant difference between seeding rates of 150 and 250 plants per m^{-2} at both CDC North and Alpac. At CDC North the mean plant densities were 108 and 123 plants for 150 and 250 plants per m^{-2} respectively. At both locations there were significant differences between heights at flowering. Plant height ranged from 157 cm (Finola) to 222 cm (USO 31) at Edmonton. At the Alpac Mill site, the height of the hemp varieties ranged between 125 cm (Finola) and 160 cm for CRAG.

The biomass yield ranged between 13,177 kg ha^{-1} (Crag) and 8,171 kg ha^{-1} (Finola). The mean stem fraction of the total biomass was 63.9%. At Alpac the second harvest biomass yield ranged between 3,486 kg ha^{-1} for Fasamo and 6,767 kg ha^{-1} for Crag. The seed yields at CDC were 1,595 kg ha^{-1} for Finola, 1,819 kg ha^{-1} Crag, 1,494 kg ha^{-1} Fasamo, 1,547 kg ha^{-1}

Uso 13 and 1,336 kg ha^{-1} for Uso 31 and the differences were highly significant. At Alpac, seeds yields were 1028 kg ha^{-1} for Finola, 849 kg ha^{-1} Crag, 322 kg ha^{-1} Fasamo, 552 kg ha^{-1} Uso 13 and 522 kg ha^{-1} for Uso 31 and the differences were once again highly significant (Tables 10 and 11). Seed yield of Finola highest yielding at both CDC North and Alpac. It is also early maturing.

Table 10: Effect of Variety and Plant Density on Biomass and Grain Yield of Hemp, CDCN, 2005

Variety	**Density (Plants m^{-2})**	**Total Biomass (kg ha^{-1})**	**Stem Biomass (kg ha^{-1})**	**Seed Yield (kg ha^{-1})**
		13,790	8,914	1,849
CRAG	250	12,563	8,649	1,790
Fasamo	150	9,498	5,995	1,370
Fasamo	250	10,825	6,793	1,618
Finola	150	8,554	4,381	1,802
Finola	250	7,788	4,311	1,387
USO13	150	10,119	6,235	1,523
USO13	250	11,663	7,485	1,572
USO31	150	12,929	8,755	1,475
USO31	250	11,730	8,443	1,198
Variety		0.001	0.000	0.085
Density		0.927	0.586	0.388
S.E Diff		1,551	1,138	231

Source: Crop Diversification Centre North, AAFRD

Table 11: Effect of Variety and Plant Density on Biomass and Grain Yield of Hemp, Alpac, 2005

Variety	Density (Plants m^{-2})	Total Biomass (kg ha^{-1})	Stem Biomass (kg ha^{-1})	Seed Yield (kg ha^{-1})
		7,137	4,886	915.1
CRAG	250	6,396	4,468	784.3
Fasamo	150	3,628	2,561	318.4
Fasamo	250	3,345	2,335	326.1
Finola	150-	3,273	1,464	885.8
Finola	250	4,794	2,364	1,170.0
USO13	150	5,500	3,834	567.5
USO13	250	5,337	3,671	538.3
USO31	150	5,166	3,603	544.4
USO31	250	5,718	4,158	501.4
Variety		0.001	0.000	0.000
Density		0.692	0.699	0.764
S.E Diff		990.5	739.7	131.7

Source: Alberta Agriculture, Food and Rural Development

Project 5 Oilseed and fiber flax variety evaluation

Successful flax production for bio industrial application depends to a considerable extent on selecting the best varieties for a particular environment and end-use. Varietal characteristics such as seed yield, oil content and fiber yield vary with variety. Flax type is also important depending on the end-use. For instance oil content or other traits may offset a yield advantage. Oilseed flax is an established crop resulting in less risk for farmers to grow. However, fibre yield is generally higher with fibre type cultivars.

Objectives

- Evaluate the performance of oilseed and fibre cultivars of flax to determine their agronomic merit in the regions in which they will be grown
- Evaluate the effects of flax varieties on quality and biomass properties
- Develop cost of production data (variable and fixed costs)
- Perform sensitivity analysis to determine profitability margins at the farm level;

A randomized complete block design was used with four replications and ten treatments (flax varieties). The flax varieties were five oilseed type (CDC Bethune, Flanders, CDC Normandy, Hanley, Norlin) and five-fibre type (Jitka, Elektra, Evelyn, Hermes, IIona). Inter row spacing was 20 cm. The experiments were planted on 12 May at Onoway, 18 May Brooks and 27 May at Alpac. At Brooks the flax was grown under irrigation. The plants were harvested on September 2 at CDC North, September 20 at Onoway, and September 29 at Alpac. Data collected at each site included soil sample, precipitation, maximum and minimum temperature, stand emergence and final stand at harvest, flowering dates, plant heights, stem yield and grain yield.

There were highly significant differences in plant height at harvest between the flax varieties, and location. The tallest variety was Hermes with the mean height of 97 cm and the shortest was CDC Normandy with a height of 70.2 cm. The mean plant height for the fibre type was 92.2 cm compared to 73 cm of the oilseed type.

There were highly significant differences in grain yield at harvest between the flax varieties. The highest yielding variety was Flanders with a grain yield of 2472 kg ha^{-1} and the least was Ilona with a yield of 1300 kg ha^{-1} (Table 12). The mean grain yield for the fiber type was 1513 kg ha^{-1} compared with 2380 kg ha^{-1} of the oilseed type. There were highly significant differences in stem biomass yield at harvest between the flax varieties, and location. The highest yielding variety was Hermes with a stem biomass yield of 8223 kg ha^{-1} the least was CDC Normandy with a yield of 3935 kg $ha^{-1.}$ The mean stem yield for the fiber type was 6588 kg ha^{-1} compared with 4328 kg ha^{-1} of the oilseed type.

Table 12: Seed Yield of Different Flax Varieties and Type at Four Locations in Alberta, 2005 (kg ha^{-1})

Variety	Type	CDC North	Alpac	Onoway	Brooks
CDC Bethune	Oilseed	3,944	1,681	906.5	3,230
Flanders	Oilseed	3,649	1,341	1,727	3,173
CDC Normandy	Oilseed	3,356	2,084	781.5	2,799
Hanley	Oilseed	3,300	1,563	1,658	3,235
Norlin	Oilseed	3,295	1,619	1,344	2,912
Jita	Fibre	2,306	1,654	1,250	1,353
Elektra	Fibre	2,104	1,358	1,289	1,456
Evelyn	Fibre	2,015	1,225	1,025	2,175
Hermes	Fibre	2,077	1,479	1,161	1,133
Ilona	Fibre	1,900	1,225	986.2	1,088
Variety		0.0			
S.E. diff		315.4			

Source: Alberta Agriculture, Food and Rural Development

New Crop Development

Crop Diversification Centre South

Manjula Bandara, Forrest Scharf, Judy Webber, Shauna Pow,
Judy Tokuda, Valerie Catinot and Julie Lecombe

The special crops program at the Crop Diversification Centre South (CDCS) at Brooks is primarily responsible for the evaluation, introduction, and development of new crops for southern Alberta through applied and adaptive research projects. Some study projects are conducted in collaboration with other research programs at CDCS, other divisions of Alberta Agriculture, Food and Rural Development (AAFRD), University of Alberta, Crop Development Centre (CDC) at the University of Saskatchewan, Agriculture and Agri-Food Canada, Applied Research Associations and industry partners. Different funding sources such as Agriculture Funding Consortium, regional variety testing programs and also several industry partners, provide the financial support for the program.

Pulse Crop Studies

Chickpea and lentil crop improvement project

In 2001, a five-year crop improvement project for chickpeas and lentils was initiated at CDCS, Brooks in collaboration with the Crop Development Centre (CDC) and the University of Saskatchewan, Saskatoon, where F_1 and F_2 generations of both crop species are raised. The main objective of this project was to develop new chickpea and lentil cultivars for southern Alberta under dryland conditions, with specific selection criteria of high seed yield, early flowering, early and uniform maturity, resistance to common foliar and root diseases, and desired market traits. Lentil and chickpea ($F_{2:3}$ generation) seeds were acquired from CDC, and seeds of $F_{2:4}$, $F_{2:5}$, $F_{2:6}$ and $F_{2:7}$ lines were selected from early generations grown under field conditions in southern Alberta in previous years. These seed categories were all planted in early May 2005 for further evaluation and selection.

From the two lentil trials, which were established with 81 $F_{2:4}$ lines in standard plots in a 9 x 9 lattice design at the Bow Island Sub Station (BISS), 20 lentil lines from Test 1, and 21 lentil lines from Test 2, were selected for further evaluation in 2006. Two separate trials were established, using 21 $F_{2:5}$ red lentil and 3 recommended cultivars (Test 1), and 16 $F_{2:5}$ green lentil and 2 recommended cultivars (Test 2), at 3 sites (CDCS, BISS and Bow Island grower's site). On average, crop maturity of red lentil varied from 91 days (2269-7) to 99 days (CDC Redberry) and seed yield varied from 1407 kg/ha (CDC Redwing) to 3187 kg/ha (2271-5). In the green lentil trial, on average, crop maturity varied from 92 days (2342-12) to 97 days (2509-1) and seed yield varied from 1803 kg/ha (2423-1) to 2602 kg/ha (CDC Viceroy). Based on crop growth and other desirable traits, 11 red and 7 green lentil lines were selected for further evaluation in 2006. Results of an another trial established using 25 $F_{2:5}$ and 3 $F_{2:6}$ lines, 2 recommended cultivars of large green lentil with 2 replicates at BISS, revealed that crop maturity ranged from 86 (1915-1) to 99 days (1956-2, 1434-3 and 1444-1) and seed yields ranged from 852 kg/ha (1915-1) to 2607 kg/ha (1423-3). Based on performance, 10 large green lentil lines were selected for further evaluation in 2006. Results of the $F_{2:6}$ red lentil study (Test 1) revealed that, on average, crop maturity ranged from 93 days (1967S-5) to 101 days (CDC Redberry) and seed yield ranged from 2119 kg/ha (1900-2) to 3237 kg/ha (CDC Redberry). Based on line performance, 9 lines were selected for further evaluation in 2006. In the $F_{2:6}$ small green lentil line test (Test 2), crop maturity varied from 91 days (1887T-9 and 1888T-3) to 101 days (CDC Plato) and seed yield varied from 1949 kg/ha (1887T-16) to 3190 kg/ha (CDC Viceroy). Based on the line performance, 6 lines were selected for further evaluation in 2006. In addition, the test with small green lentil trials was established at 5 sites in Saskatchewan (Kyle, Goodale, Rosethern, Saskatoon and Davidson). Seed yields of that study varied from 1599 kg/ha (1984S-4) to 2124 kg/ha (CDC Viceroy). Results of the advanced yield trail established using 5 $F_{2:7}$ lines and 2 recommended cultivars of red lentils at 3 sites (CDCS, BISS and Bow Island grower's site) revealed, on average, crop maturity varied from 95 days (1405T-7) to 98 days (Redberry) and seed yield ranged from 2157 kg/ha (1405T-7) to 2771 kg/ha (Redberry). Based on crop performance, 4 red lentil lines were selected for further evaluation in 2006.

Seventy-three $F_{2:4}$ lines and 11 recommended cultivars of desi and kabuli chickpeas were grown in standard plots at CDCS and BISS, with one replicate at each site. All the plots were harvested at both sites and a total of 40 lines were selected based on desirable growth habits, seed weight, seed yield and crop maturity. In addition, 14 $F_{2:5}$ lines (11 desi and 3 kabuli) and 4 recommended cultivars of desi and kabuli chickpeas were grown in standard plots at CDCS and BISS with 2 replicates at each location. Based on crop growth and other desirable traits, a total of 12 (9 desi and 3 kabuli) lines were selected for further evaluation. A total of 16 lines of $F_{2:6}$ and $F_{2:7}$ (9 desi and 7 kabuli) and 6 recommended cultivars were grown in standard plots at 3 sites in Alberta (CDCS, BISS and Bow Island grower's site) and 4 sites in Saskatchewan (Kyle, Goodale, Elrose and Davidson) with 2 replicates at each site. Based on crop growth and other desirable traits, 11 lines (5 desi and 6 kabuli) were selected. All these selected lines will be evaluated in advanced or elite trials in 2006. However, some promising chickpea lines will be included in the pre-breeder seed production program.

Impact of size of the seed planted, on crop phenology and seed yield of kabuli chickpeas

The size of the seeds planted has been shown to have a significant impact on seedling establishment and vigor, and crop growth of several small-seeded field crops such as canola, mustard, coriander and carrot. Conversely, other studies have revealed that the seed size had no significant impact on plant growth, development and seed yield of large-seeded crops such as chickpeas. Two studies were conducted at CDCS to examine the effect of size of seeds planted, on seedling growth, seed yield and seed size profile of the resulting crop have indicated that seed size planted, has no significant impact on plant growth, seed yield components and seed yield. These observations suggest that smaller seed category of kabuli chickpeas can be used for planting without affecting seed yield or the seed size profile of the resulting crop. Moreover, the use of a smaller seed category at a higher seeding rate (1.4 x recommended seeding rate) had no significant effect on seed yield. This assumes the reduction in seed size is not due to disease infected or immature seed. If a smaller seed category is used for planting purposes, the grower could reduce their seed cost due to a reduced seeding rate and transportation cost. At the same time, the larger seed portion of the crop can be sold at a premium for human consumption.

Impact of seeding date on size and variation of seed of the resulting crop and impact of seed size on seedling emergence and vigour of chickpea (*Cicer arietinum*) cultivars CDC Chico and Myles

The cultivation of a pulse crop in rotation with cereals is an effective mean to improve soil quality. The many advantages extend beyond the years they are grown. Commercial production of chickpeas (*Cicer arietinum*) started in Canada in 1995. Several agronomic studies are being conducted on the semi-arid prairies to enhance the crop productivity and product quality of chickpeas. A study was conducted to evaluate the impact of seeding date (fall-seeded and early/late spring-seeded) on size and variation of the seed of the resulting crop and the impact of seed size on seedling emergence and vigour of small-seeded kabuli cultivar CDC Chico and desi chickpea cultivar Myles. Randomly selected seeds of CDC Chico and Myles, derived from four different seeding treatments (fall-seeded without seed coat treatment, fall-seeded with seed coat treatment, early spring-seeded and later spring-seeded) were used to determine the individual seed weight. Seeds were planted individually into plug trays and were placed in a greenhouse. Seedling emergence and growth were observed. Seedlings were harvested at 4 weeks after seeding and plant height, above ground and root biomass dry weight were determined. Results showed on average, the Chico cultivar produced heavier seeds, higher plants, heavier plant biomass, and showed earlier seedling emergence than the Myles cultivar. Seeds derived from fall-seeded Myles were more uniform than that of CDC Chico. . The seeding date had no significant impact on plant growth and variation for CDC Chico. There was no strong evidence that seed weight had a significant impact on seedling emergence and vigour. Previous studies have shown that the size of the seed planted had no significant impact on seed yield of large-seeded chickpeas. The lack of significant impact of weight of the seeds planted on seed yield suggests that a lighter seed category can be used as a planting material without significantly affecting the yield of the resulting crop. Growers could sell heavier portions at a premium price and use lighter seed portion for seeding.

Regional cultivar/Coop evaluations

Newly recommended cultivars and promising lines of chickpeas, dry beans, field peas, lentils and soybean received from various pulse breeding programs are evaluated under growing conditions in southern Alberta, to select the most promising cultivars for the region.

The emphasis of the dry bean cultivar testing is on yield performance, early maturity, and the architecture of a dry bean plant that allows for narrow row configurations, direct combining and consequently, an expansion of dry bean production to areas in Alberta. The majority of bean cultivars/lines for this evaluation were received from the dry bean crop improvement programs at Agriculture and Agri-food Canada Lethbridge Research Centre and the CDC at the University of Saskatchewan.

In late May 2005, five field studies were established at BISS, using various dry bean lines/varieties belonging to different commercial classes such as black, great northern, pink, pinto and small red, (1 coop, 1 narrow row and 1 wide row under irrigation) and at CDCS (1 narrow row and 1 wide row under irrigation). Performance of most bean cultivars/lines was site-specific. Among the cultivars evaluated, CDC Minto (pinto), CDC Expresso (black), AC Black Violet (black), AC Scarlet (small red), CDC 95346 (pink) and AC Early Rose (pink) produced higher seed yields than their respective check cultivars.

Two field pea cultivar evaluation studies were conducted at CDCS and BISS, to evaluate varieties/lines for regional adaptation. At both test sites, under rain-fed conditions, 6 green pea cultivars/lines produced seed yields ranging from 4569 to 5719 kg/ha in Brooks and 3031 to 4087 kg/ha at Bow Island. Among the 12 yellow field pea cultivar/lines evaluated, SW Marquee (3892 kg/ha) produced the lowest and Carrera (5792 kg/ha) produced the highest seed yield at Brooks, and CDC Handel (3029 kg/ha) the lowest and CDC 653-8 (4135 kg/ha) produced the highest seed yield at Bow Island.

One study was conducted with 13 chickpea cultivars at CDCS. Seed yield ranged from 3515 kg/ha for CDC Diva to 6288 kg/ha for CDC Cabri. Two separate trials were conducted with 9 early maturing lentil cultivars and 9 late maturing cultivars at CDCS. Seed yield for early maturing cultivars ranged from 1978 kg/ha for CDC Blaze to 2894 kg/ha for CDC Milestone. Among the late maturing cultivars, Laird produced the lowest seed yield (1784 kg/ha), whereas CDC Richlea produced the highest seed yield (2591 kg/ha).

Soybean tests were established at BISS under rain-fed and irrigated conditions using 16 cultivars received from the oilseed breeding program at Agriculture Canada Research Station in Ottawa. Due to poor seedling emergence caused by silt deposition as a result of severe rainfall, the non-irrigated (rain-fed) soybean test was abandoned. Among the cultivars tested in the irrigated test, soybean cultivars AC Orford (2071 kg/ha) and Prembina (2011 kg/ha) produced significantly higher seed yield than that of standard cultivar, Gentleman (1640 kg/ha).

Over 65 cultivars/lines of silage and grain corn were established for regional adaptation. Both silage and grain corn performed very well under both Bow Island and Brooks' growing conditions.

Evaluation of new pulse crop species

Seed of unnamed and named lines of mung bean (*Vigna radiata* L. Wilczek), black gram (*Vigna mungo* L. Hepper.), moth bean (*Vigna aconitifolia*) and pigeon pea (*Cajanus cajan* L.

Millisp) were planted in the research field at CDCS in early June 2005. Crop maturity was challenged by a cool and wet growing season so that none of the crop species was able to harvest.

Medicinal botanical studies

Evaluation of chicory (*Cichorium intybus* L.) in Alberta for local processing of high quality inulin, functional food ingredient

Chicory (*Cichorium intybus*) is a perennial root crop belonging to the *Asteraceae* family. It is native to Europe, central Russia and western Asia, and cultivated widely through Europe in early times. Chicory root may be roasted and ground to produce a coffee substitute/adulterant (chicory coffee), or harvested, stored, and forced to produce a high-value vegetable. Chicory roots contain high levels of inulin and fructo-oligosaccharides. Inulin is a long-chain fructan molecule. Fructans are non-reducing, water-soluble carbohydrates formed in higher plants composed of fructosyl units, but usually contain one terminal glucose moiety per molecule. They occur as linear, branched, or less frequently, cyclic molecules. Natural β-fructans have a degree of polymerization (DP) ranging from 2 to 55, or more. Lower mass fructans (DP $\leq$ 10) are called fructo-oligosaccharides (FOS) or oligofructose, while higher mass polymers are known as a 'high performance' type inulin. The 'high performance' type of inulin has an average DP of 25 and a molecular distribution ranging from 11 to 60. Inulin and FOS have been shown to act in a similar way as dietary fiber products, and are also lower in calories than sucrose. Inulin and FOS have prebiotic effects; they enhance growth of lactobacillus bifidobacteria in the human intestine and can improve the balance of the beneficial bacteria in the bowel. Humans cannot digest inulin and fructo-oligosaccharides, as they do not have the necessary enzymes available in their digestive system. Inulin and fructo-oligosaccharides are used as a food ingredient in low-fat, calorie-reduced products and can also act as a natural sugar replacement for diabetics.

Based on the local current demand, it is estimated that inulin production will require up to 4,000 ha of chicory crop to be grown in southern Alberta. This would be a new, high-value crop for Alberta, providing additional options for southern Alberta farmers and further lessening the dependence on grains and other low-value crops. Moreover, much of the existing plant equipment could be used for growing chicory crops and processing chicory roots for inulin. However, chicory is a relatively new crop to North America, thus, information on cultivars with high-quality inulin content and cultural practices for root production on the Canadian Prairies, is lacking. Thus the 3-year study project was initiated in 2005 with the following objectives:

- To determine the impact of the growing environment on root and inulin production in chicory.
- To select promising chicory cultivar(s) for higher root production and inulin production.

- To determine the seeding time for higher root and inulin production.
- To examine the impact of storage conditions on quality of inulin (length of the inulin chain) of chicory crude extract.

Five European chicory cultivars were seeded on two different dates (mid April and early May) at two test sites, BISS and Taber. The crops were successfully grown under irrigation and were harvested in late September. Results indicated, that on average, the seeding date had no significant impact on root yield when expressed on dry weight basis, at both test sites. Depending upon the cultivar, root yield varied from 36.7- 45.9 FW t/ha or 9.8-11.8 DW t/ha at BISS and from 41.0 to 43.1 FW t/ha or 9.5-13.7 DW t/ha at Taber. Total fructan yield of chicory roots did not change due to seeding date or among cultivars used in this study at both test sites. The study on the effect of storage condition on the chain length of inulin in the crude root extract is in progress, and results will be available in three months. This information, however, suggests that chicory can be successfully grown for root production in southern Alberta.

Rosemary nutraceutical industry feasibility study

Rosemary (*Rosmarinus officinalis* L.) is a native shrub of southern Europe, Morocco and Tunisia, belonging to the *Labiateae* family. Rosemary is used as a culinary herb with meat, vegetables and soups. Numerous studies have indicated that rosemary leaf extract contains diterpenoid compounds that possess antioxidant properties. Norac Technologies Inc., Edmonton, Alberta, extracts antioxidants such as carnosic acid, carnosol and methoxy carnosic acid, using rosemary leaves imported from Mediterranean countries, with inconsistent quality. Thus, the company has started looking for alternative means of purchasing high-quality rosemary leaves, possibly from local producers. However, information on production of rosemary leaves at commercial scale on the Prairies is not available. The main objectives of this project were to examine the possibility of growing rosemary as an annual crop under field conditions in southern Alberta, to select promising cultivar(s) with higher leaf biomass productivity and higher content of selected diterpenoid compounds (antioxidants), and to evaluate the impact of soil nitrogen content, plant population density, nursery period of rooted stem cutting and first and killing frosts on above ground biomass productivity and antioxidant content.

Rosemary can be successfully grown as an annual crop under the field conditions in southern Alberta. The results indicated that (a) under experimental conditions, depending upon the cultivar, total aboveground biomass yield with a range of 6870-8915 kg/ha[1] and leaf yield with a range of 3420-4508 kg/ha can be harvested; (b) Rex, an unnamed cultivar and Primery Blue are the most promising cultivars in terms of total and leaf biomass production; (c) first frost had no adverse impact on total phenolic compound yield of rosemary, but killing frost reduced the carnosic acid content only in Rex; (d) for the highest phenolic compound productivity, rosemary should be grown at a plant population of 250,000 plants/ha; (e) soil N content of 100 kg NO_3-N/ha within a depth of 30 cm is sufficient for maximum leaf production of rosemary. Additional application of nitrogen has no impact on either crop productivity or phenolic compound yield of rosemary. However, further studies should be conducted to determine the optimum nursery period for rooted stem cuttings, to minimize the nursery cost and also to initiate a collaborative project with Norac Technologies Inc., and prospective growers to produce rosemary for processing of antioxidant in Alberta.

Micro-propagation of EMS-induced mutants and promising lines of non-mutant of Echinacea (*Echinacea angustifolia*, *E. pallida* and *E purpurea*)

Echinacea (*Echinacea angustifolia*) is the most extensively grown medicinal herb in Alberta. The root yield of field-grown Echinacea in Alberta varies from 300-900 kg/ha, even though the yield potential of the crop can be as high as 5500 DW kg/ha. Moreover, the echinacoside content varies from 0.6% to 2.1%. Aster Yellows, caused by phytoplasma, is the most common and destructive disease in Echinacea. It reduces the root productivity as well as the over-wintering ability of the plant. Very little attention has been given towards the crop improvement activities in Echinacea. Consequently, Echinacea varieties with Aster Yellows resistance are not available in North America. Over the past 6 years, an ethyl methane sulphonate (EMS)-induced mutation breeding project on *E. angustifolia, E. pallida* and *E. purperea* was initiated and carried out to develop Aster Yellows resistant *Echinacea* cultivars with high active ingredient content at CDCS. The main goal of this study was to develop Echinacea lines with Aster Yellows resistance and high medicinal qualities. The micro-propagation project was funded through the New Initiatives Funds. Individual plants with field resistance to Aster Yellows were selected over several years. In addition, seed samples from two sources of Echinacea crops with high bioactive ingredients, were planted in a greenhouse. Despite the fact that surface sterilization of the field-grown Echinacea leaves was a challenging process, we managed to propagate over 200 plantlets through tissue culture techniques. These plantlets are in different growing stages (organogenesis, root proliferation, greenhouse-ready stage and greenhouse stage).

It may take another 4-5 months for tissue culture plantlets to reach the size that we need them to be before transferring them to a greenhouse for root production. After growing these plants for 2 months in a greenhouse, roots will be analyzed for bioactive compounds and also for resistance to Aster Yellows disease. This project will be conducted in collaboration with Dr. Ron Howard (Plant Pathologist at CDCS) and Scott Meers (Entomologist at CDCS).

Fenugreek advanced line evaluation for seed yield and galactomannan content

Fenugreek (*Trigonella foenum-graecum* L.) is an annual plant species belonging to the *Fabaceae* family. It has great potential for food, pharmaceutical and industrial uses, and also as a forage crop. Traditional oral use of fenugreek had been for the treatment of decreased appetite, upset stomach, bronchitis, fevers, sore throats, and in expelling intestinal worms.

About 30% of the reserve food material in the fenugreek seed is galactomannan, which deposits in the endosperm. Galactomannan is a polysaccharide made of galactose combined with mannan, a high molecular compound of mannose. Mannose cannot be digested and it is not nutritious. Galactomannan has a property, which increases viscosity when dissolved in water. The galactomannan fraction of fenugreek endosperm is often referred to as 'gum'. Many of the dietary effects and uses of fenugreek are related to the presence of galactomannan in the endosperm. Clinical studies have shown that galactomannan in the diet decreased the concentrations of cholesterol in both liver and blood plasma, and also decreased the synthesis of cholesterol in the liver. The current fenugreek lines available in Canada have been selected for early crop maturity and higher seed yield. The main goal of this is to select fenugreek line(s) with a higher content of galactomannan in order to use them as a source for functional food ingredients. Over 15 fenugreek lines were evaluated for crop growth, crop maturity and seed yield. Several lines of fenugreek with early maturity and higher seed yields were selected. Due to limitation of funding, only a few fenugreek lines were evaluated for galactomannan content. Results indicated that those tested lines are significantly different in galactomannan content. A project proposal is being developed for a comprehensive evaluation of fenugreek lines for galactomannan content.

Extension and industry development activities

Program staff continued to answer numerous inquiries on the production of special crops, particularly on herb, spice and essential oil crops. Several field days and workshops were organized and research information was contributed on special crops to producer newsletters and the news media. Test plots of various special crops, including pulse crops and medicinal herbs at CDCS and Bow Island, were visited by a large number of interested individuals and groups. Extension staff and other interested parties were provided with planting materials for demonstration and field testing to assist herb, essential oil and spice producers in evaluating new crops and developing agronomic practices.