Alberta 2004 Specialty Crop Report

Economics & Competitiveness

AGRICULTURE, FOOD AND RURAL DEVELOPMENT

Acknowledgments

The Statistics and Data Development Unit of Alberta Agriculture, Food and Rural Development (AAFRD) wishes to thank all of the producers that participated in the specialty crop survey conducted in the winter of 2003/2004. Without their cooperation and assistance, this report would not have been possible.

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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/sdd8416

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

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Alberta 2003 Specialty Crop Survey

Purpose of Survey:

By Maureen Wenger

To address some of the data and information needs of the specialty crop industry in Alberta, the Statistics and Data Development (SADD) Unit has been conducting an annual Specialty Crop Survey. Now into its twenty-first year, the survey attempts to capture data on area (seeded and harvested acres), yield and production for the various types of specialty crops grown in Alberta.

Data gathered from the survey are used primarily to generate related provincial and sub-provincial estimates by the SADD Unit. 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 grown in the province.

Methodology

The Alberta Specialty Crop Survey, which is provincial in scope, collects data through a non-probability sampling procedure. In December 2003, survey questionnaires were mailed out to 3,607 specialty crop producers across Alberta. 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 2003. Survey participants were also made aware 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 16, 2004, a total of 1,045 questionnaires were returned. Of this total 921 were usable and formed part of the basis in the generation of the Alberta 2003 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, entry editing and tabulation. Nonetheless, we believe that the statistics published in this report are reliable estimates for Alberta.

Survey Results

By Chuanliang Su

Area, Yield and Production in Alberta

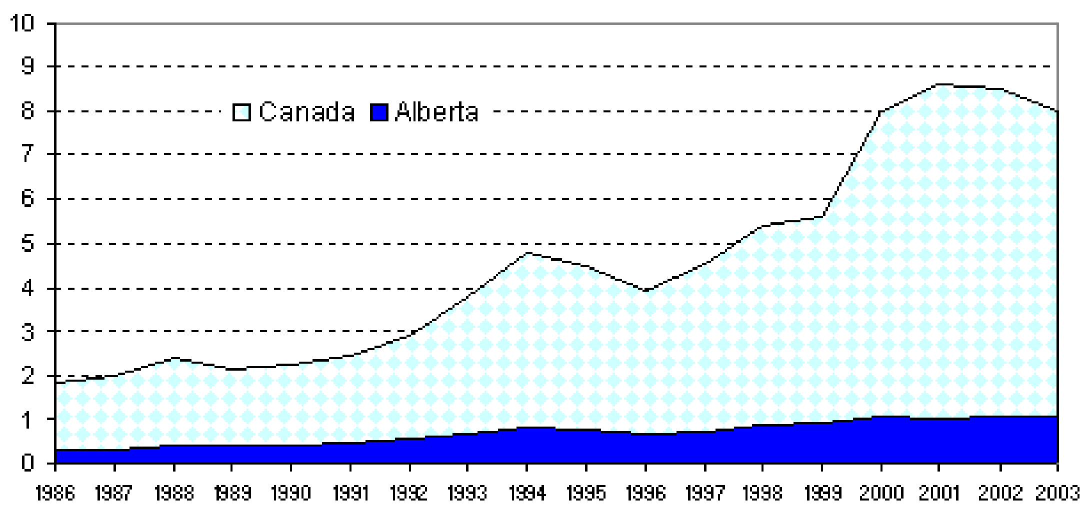
Following two consecutive dry years, the 2003 crop season began under favorable moisture conditions. Soil moisture reserves were mostly rated as good to excellent in the spring of 2003. However, lack of precipitation in the summer reduced yield potential of specialty crops grown on dryland.

The upward trend in specialty crop area continued in 2003, with total seeded area reaching a record high of 1.06 million acres in Alberta - Figure 1 (excluding potatoes and forage seeds). This represented an increase of two per cent from 1.04 million acres in 2002. The record seeded acreage in 2003 can be attributed to the need for crop rotation and diversification, as well as good cash returns for some specialty crops. Nearly 0.95 million acres or 90 per cent of total seeded area were harvested for grains. Percentage distribution of 2003 specialty crop seeded acreage by crop type is presented in Figure 3.

Yields for most specialty crops grown on dryland in 2003 were below the 10-year average levels. For example, dry peas produced an average yield of 30.8 bushels per acre, about 13 per cent below the 10-year average. Above average yields, however, were achieved for specialty crops grown under irrigation in southern Alberta, including potatoes, sugar beets and dry beans.

On June 29, 2004, Statistics Canada is expected to release estimates of 2004 seeded area for major crops as well as some specialty crops by province.

Figure 1 Specialty Crop Seeded Area, Alberta and Canada 1986-2003 (million acres)



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

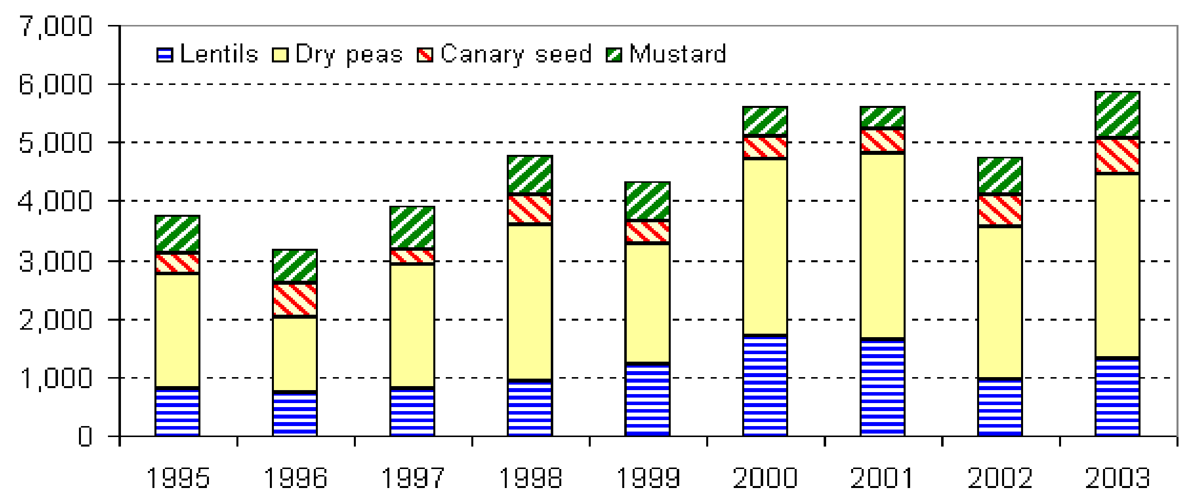
Specialty Crops in Western Canada

Producers in Western Canada planted fewer acres of specialty crops in 2003, according to Statistics Canada's November Estimate of Production of 2003 Principal Field Crops and the Alberta 2003 Specialty Crop Survey. Seeded acreage in both Saskatchewan and Manitoba was lower than a year ago, which more than offset the higher area in Alberta. However, total harvested area and average yields in Western Canada increased significantly from 2002, due to improved growing conditions. As a result, total production of specialty crops in 2003 was much higher than a year ago.

Total seeded area of specialty crops in Western Canada was estimated at 7.44 million acres in 2003. Of this total, 5.35 million acres or 72 per cent were in Saskatchewan. Alberta accounted for 14 per cent of the total seeded area, Manitoba 13 per cent, and British Columbia one per cent. A total of 7.10 million acres of specialty crops were harvested in Western Canada in 2003, compared to 6.11 million acres in 2002.

Dry peas remained the largest specialty crop in Western Canada in 2003, with total seeded area estimated at 3.22 million acres. A total of 2.12 million tonnes of dry peas were produced from 3.14 million acres harvested. Total harvested area of lentils was estimated at 1.32 million acres and production at 0.52 million tonnes. Total production of mustard was 0.23 million tonnes from a total harvested area of 0.81 million acres. In addition, about 0.22 million tonnes of canary seed were produced from 0.60 million acres harvested. Harvested area of major specialty crops is shown in Figure 2. Statistics on seeded area and production of selected specialty crops are presented in Table 5.

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

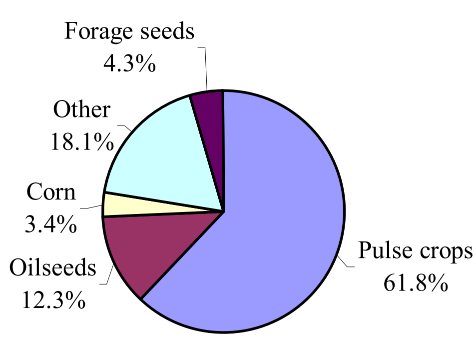


Source: Statistics Canada and Alberta Agriculture, Food and Rural Development

Table 1 Alberta 2003 Specialty Crops

		Seeded area (acres)	Harvested area (acres)	Yield (per acre)		Production (tonnes)
Pulse crops	Dry peas, green	215,000	205,000	32.0	bu	178,533
	Dry peas, yellow	408,000	390,000	30.1	bu	319,481
	Dry peas, other	12,000	10,000	36.2	bu	9,852
	Total dry peas	**635,000**	**605,000**	**30.8**	**bu**	**507,865**
	Chickpeas	25,000	25,000	1,160	lbs	13,155
	Dry beans	52,000	52,000	25.6	cwt	60,300
	Fababeans	2,000	2,000	-		-
	Lentils	15,000	15,000	1,013	lbs	6,891
Oilseeds	Brown mustard	14,000	13,000	530	lbs	3,125
	Yellow mustard	113,500	110,000	658	lbs	32,831
	Oriental mustard	12,500	12,000	527	lbs	2,869
	Total mustard	**140,000**	**135,000**	**634**	**lbs**	**38,825**
	Sunflowers	3,000	3,000	-		-
	Safflowers	2,500	2,500	1,215	lbs	1,378
Corn	Grain corn	-	-	-		-
	Silage corn	40,000	30,000	16.7	ton	453,606
Other	Potatoes (1)	66,000	61,000	330	cwt	913,200
	Triticale	110,000	40,000	33.8	bu	34,343
	Canary seed	10,000	10,000	900	lbs	4,082
	Sugar beets (2)	27,831	27,389	22.9	tonne	628,081
Forage seeds (3)	Alfalfa seed	11,292	11,292	550	lbs	2,817
	Alsike clover	530	530	-		-
	Brome grass	11,035	11,035	570	lbs	2,853
	Red fescue	5,927	5,927	310	lbs	833
	Timothy	7,647	7,647	395	lbs	1,370
	Other	14,350	14,350	-		-

Figure 3 Percentage Distribution of Specialty Crop Seeded Acreage, Alberta, 2003 (Total area: 1,179,112 acres)



Source: Alberta 2003 Specialty Crop Survey, AAFRD

Except for:

(1) Statistics Canada, Canadian Potato Production by Province, January 2004

(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 2003 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

Figure 4

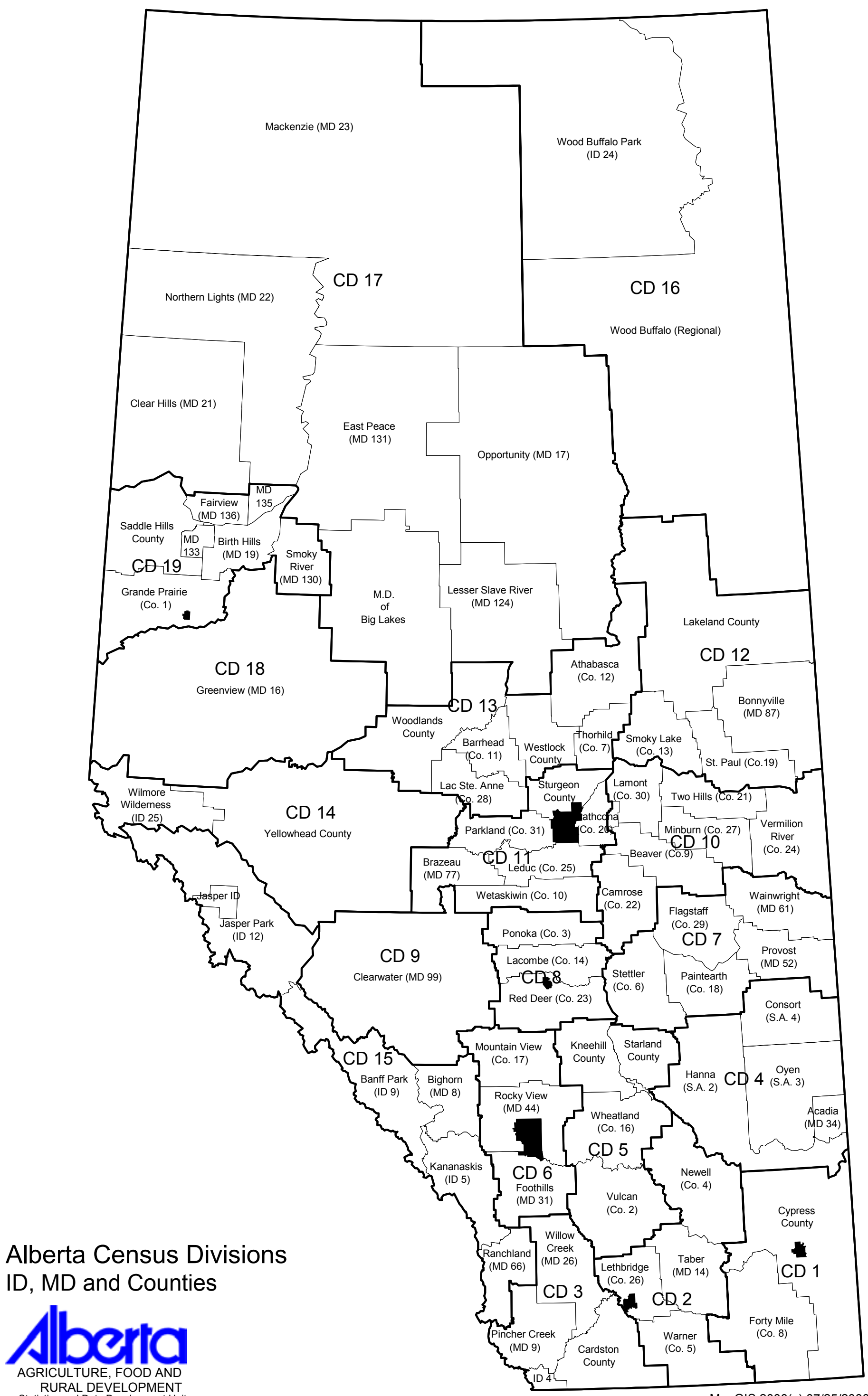

Alberta Census Divisions
ID, MD and Counties
AGRICULTURE, FOOD AND
RURAL DEVELOPMENT
Statistics and Data Development Unit
eMapGIS 2000(c) 07/25/2000
Mackenzie (MD 23)
Wood Buffalo Park
(ID 24)
CD 17
CD 16
Northern Lights (MD 22)
Wood Buffalo (Regional)
Clear Hills (MD 21)
East Peace
(MD 131)
Opportunity (MD 17)
Fairview
(MD 136)
MD
135
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
CD 18
Greenview (MD 16)
Athabasca
(Co. 12)
Bonnyville
(MD 87)
CD 13
Woodlands
County
Barrhead
(Co. 11)
Westlock
County
Thorhild
(Co. 7)
Smoky Lake
(Co. 13)
St. Paul (Co.19)
Wilmore
Wilderness
(ID 25)
CD 14
Yellowhead County
Lac Ste. Anne
(Co. 28)
Sturgeon
County
Lamont
(Co. 30)
Two Hills (Co. 21)
Parkland (Co. 31)
Strathcona
(Co. 20)
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
Clearwater (MD 99)
Lacombe (Co. 14)
Provost
(MD 52)
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)
Wheatland
(Co. 16)
Acadia
(MD 34)
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)
Lethbridge
(Co. 26)
Taber
(MD 14)
CD 1
CD 3
CD 2
Forty Mile
(Co. 8)
Pincher Creek
(MD 9)
Cardston
County
Warner
(Co. 5)
ID 4

Table 2 Alberta 2003 Specialty Crops by Census Division

C.D.	Dry Peas	Mustard	Lentils	Dry Beans	Chickpeas
			Harvested Area (acres)		
1	46,553	12,137	5,701	27,449	15,391
2	47,119	57,032	6,016	22,818	6,382
3	18,645	7,638	-	-	-
4	39,816	27,901	889	-	395
5	79,251	26,976	2,394	588	2,832
6	34,048	1,138	-	642	-
7	75,317	1,608	-	-	-
8	17,114	-	-	-	-
9	-	-	-	-	-
10	106,897	569	-	-	-
11	26,957	-	-	-	-
12	12,673	-	-	-	-
13	14,063	-	-	503	-
17	45,421	-	-	-	-
18	2,717	-	-	-	-
19	38,412	-	-	-	-
Alberta	**605,000**	**135,000**	**15,000**	**52,000**	**25,000**
			Yield Per Acre		
	(bushels)	**(pounds)**	**(pounds)**	**(cwt)**	**(pounds)**
1	25.7	810.5	-	25.5	1,092.4
2	29.5	743.4	1,147.1	25.8	1,322.1
3	35.5	583.7	-	-	-
4	17.1	287.0	-	-	-
5	27.0	718.2	-	-	-
6	35.7	-	-	-	-
7	27.6	-	-	-	-
8	33.8	-	-	-	-
9	-	-	-	-	-
10	34.6	-	-	-	-
11	44.7	-	-	-	-
12	36.4	-	-	-	-
13	40.7	-	-	-	-
17	35.6	-	-	-	-
18	34.7	-	-	-	-
19	27.4	-	-	-	-
Alberta	**30.8**	**634.0**	**1,013.0**	**25.6**	**1,160.0**
			Production (tonnes)		
1	32,584	4,462	-	31,692	7,627
2	37,775	19,231	3,130	26,667	3,827
3	18,002	2,022	-	-	-
4	18,480	3,632	-	-	-
5	58,224	8,788	-	-	-
6	33,042	-	-	-	-
7	56,642	-	-	-	-
8	15,759	-	-	-	-
9	-	-	-	-	-
10	100,557	-	-	-	-
11	32,785	-	-	-	-
12	12,550	-	-	-	-
13	15,567	-	-	-	-
17	43,967	-	-	-	-
18	2,569	-	-	-	-
19	28,602	-	-	-	-
Alberta	**507,865**	**38,825**	**6,891**	**60,300**	**13,155**

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 2002 Specialty Crops by Census Division

C.D.	Dry Peas	Mustard	Lentils	Dry Beans	Chickpeas
			Harvested Area (acres)		
1	14,131	12,170	-	16,812	6,950
2	27,325	32,277	5,616	22,309	30,219
3	24,021	7,057	3,187	-	-
4	4,215	11,747	797	-	852
5	89,912	12,949	-	879	11,624
6	26,106	674	-	-	355
7	52,363	3,127	-	-	-
8	18,786	-	-	-	-
9	-	-	-	-	-
10	69,493	-	-	-	-
11	25,790	-	-	-	-
12	8,870	-	-	-	-
13	18,944	-	-	-	-
17	31,418	-	-	-	-
18	3,010	-	-	-	-
19	25,618	-	-	-	-
Alberta	**440,000**	**80,000**	**12,000**	**40,000**	**50,000**
			Yield Per Acre		
	(bushels)	**(pounds)**	**(pounds)**	**(cwt)**	**(pounds)**
1	26.5	515.0	-	21.0	1,700.0
2	38.8	695.0	1,170.0	20.2	1,600.0
3	34.1	1,085.0	-	-	-
4	9.6	215.0	-	-	-
5	16.6	685.0	-	-	1,450.0
6	27.5	-	-	-	-
7	7.9	-	-	-	-
8	22.6	-	-	-	-
9	-	-	-	-	-
10	9.6	-	-	-	-
11	19.5	-	-	-	-
12	13.0	-	-	-	-
13	23.1	-	-	-	-
17	20.9	-	-	-	-
18	35.2	-	-	-	-
19	30.2	-	-	-	-
Alberta	**19.6**	**603.0**	**900.0**	**20.5**	**1,608.0**
			Production (tonnes)		
1	10,173	2,843	-	16,014	5,359
2	28,834	10,175	2,980	20,441	21,932
3	22,288	3,473	-	-	-
4	1,095	1,146	-	-	-
5	40,662	4,023	-	-	7,645
6	19,541	-	-	-	-
7	11,296	-	-	-	-
8	11,572	-	-	-	-
9	-	-	-	-	-
10	18,062	-	-	-	-
11	13,674	-	-	-	-
12	3,135	-	-	-	-
13	11,915	-	-	-	-
17	17,883	-	-	-	-
18	2,887	-	-	-	-
19	21,040	-	-	-	-
Alberta	**234,324**	**21,888**	**4,899**	**37,195**	**36,474**

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

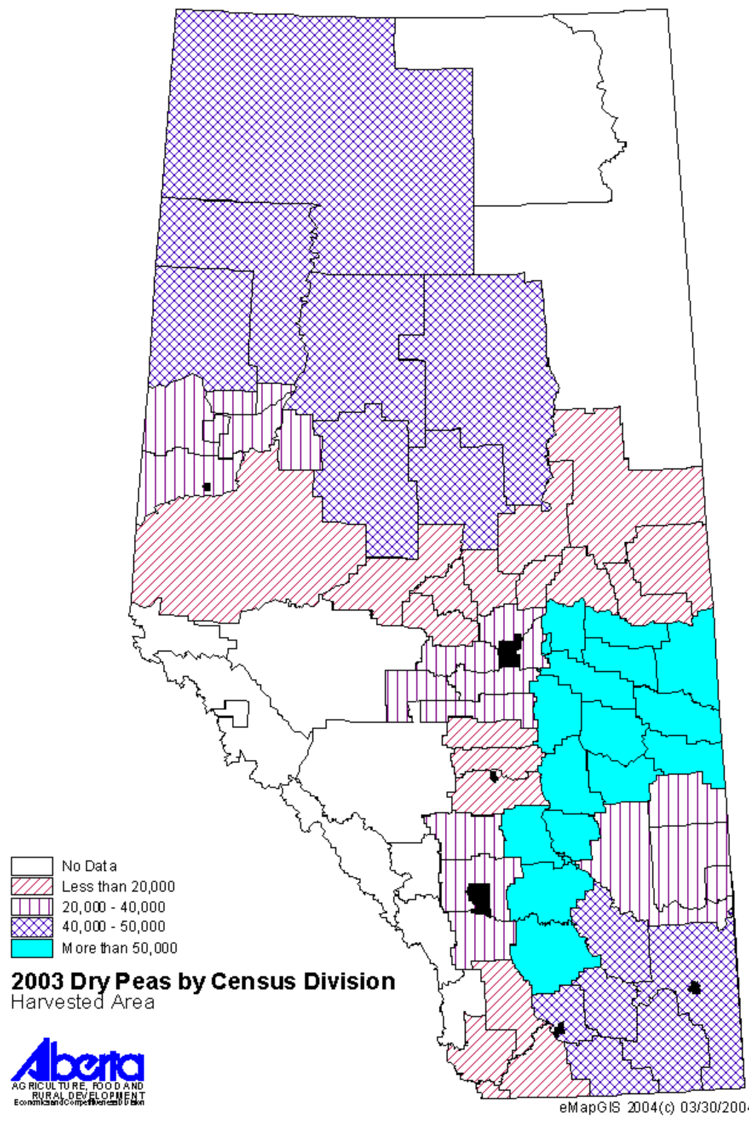
Source: Statistics Canada; and Alberta Agriculture, Food and Rural Development (AAFRD)

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, lentils, dry beans and chickpeas. Please note that census division estimates were generated from a small sample, therefore, caution is advised when using this data. Also attached for your reference is the Alberta census division and municipality map – Figure 4.

Dry Peas

Total area seeded to dry peas in Alberta was estimated at 635,000 acres in 2003 (see Table 1). A total of 507,865 tonnes of dry peas were produced from 605,000 acres harvested. The average yield of dry peas was estimated at 30.8 bushels per acre in 2003, compared to the ten-year average of 35.5 bushels per acre. Dry peas are grown primarily on dryland. A lack of precipitation and high temperatures in the summer were the primary reasons behind the lower dry pea yields in 2003.

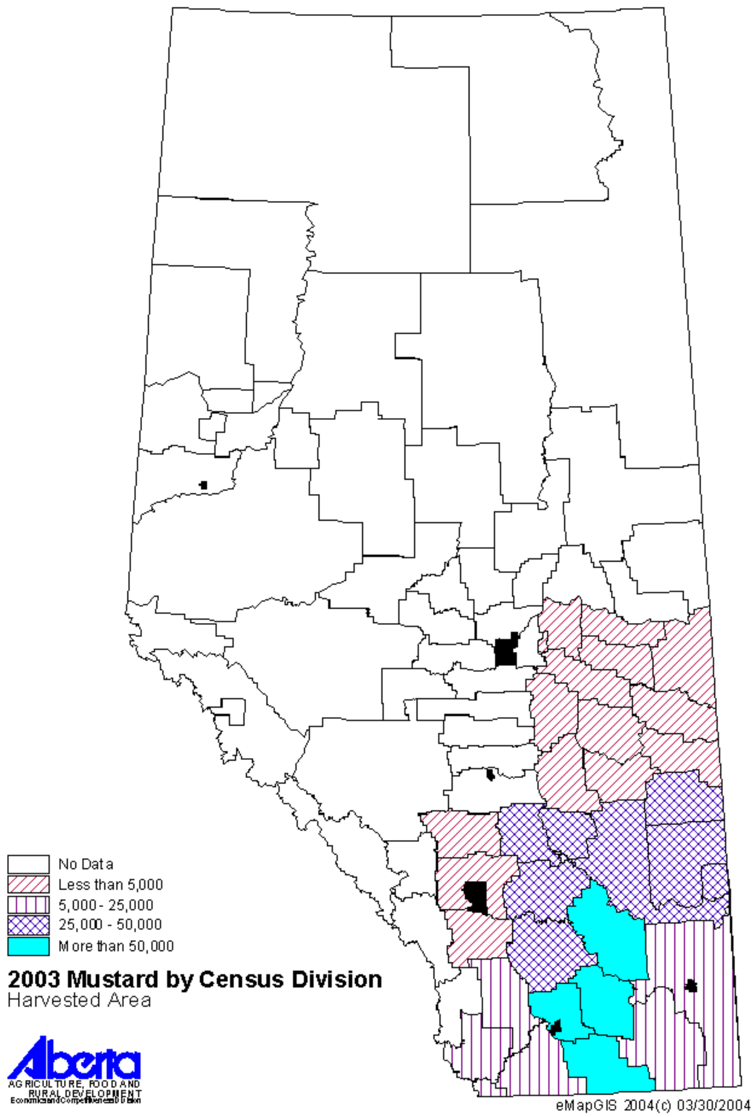


Although dry peas are grown across the province, higher acreage of dry peas is concentrated in central and northeastern Alberta, particularly in census divisions 5 (Drumheller area), 7 (Provost area) and 10 (Vermilion area) (see Tables 2 and 3). These three census divisions (5, 7 and 10) accounted for 43 per cent of the provincial total harvested area in 2003 (see Table 2). Yields of dry peas varied significantly across Alberta, ranging from 17.1 bushels per acre in census division 4, to 44.7 bushels per acre in census division 11.

Mustard Seed

Total seeded area of mustard in Alberta was estimated at 140,000 acres in 2003, of which 135,000 acres were harvested (see Table 1). The average yield of mustard was estimated at 634 pounds per acre, compared to the 10-year average of 820 pounds per acre. The lower yield in 2003 was attributed to dry conditions and high temperatures.

Total production of mustard seed was estimated at 38,825 tonnes in 2003, about 18 per cent higher than the ten-year average. Increase in total harvested area more than offset the impact of lower yield.



Of the three types of mustard seeds produced in Alberta, yellow mustard continued to dominate in 2003, accounting for 81 per cent of the provincial total harvested acreage, while brown and oriental mustard represented ten per cent and nine per cent, respectively.

Mustard seed is grown primarily on dryland in southern Alberta. In 2003, about 92 per cent of the provincial total harvested area was in census divisions 1, 2, 4 and 5 (see Table 2). Yields varied significantly across the province. Census division 4 had the lowest yield at 287 pounds per acre, due mainly to dry conditions. The highest average yield, 811 pounds per acre, was reported in census division 1.

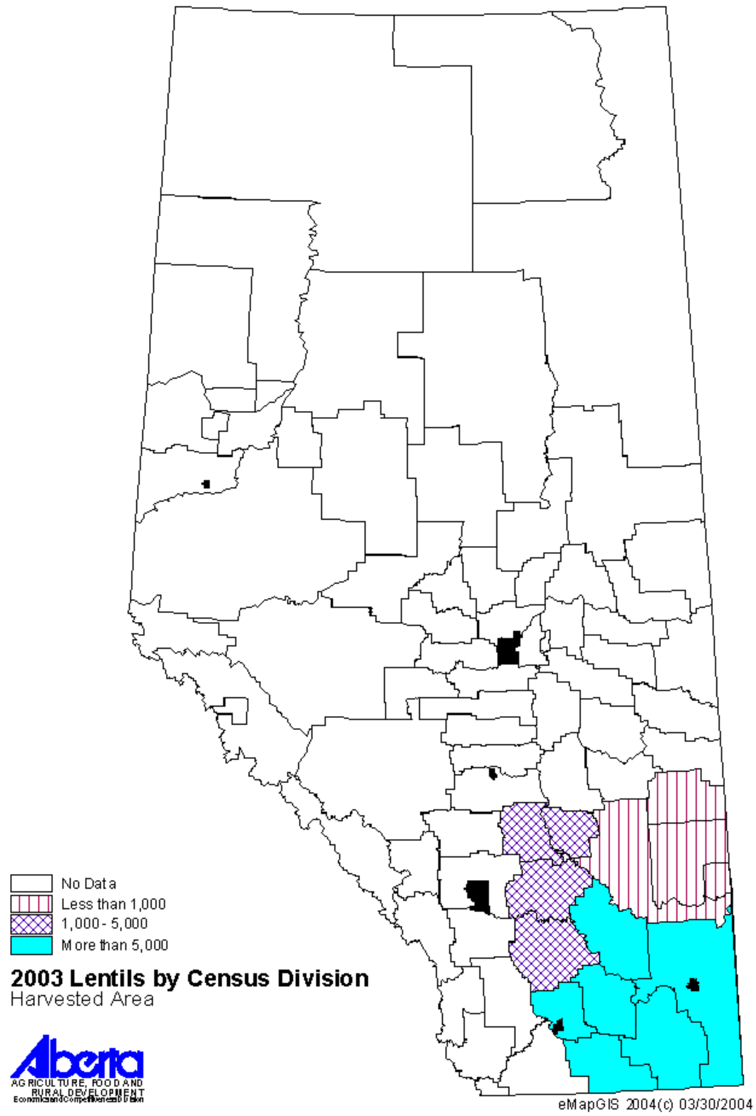
Lentils

Alberta producers seeded and harvested a total of 15,000 acres of lentils in 2003 (see Table 1). The average yield of lentils was estimated at 1,013 pounds per acre, up about 11 per cent from the 10-year average.

A total of 6,891 tonnes of lentils were produced in 2003, down 36 per cent from the 10-year average. The lower production in 2003 was attributed to a much smaller harvested area, which more than offset the impact of higher yield.

Lentils are grown in southern Alberta. In 2003, about 94 per cent of the provincial total harvested area was in census divisions 1, 2 and 5 (see Table 2).

There is limited lentil acreage under irrigation in the province.

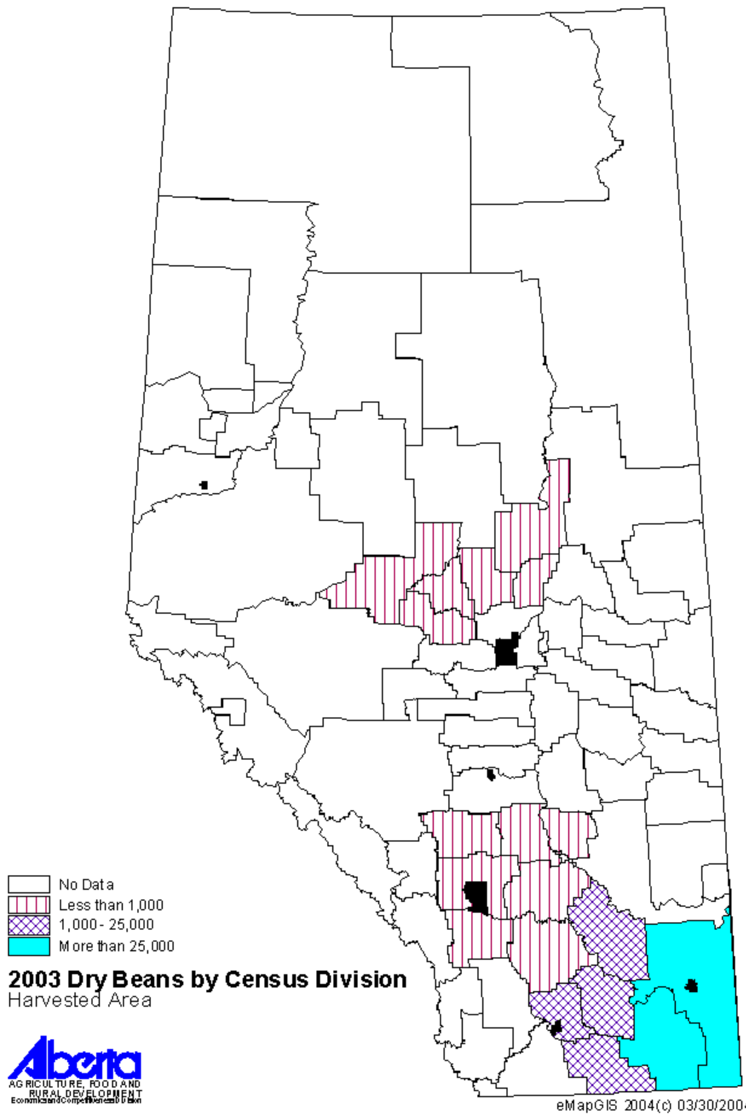


Dry Beans

Total production of dry beans in Alberta reached a record high of 60,300 tonnes in 2003 (see Table 1). This was up 47 per cent from the 10-year average. The record high production was a result of a combination of higher area and better yields. Total seeded area was estimated at 52,000 acres and all acreage was harvested. The harvested area was up 29 per cent from the 10-year average. The average yield, estimated at 25,600 pounds per acre, was 14 per cent higher than the 10-year average.

Dry beans are grown mostly under irrigation in southern Alberta. In 2003, census divisions 1 and 2 jointly accounted for 97 per cent of the provincial total harvested area (see Table 2).

Over 80 per cent of dry bean area is irrigated in Alberta, according to information from the Irrigation Branch of Alberta Agriculture, Food and Rural Development.



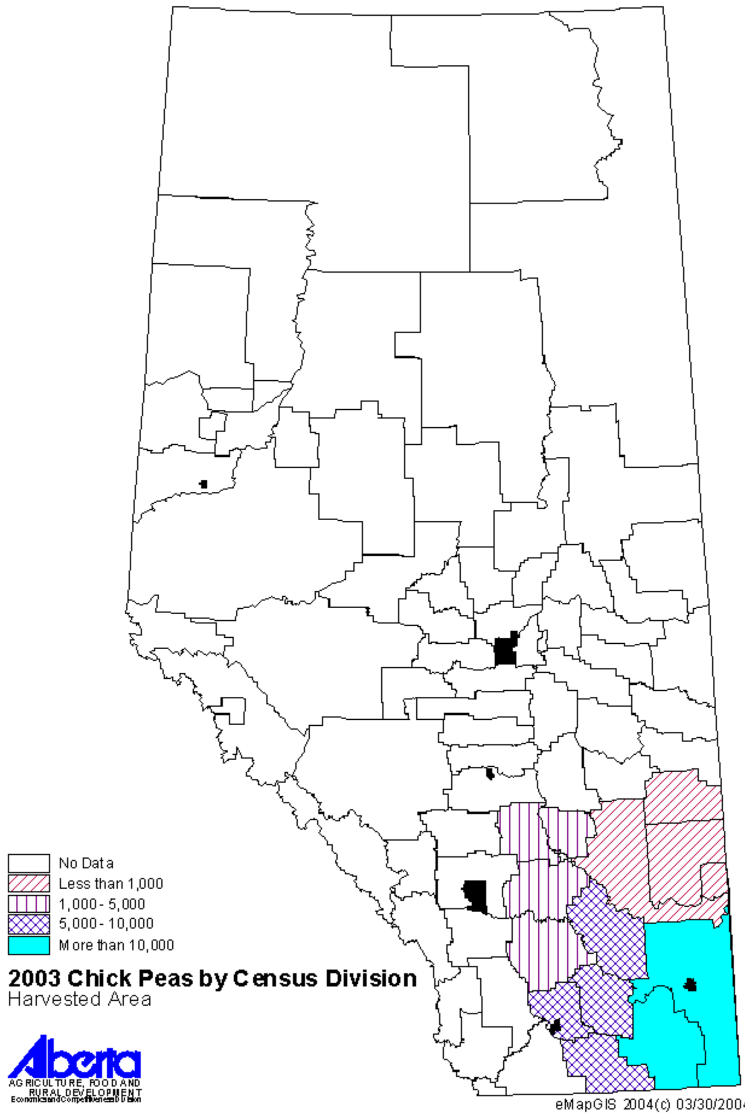
Please note, dry beans are grown under contract in Alberta.

Chickpeas

Total area seeded to chickpeas in Alberta was estimated at 25,000 acres in 2003, down dramatically from 2002. All acreage of chickpeas was harvested in 2003, with an average yield of 1,160 pounds per acre (see Table 1). Total production of chickpeas was estimated at 13,155 tonnes, compared to 36,474 tonnes in 2002.

Chickpeas are grown in the southeastern parts of Alberta. In 2003, census divisions 1, 2 and 5 accounted for 98 per cent of the provincial total harvested area (see Table 2).

The two types of chickpeas grown in Alberta are desi and kabuli. In 2003, kabuli represented 95 per cent of the provincial total harvested area for chickpeas. Desi accounted for the remaining five per cent.



Chickpeas is a relatively new crop in the Prairies. Producers in Alberta started growing chickpeas in the late 1990's. The crop has contributed to the diversification of crop production in the province. It is also valuable in crop rotation, as the crop helps improve soil texture and fertility.

Only a small amount of chickpeas in Alberta are grown under irrigation.

Table 4 Alberta Specialty Crops Historical Series

		1994	1995	1996	1997	1998	1999	2000	2001	2002*	2003*
Alfalfa Seed (1)											
Inspected area	(acres)	13,116	12,851	10,355	10,376	12,069	16,461	17,117	15,381	12,709	11,292
Yield	(lbs/acre)	340	265	265	300	425	200	525	385	265	550
Production	(tonnes)	2,023	1,545	1,245	1,412	2,327	1,493	4,076	2,686	1,528	2,817
Buckwheat											
Harvested area	(acres)	500	850	850	400	400	400	-	-	-	-
Yield	(bu/acre)	-	-	-	-	-	-	-	-	-	-
Production	(tonnes)	-	-	-	-	-	-	-	-	-	-
Canary Seed											
Harvested area	(acres)	-	10,000	25,000	10,000	20,000	10,000	10,000	4,000	7,000	10,000
Yield	(lbs/acre)	-	990	960	810	950	1,400	1,100	775	520	900
Production	(tonnes)	-	4,500	10,900	3,700	8,600	6,400	5,000	1,400	1,651	4,082
Corn for Grain											
Harvested area	(acres)	5,000	5,000	2,600	4,000	5,000	10,000	10,000	3,000	-	-
Yield	(bu/acre)	100.0	100.0	96.2	100.0	90.0	80.0	110.0	86.7	-	-
Production	(tonnes)	12,700	12,700	6,400	10,200	11,400	20,300	27,900	6,600	-	-
Corn Silage											
Harvested area	(acres)	10,000	10,000	10,000	15,000	15,000	15,000	30,000	30,000	30,000	30,000
Yield	(tons/acre)	20.0	16.0	19.5	12.0	20.0	13.3	17.0	16.0	16.0	16.7
Production	(tonnes)	181,400	145,100	176,900	163,300	272,200	181,400	462,700	435,400	435,453	453,606
Fababeans											
Harvested area	(acres)	-	-	200	1,000	2,000	-	-	3,000	2,500	2,000
Yield	(lbs/acre)	-	-	1,300	2,000	2,500	-	-	1,700	1,450	-
Production	(tonnes)	-	-	120	900	2,300	-	-	2,300	1,644	-
Dry Beans											
Harvested area	(acres)	25,000	30,000	25,000	35,000	45,000	47,000	45,000	59,000	40,000	52,000
Yield	(cwt/acre)	32.0	20.0	18.0	22.9	22.2	20.0	21.3	22.3	20.5	25.6
Production	(tonnes)	36,300	27,200	20,400	36,300	45,400	42,700	43,500	59,700	37,195	60,300
Dry Peas											
Harvested area	(acres)	390,000	445,000	280,000	385,000	500,000	455,000	640,000	570,000	440,000	605,000
Yield	(bu/acre)	35.3	34.0	40.4	40.3	35.9	42.9	35.6	32.6	19.6	30.8
Production	(tonnes)	374,200	412,300	307,500	421,800	488,000	530,800	620,500	506,200	234,324	507,865
Lentils											
Harvested area	(acres)	40,000	38,000	20,000	25,000	15,000	22,000	32,000	15,000	12,000	15,000
Yield	(lbs/acre)	1,075	1,250	845	732	1,180	1,245	684	722	900	1,013
Production	(tonnes)	19,500	21,500	7,700	8,300	8,000	12,400	9,900	5,000	4,899	6,891
Mustard Seed											
Harvested area	(acres)	90,000	100,000	85,000	145,000	110,000	90,000	50,000	50,000	80,000	135,000
Yield	(lbs/acre)	889	1,125	753	769	795	1,100	606	373	603	634
Production	(tonnes)	36,300	51,100	29,000	50,600	39,700	44,800	13,800	8,500	21,888	38,825
Safflower											
Harvested area	(acres)	2,000	2,000	800	-	12,000	5,000	3,000	1,000	-	2,500
Yield	(lbs/acre)	500	870	760	-	1,020	900	625	750	-	1,215
Production	(tonnes)	1,100	2,000	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

Note: * Data shown in 2002 and 2003 are from Alberta Specialty Crop Survey, AAFRD.

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

		1994	1995	1996	1997	1998	1999	2000	2001	2002*	2003*
Sugar Beets (2)											
Harvested area	(acres)	34,836	33,656	33,463	33,124	41,132	44,522	42,017	28,457	27,754	27,389
Yield	(tonnes/acre)	21.17	20.46	20.22	19.64	23.32	18.86	21.90	18.38	15.22	22.90
Production	(tonnes)	737,774	688,498	676,611	650,423	959,310	839,773	920,252	523,110	422,389	628,081
Sunflowers											
Harvested area	(acres)	5,000	5,000	2,000	5,000	5,000	5,000	5,000	5,000	2,000	3,000
Yield	(lbs/acre)	2,000	1,900	1,675	1,400	1,900	1,600	2,240	1,250	1,500	-
Production	(tonnes)	4,500	4,300	1,500	3,200	4,300	3,600	5,100	2,800	1,361	-
Triticale											
Harvested area	(acres)	10,000	10,000	15,000	15,000	50,000	60,000	50,000	20,000	35,000	40,000
Yield	(bu/acre)	40.0	50.0	33.3	36.7	38.0	53.3	41.0	37.0	50.0	33.8
Production	(tonnes)	10,200	12,700	12,700	14,000	48,300	81,300	52,100	18,800	44,452	34,343
Potatoes											
Harvested area	(acres)	29,000	29,500	31,000	30,500	32,200	42,300	47,700	57,300	55,800	61,000
Yield	(cwt/acre)	277.8	297.7	268.0	290.0	295.0	290.0	310.0	315.0	280.0	330.0
Production	(tonnes)	365,500	398,400	376,900	401,200	430,900	556,400	670,700	818,700	708,700	913,200

Source: Statistics Canada; and Alberta Agriculture, Food and Rural Development (AAFRD)

- Not available

(2) Alberta Sugar Beet Growers, Annual Report

Note: * Data shown in 2002 and 2003 are from Alberta Specialty Crop Survey, AAFRD.

Table 5 Western Canada Specialty Crops Area and Production

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*	2003*
Mustard Seed					**Seeded Area '000 acres**						
Alberta	60.0	90.0	100.0	90.0	145.0	110.0	100.0	50.0	60.0	95.0	140.0
Saskatchewan	400.0	700.0	550.0	490.0	560.0	580.0	585.0	465.0	330.0	600.0	675.0
Manitoba	10.0	10.0	10.0	11.0	17.0	10.0	7.0	10.0	20.0	30.0	25.0
Western Canada	470.0	800.0	660.0	591.0	722.0	700.0	692.0	525.0	410.0	725.0	840.0
					Production '000 tonnes						
Alberta	32.1	36.3	51.1	29.0	50.6	39.7	44.8	13.8	8.5	21.9	38.8
Saskatchewan	180.0	278.9	190.6	196.9	186.5	195.5	259.7	185.1	91.2	125.2	176.9
Manitoba	3.8	4.1	2.6	4.9	6.3	3.4	1.9	3.3	5.1	10.0	10.4
Western Canada	215.9	319.3	244.3	230.8	243.4	238.6	306.4	202.2	104.8	157.1	226.1
Sunflowers					**Seeded Area '000 acres**						
Alberta	5.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0	3.5	3.0
Saskatchewan	80.0	60.0	40.0	25.0	35.0	40.0	65.0	25.0	20.0	30.0	70.0
Manitoba	125.0	140.0	75.0	63.0	85.0	125.0	140.0	155.0	155.0	210.0	220.0
Western Canada	210.0	205.0	120.0	90.0	125.0	170.0	210.0	185.0	180.0	243.5	293.0
					Production '000 tonnes						
Alberta	2.3	4.5	4.3	1.5	3.2	4.3	3.6	5.1	2.8	1.4	-
Saskatchewan	29.0	25.9	18.4	15.7	14.3	21.3	35.4	12.4	8.1	17.2	23.6
Manitoba	47.2	86.6	43.5	37.7	47.6	86.2	82.9	101.8	92.9	136.1	124.7
Western Canada	78.5	117.0	66.2	54.9	65.1	111.8	121.9	119.3	103.8	154.7	148.3
Lentils					**Seeded Area '000 acres**						
Alberta	40.0	40.0	40.0	20.0	25.0	20.0	25.0	32.0	20.0	15.0	15.0
Saskatchewan	750.0	830.0	735.0	690.0	780.0	900.0	1,210.0	1,660.0	1,720.0	1,470.0	1,350.0
Manitoba	130.0	115.0	50.0	40.0	8.0	15.0	16.0	35.0	10.0	0.0	4.0
Western Canada	920.0	985.0	825.0	750.0	813.0	935.0	1,251.0	1,727.0	1,750.0	1,485.0	1,369.0
					Production '000 tonnes						
Alberta	9.4	19.5	21.5	7.7	8.3	8.0	12.4	9.9	5.0	4.9	6.9
Saskatchewan	315.2	381.0	381.9	373.8	365.2	465.9	702.6	888.1	557.9	351.9	510.3
Manitoba	24.1	49.9	28.5	21.0	5.3	5.9	8.8	16.1	3.4	0.0	2.7
Western Canada	348.7	450.4	431.9	402.5	378.8	479.8	723.8	914.1	566.3	356.8	519.9
Dry Peas					**Seeded Area '000 acres**						
Alberta	300.0	400.0	465.0	290.0	385.0	510.0	470.0	660.0	610.0	650.0	635.0
Saskatchewan	750.0	1,110.0	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
Manitoba	200.0	210.0	180.0	145.0	205.0	260.0	105.0	155.0	150.0	200.0	135.0
Western Canada	1,250.0	1,720.0	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
					Production '000 tonnes						
Alberta	299.4	374.2	412.3	307.5	421.8	488.0	530.8	620.5	506.2	234.3	507.9
Saskatchewan	585.1	898.1	868.2	729.4	1,158.1	1,613.8	1,623.4	2,072.4	1,366.2	963.5	1,469.6
Manitoba	85.7	168.7	147.0	132.0	178.3	225.9	92.0	160.5	146.1	176.9	137.4
Western Canada	970.2	1,441.0	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
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
Saskatchewan	300.0	480.0	330.0	520.0	250.0	450.0	340.0	360.0	360.0	600.0	550.0
Manitoba	12.0	25.0	25.0	70.0	20.0	50.0	15.0	40.0	55.0	100.0	60.0
Western Canada	312.0	505.0	365.0	615.0	280.0	520.0	370.0	410.0	420.0	680.0	620.0
					Production '000 tonnes						
Alberta	-	-	4.5	10.9	3.7	8.6	6.4	5.0	1.4	1.7	4.1
Saskatchewan	124.7	226.8	137.9	240.0	102.1	201.8	152.0	148.6	101.2	140.6	183.7
Manitoba	3.1	13.6	12.2	33.7	9.2	24.9	7.6	17.2	11.3	32.7	31.8
Western Canada	127.8	240.4	154.6	284.6	115.0	235.3	166.0	170.8	113.9	175.0	219.6

Source: Statistics Canada; Saskatchewan Agriculture and Food; and Alberta Agriculture, Food and Rural Development (AAFRD)

* Data shown in 2002 and 2003 for Alberta are from Alberta Specialty Crop Survey, AAFRD - Not available

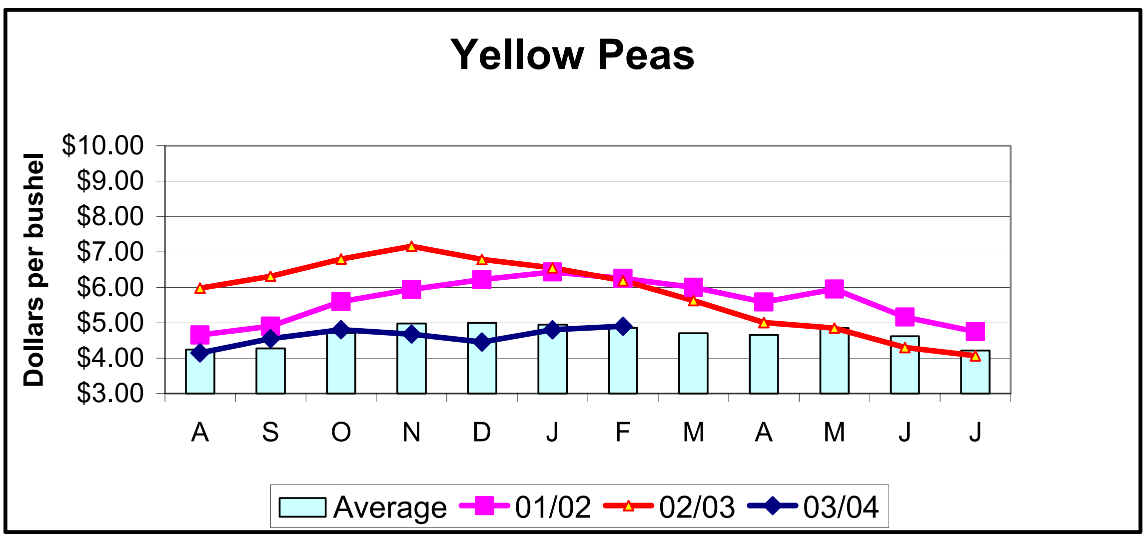
MARKET OUTLOOK FOR SELECTED SPECIALTY CROPS

By Charlie Pearson

Dry Pea Markets

Edible pea prices (both greens and yellows) have returned to more normal levels after the previous two drought years. Human consumption pea prices (both greens and yellows) have held in the $4.50 to $5.50/bushel range over the past winter. A combination of better pulse crops in south east Asia, a higher valued Canadian dollar relative to the US dollar and expensive ocean freight rates have kept pressure on edible pea prices.

Dry pea prices have equaled edible yellow pea prices over the winter reflecting the tight US/world soybean situation and its' impact on soybean meal and other livestock feeds. This has been the case both domestically and in the European feed markets. The availability of new crop South American soybeans/meal in the spring and new crop European peas during the summer will likely pressure international feed pea prices lower starting in June. Tight North American protein meal supplies will keep feed peas competitive into domestic feed rations with feed mill/farm direct domestic feed pea prices staying high.

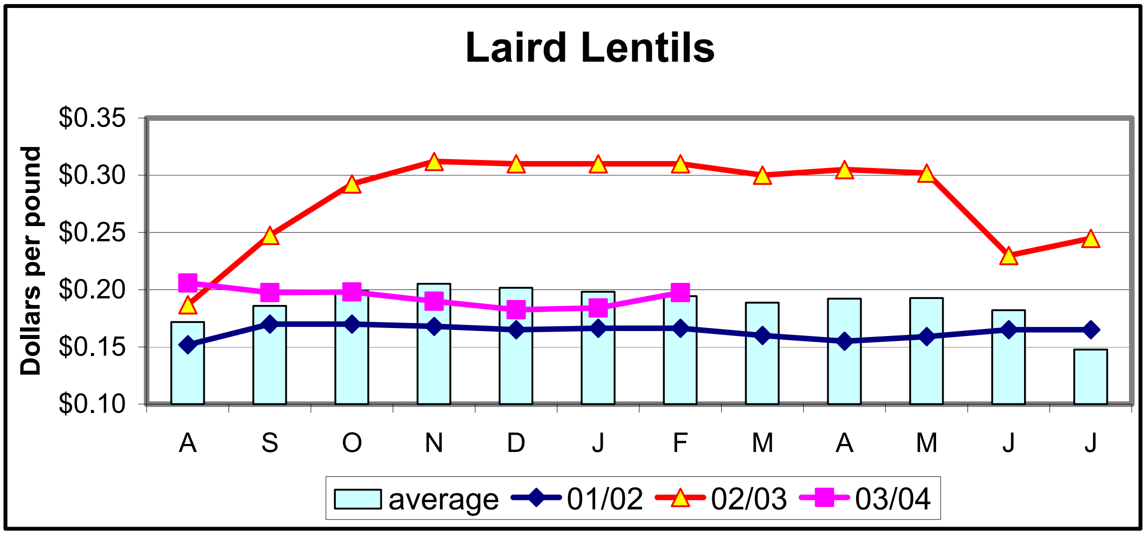


New crop pea price are similar to old crop values. Unless there are production problems in a major pulse growing area, edible pea prices can be expected to remain in the $4.50 to $5.00/bu range over the coming year. Feed pea prices will be dependent on prices for other feed grains/protein sources.

Lentil Markets

Larger Canadian and world lentil production has pushed 2003/04 prices lower relative to 2002/03 with a range of 18 to 22 cents/lb for top quality lairds, down from 30 cents/lb in the previous winter. Canadian lentil production in 2003 increased to 519,900 tonnes (356,800 tonnes in 2002) reflecting a return to normal yields after the 2002 drought.

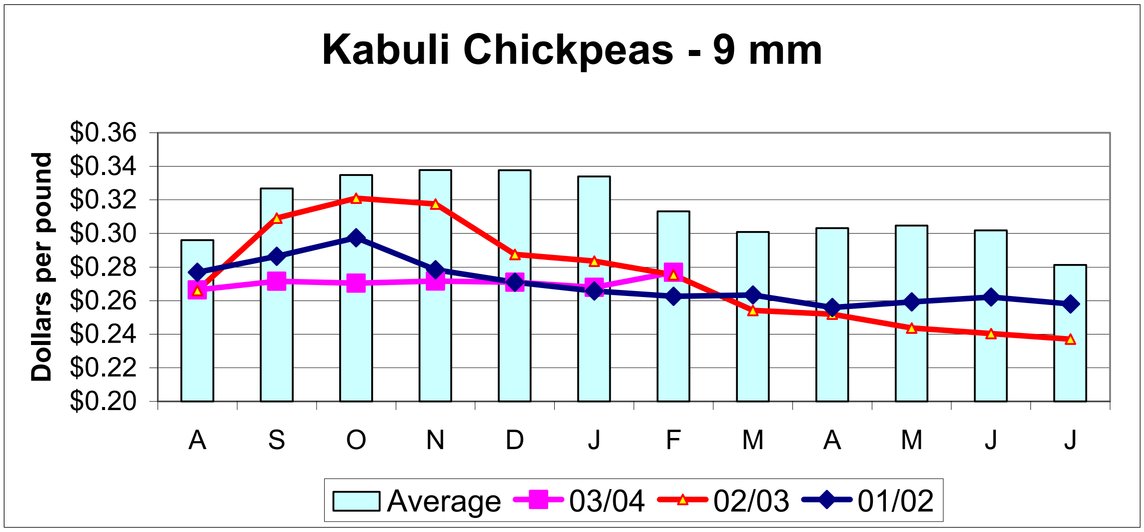
New crop lentil prices (No. 1 grade) are sitting in the 15 to 18 cent/lb range, with large seed green varieties (Laird type) at the top end and medium seed (Richlea type)/small seed (Eston type) at the bottom. Red lentils are also at the bottom end of this range. Lentil acres in 2004 are forecast to remain in the 1.4 to 1.5 million acre range, up slightly from 2003.

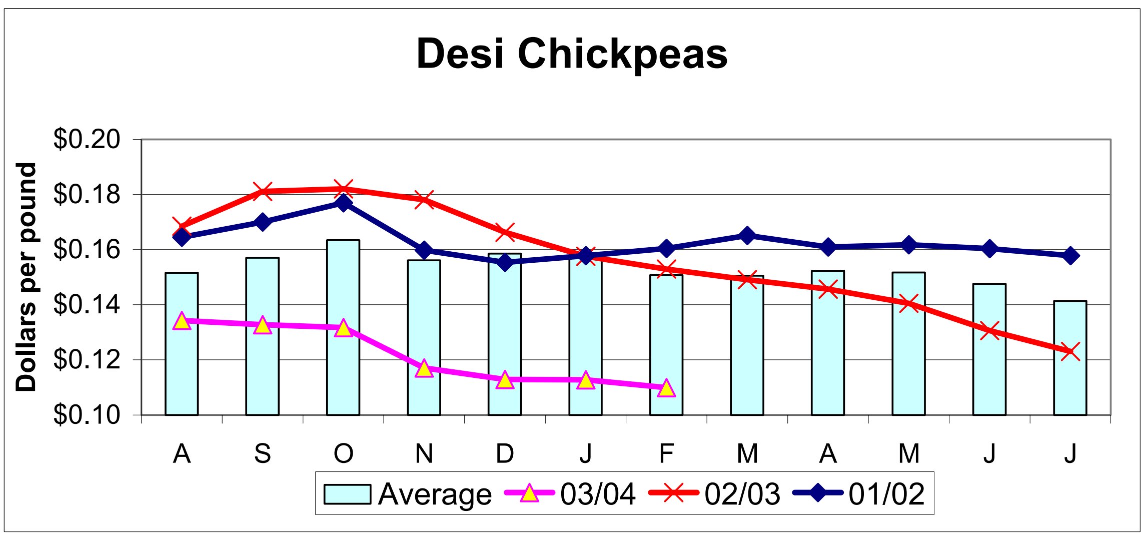


Chickpea Markets

Canadian chickpea production in 2003 is estimated to be 68,000 tonnes, less than half the level of 2002 and less than 1/6th the record 455,000 tonnes produced in 2001. The smaller crop in Canada has been more than offset by increased production in other major producing regions (mainly India and Australia). Prices for high quality kabuli chickpeas have ranged from 24 to 26 cents/lb for 9 mm size, 19 to 21 cents/lb for 8 mm and 12 to 15 cents/lb for 7 mm. Desi chickpeas have stayed in the 10 to 13 cent/lb area. Prices for both types remain well below the average levels achieved over the past 5 years.

Unless weather impacts pulse production in South East Asia again, chickpea prices can be expected to remain under pressure in the coming year – particularly for desi chickpeas. A more optimistic picture can be developed for larger kabuli chickpeas given the development of higher valued specialty markets. The issue for farm managers will be to hit the top quality color and size requirements within the growing season window on your farm and the disease pressure you have seen on this crop in the past. New crop prices for Desi chickpeas are holding in the 9 to 10 cent/lb range and 9 mm kabuli in the 25 to 27 cent/lb range.

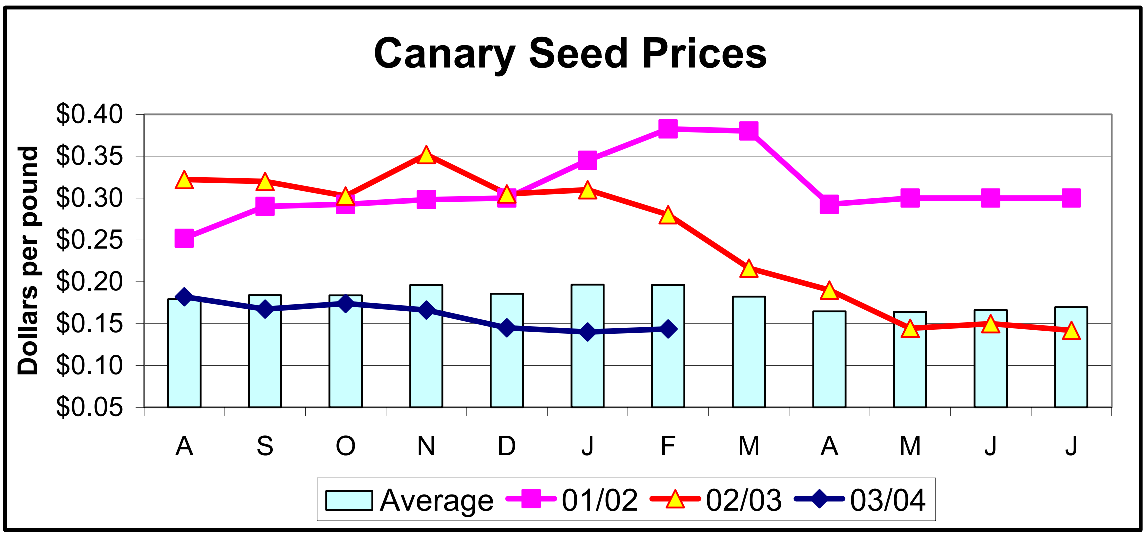




Canary Seed

Canary seed prices dropped over the past winter into the 14 to 18 cent/lb range. Canadian canary seed production is estimated to be 219,600 tonnes in 2003, up 34 per cent from 2002 and over double that of 2001.

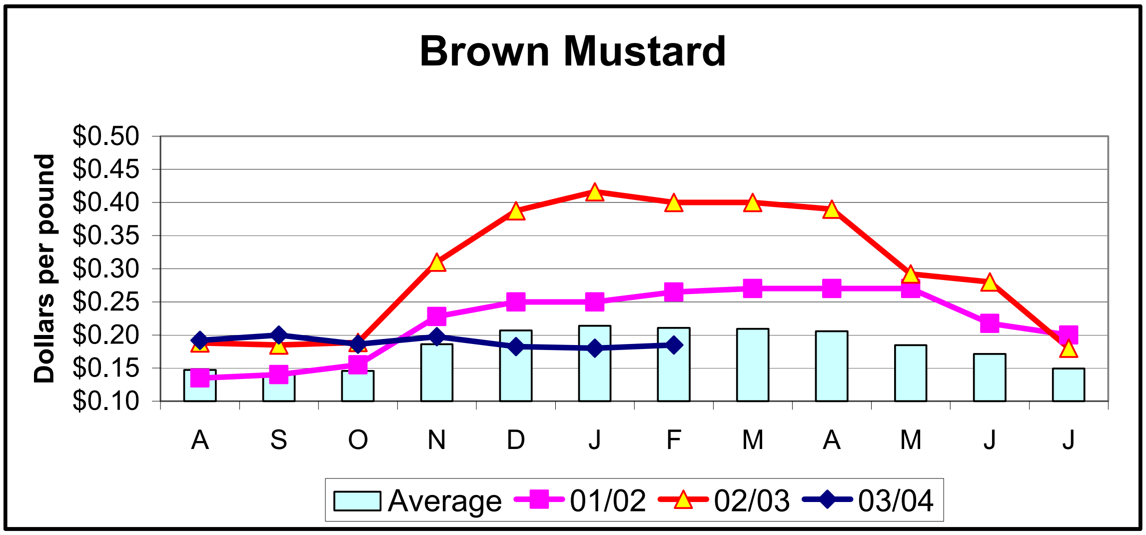
New crop canary seed prices are in the 12 to 15 cent/lb range. Based on western Canada canary seed area holding around 600,000 acres and an average yield of 750 lb/acre, total production in the coming year would be in the 200,000 to 210,000 tonne range. With about 170,000 tonnes exported and 20,000 tonnes domestically, a small build up in stocks would occur at the end of the 2004/05 crop year. Assuming favorable weather this summer, canary seed prices are expected to hold the 15 plus/minus range in 2004/05.

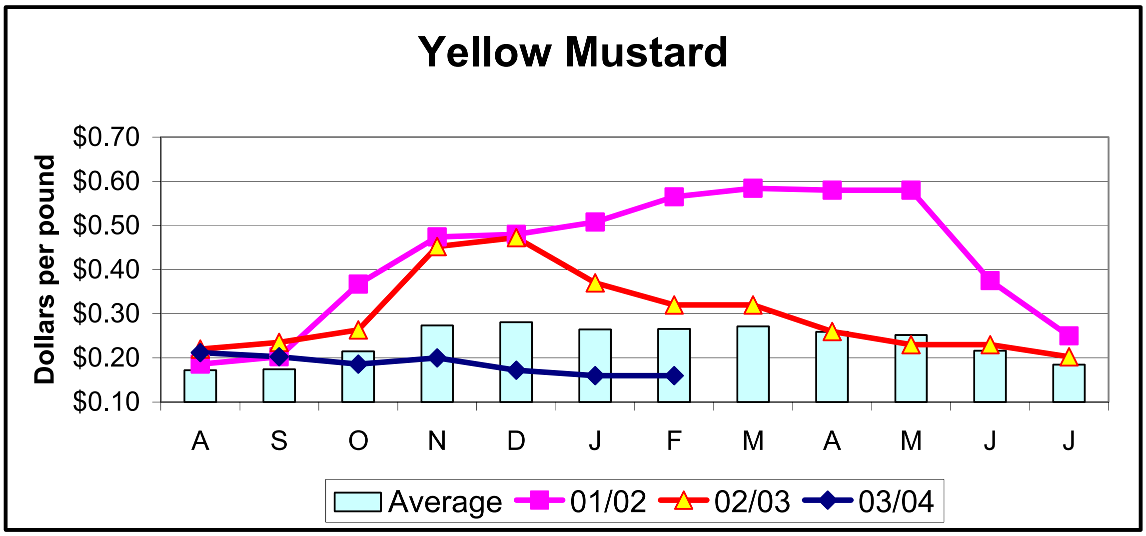


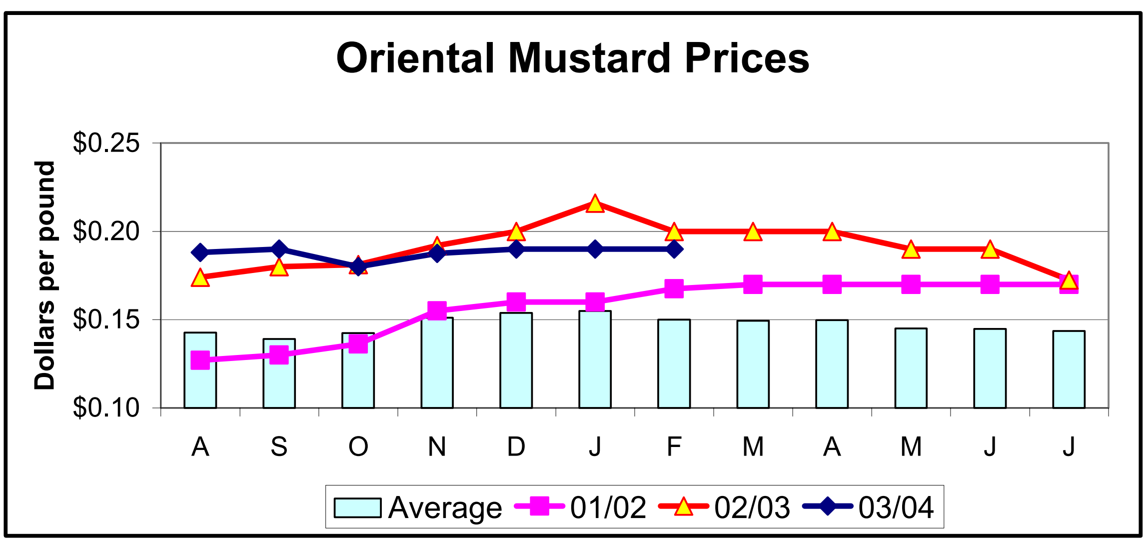
Mustard

Canadian Mustard seed production returned to more normal levels in 2003 after the drought in 2002. Canadian mustard seed production in 2003 was around 226,000 tonnes, well above the levels of the previous two drought years. Prices for both yellow and brown mustard have come down significantly from the past two years as a result of the increased supplies. The one bright light in mustard prices has been that of oriental mustard.

New crop mustard prices are holding in the 18 to 20 cent/lb range for yellow mustard and 16 to 18 cents/lb for oriental/brown mustard.


Brown Mustard
Dollars per pound
$0.50
$0.45
$0.40
$0.35
$0.30
$0.25
$0.20
$0.15
$0.10
A S O N D J F M A M J J
Average 01/02 02/03 03/04


Yellow Mustard
Dollars per pound
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
A S O N D J F M A M J J
Average 01/02 02/03 03/04


Oriental Mustard Prices
Dollars per pound
$0.25
$0.20
$0.15
$0.10
A S O N D J F M A M J J
Average 01/02 02/03 03/04

Economics of Specialty Crop Production

By 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.

Continued depressed prices and 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. 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).

During the last decade dry beans and lentils production in Alberta has considerably fluctuated. 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. Most of the dry beans are grown under contract. In 2003, seeded area for dry beans decreased by about 13 per cent from the previous year. Similarly, 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 also at 15,000 acres.

In late nineties there was a considerable interest in chickpeas (known as the new Cinderella crop in 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. 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.

Following Tables provide information on production costs and returns for dry peas, dry beans and chickpeas (desi and kabuli).

Table 6 Production Costs and Returns for Dry Peas in Dark Brown Soil Zone, 2003

	$ per acre	$ per bushel
Revenue per Acre		
Yield per Acre (bushels)	33.6	
Expected Market Price/Acre ($)	4.65	
(a) Gross Revenue per Acre	**156.24**	**4.65**
Costs per Acre ($)		
Seed and Seed Cleaning	26.47	0.79
Fertilizer Rates: 2N 16P 1K 3S	6.85	0.20
Chemicals	28.60	0.85
Hail/Crop Insurance Premiums	7.55	0.22
Trucking and Marketing	1.46	0.04
Fuel	8.15	0.24
Repairs - Machinery & Buildings	7.68	0.23
Utilities & Miscellaneous Expenses	11.28	0.34
Custom Work & Labour	6.90	0.21
Operating Interest Paid	2.96	0.09
Unpaid Labour	3.75	0.09
(b) Variable Costs	**111.65**	**3.30**
Taxes, Licence & Insurance	9.85	0.29
Equipment & Building - Depreciation	17.85	0.53
Paid Capital Interest	5.45	0.16
(c) Capital Costs	**33.15**	**0.99**
(d) Total Production Costs (b+c)	**144.8**	**4.31**
Gross Margin	**34.74**	**1.03**
Return to Investment (a-d+capital interest)	**16.89**	**0.50**
Return to Equity (a-d)	**11.44**	**0.34**

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

Source: Economics Unit, Alberta Agriculture, Food and Rural Development
Edmonton, Alberta (780) 422 - 4054
nabi.chaudhary@gov.ab.ca

Table 7 Production Costs and Returns for Dry Beans
in Dark Brown Soil Zone, 2003

	$ per acre	$ per pound
Revenue per Acre		
Yield per Acre (lbs)	2270	
Expected Market Price/Acre ($)	0.26	
(a) Gross Revenue per Acre	**590.20**	**0.26**
Costs per Acre ($)		
Seed and Seed Cleaning	28.06	0.01
Fertilizer Rates: 2N 16P 1K 3S	70.24	0.03
Chemicals	89.86	0.04
Hail/Crop Insurance Premiums	10.25	0.00
Trucking and Marketing	7.68	0.00
Fuel	33.65	0.01
Repairs - Machinery & Buildings	48.60	0.02
Utilities & Miscellaneous Expenses	12.49	0.01
Custom Work & Labour	8.65	0.00
Operating Interest Paid	2.96	0.00
Unpaid Labour	90.01	0.00
(b) Variable Costs	**402.45**	**0.18**
Cash/Crop Share Rent	155.00	0.07
Taxes, Licence & Insurance	29.06	0.01
Equipment & Building - Depreciation	67.07	0.03
Paid Capital Interest	9.85	0.00
(c) Capital Costs	**105.98**	**0.05**
(d) Total Production Costs (b+c)	**508.43**	**0.22**
Gross Margin	**158.69**	**0.07**
Return to Investment (a-d+capital interest)	**91.62**	**0.04**
Return to Equity (a-d)	**81.77**	**0.04**

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

Source: Economics Unit, Alberta Agriculture, Food and Rural Development
Edmonton, Alberta (780) 422 - 4054
nabi.chaudhary@gov.ab.ca

Table 8 Production Costs and Returns
for Desi and Kabuli Chickpeas, 2003

	Desi Chickpeas	Kabuli Chickpeas
Revenue Per Acre		
Estimated Yield per Acre (lbs)	865	1140
Price per Pound ($)	0.14	0.23
(a) Gross Revenue per Acre ($)	**121.10**	**262.20**
Costs per Acre ($)		
Variable Costs per Acre		
Seed	22.73	51.65
Fertilizer	12.36	13.42
Chemicals	15.64	19.85
Machinery Expenses (Fuel & Repair)	15.35	15.35
Custom Work & Hired Labour	6.00	6.00
Utilities & Miscellaneous	7.50	7.55
Interest on Variable Expenses	2.19	3.22
(b) Total Variable Costs	**81.77**	**117.04**
Other Costs per Acre		
Building Repair	1.95	1.95
Property Expenses, Insurance & Licences	5.30	5.30
Machinery & Building Depreciation	17.65	17.65
Machinery & Building Investment	12.45	12.45
Land Rent	35.00	55.00
Labour & Management	15.60	15.60
(c) Total Other Costs	**87.95**	**107.95**
(d)TOTAL PRODUCTION COSTS (b+c)	**169.72**	**224.99**
RETURNS PER ACRE ($)		
Return Over Variable Expenses (a-b)	39.33	145.16
Return Over Total Production Costs (a-d)	-48.62	37.21

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

Source: Economics Unit, Alberta Agriculture, Food and Rural Development
Edmonton, Alberta (780) 422 - 4054
nabi.chaudhary@gov.ab.ca

Special Crops Program (Crop Diversification Centre North)

K. Ampong-Nyarko, S. F. Blade, and N. Clarke

Research Projects

The special crops program at CDCN has been active in the identification and development of promising economic crops since 1995. The focus has been research on several categories of new crops: pulse, medicinal, culinary and aromatic. In 2003 work on biomass crops was added as a non-food industrial crop.

Pulse Crops

Western field pea co-operative trial - Cutlass field pea, which was released last year by Stan Blade, did well in 2003 regional trials. It also out-yielded the checks in both northern and southern Saskatchewan trials by 19 per cent. Cutlass out-yielded the checks in the 2003 Co-op trials by 13 per cent.

Dry pea breeding and germplasm evaluation CDC Advance - To jumpstart the dry pea breeding program CDCN staff have established a strong collaboration with the Crop Development Centre in Saskatoon to obtain early-generation lines from crosses which were targeted to the cool, moist conditions of Alberta.

The original non-replicated screening in 1996 was followed by a replicated preliminary yield trial in Edmonton and Grande Prairie in 1997. The elite material was put into an ongoing yield test in several locations in Saskatchewan and Alberta. The advancing material was in limited supply due to a drought in 2002. In 2003 seed stocks were increased to provide for replicated trials in the 2004 season

CDCN - Pea lines crossed in the greenhouse were planted in the field for the 2003-growing season. These new materials were evaluated with several objectives in mind: plant maturity, height, harvestability, plant architecture, disease resistance, seed vigor, and yield.

Narrow leafed lupins (*Lupinus angustifolius)* yield and yield parameters - The research on lupins initiated in 2002 was continued in 2003. Lupins are a pulse crop, which has very high protein (32-40 per cent) and energy levels (due to 6-7 per cent oil). Preliminary trials in 2002 indicated some promise for this crop using genetics from northern Europe, rather than the Australian cultivars, which have failed in our earlier tests across the province. Lupins could be a viable alternative to soy imports; we need to do some additional work to make a realistic assessment of their potential.

Biomass production research in Alberta

The foundation of a biobased industry depends on an abundant and consistent supply of biomass. In many cases biomass quality and characteristics are very critical for their suitability in a particular end-use. For these reasons the growing of dedicated plants for biomass production could help meet some of these needs in Alberta. The objective of the study was to identify dedicated high yielding annuals and perrenial plants as biomass crops for Alberta. We evaluated 16 annual and perennial species at four locations: Edmonton, Brooks, Vegreville, and Fairview. In Edmonton where data is available the yield productivity for the species per ha during the year of establishment were for corn 28.0 ton, sorghum Sudan grass 15.4 ton, Jerusalem artichoke 9.6 ton, German millet 8.9 ton, triticale 8.8 ton, millet hybrid 6.2 ton, Canada wild rye 5.4 ton, dahurian wild rye 5.1 ton, reed canary grass 4.7 ton, tall fescue 4.0 ton, flax 2.5ton, switch grass 1.5 ton, basin wild rye 1.0 ton, blue joint reed grass 0.3 ton, big bluestem 0.17 ton, prairies and reed 0.16 ton in the year of establishment. Biomass samples are being analyzed for the suitability in ethanol production and for their pulping properties. The economic analysis for each species and of annual and perennial production systems will be established at the end of the third year.

Medicinal Herb Research

Echinacea was selected as one of several crops that Alberta has an advantage to grow and market. During the year, research on Echinacea was emphasized.

Echinacea Field Production System Trials

Echinacea, with a market share of 35 per cent is the top selling medicinal herb in Canada. Echinacea production in Alberta for 2004 is estimated to reach 18 tons of dry roots from about 18 hectares. We initiated studies to answer growers' questions on plant density, spacing, time of planting and winter survival. We tested six plant densities: 10, 20, 40, 80, 160 and 320 plants/m^2. We used *Echinacea angustifolia* and were replicated 4 times. This study is in its' second year and will be harvested in October 2004.

Echinacea Time of Planting and Winter Survival Trial

Echinacea bare roots seedlings were field transplanted at CDC North on June 6, June 26, July 17, August 7, August 28, September 18, and October 9, 2002 to study effects of time of planting on establishment and winter survival. This study is in its' second year and will be harvested in October 2004.

Greenhouse production of Echinacea

There are several advantages of greenhouse echinacea cultivation such as accelerated cultivation cycles, potential for improved root yield, phytochemical consistency, uniform product quality, and independence from local land and climate conditions The objectives of the studies were to establish optimum density, length to maturity, yield and the best establishment method.

In all studies we determined echinacoside content of dry roots. Analysis consisted of extraction, purification and quantification of echinacoside by solid phase extraction and high-pressure liquid chromatography. It was concluded that greenhouse production can be accomplished in less than a year with higher levels of echinacoside and higher potential yields than field grown echinacea. Yields in greenhouse were up to 8-ton ha^{-1}. However, planting window to fit in existing uses of greenhouse such bedding plant enterprise may not feasible. As the plants were dormant during December to February the best planting time will be February and harvest in October to avoid heating greenhouse in winter months. The critical production cost factors were identified, as are seedling cost, transplanting and heating cost. This work was done in collaboration with Dr Mohyuddin Mirza.

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, and medicinal). This also served as a demonstration plot at CDC North. In 2002, we grew yarrow (*Achillea millefolium), a*rnica (*Arnica chamissonis), m*ustard (*Brassica hirta (Sinapis alba), s*afflower (*Carthamus tinctorius),* caraway (*Carum carvi),* quinoa (*Chenopodium quinoa)* teff (*Erogrostis tef,* buckwheat (*Fagopyrum esculentum)),* Jerusalem artichoke (*Helianthus tuberosus.* In 2003 the study was expanded to include 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. John's wort (H*ypericum perforatum)* valerian (*Valeriana officinalis.)* Those species that were transplanted were seeded on April 2, 2003 and transplanted in the field on May 26, 2003 and harvested on September 29, 2003.

Transplanted chicory dry roots yield was 550 kg/ha. Many of the species were not able to mature seeds during the growing season. It seems that special crops where the leaves, flowers and roots are used will be most adapted to our climate.

Rhodiola potential commercialization in Alberta

Rhodiola rosea a plant with adaptation potential to Alberta has a high-safety profile, compelling benefits and a reasonable amount of scientific medical research. As health product and dietary supplement it is used to maximize endurance, improve memory, and treat depression, stress and anxiety. We initiated a project to build the foundation for the cultivation, commercialization and the processing of rhodiola in Alberta. In collaboration with Alberta Natural Health Agricultural Network (ANHAN) we planted one trial to study the optimum plant density and spacing. In addition, ANHAN distributed rhodiola seedlings maintained at CDC North to its' members.

Adaptation of *Cuphea lanceolata* in Alberta

This study was carried out in collaboration with Rodney Turner of Fence Line Ltd who also co-funded the project. Currently, there is no cuphea market, but its seeds are rich in laurate, a fatty acid also found in tropical oils such as palm and coconut and desirable for soaps, detergents and cosmetics. The plant is sticky and seeds shatter easily and it does not tolerate frost. Germination is slow 20 to 30 days. The objective was to assess the adaptation of cuphea to the growing conditions in Alberta and capture information on some aspects of the agronomy of the plant. We evaluated 38 germplasm from GRIN collection.

Technology Transfer

A very successful Echinacea Workshops was held on March 12, 2003 at CDC North. Crop Diversification and Business and Innovation Divisions jointly organized the forum. Over seventy participants attended. We also organized an open day for Echinacea growers on August 13, 2003.

The special crops program would like to acknowledge the contribution of Chunyu Jiao and Jackie Teulie.

Special Crops Program 2003

Crop Diversification Centre South, Brooks, AB

Manjula Bandara, Carina Weisbach, Judy Webber and Debbie Schuiling

The special crops program at the Crop Diversification Centre South (CDCS), Brooks, AB, 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, University of Saskatchewan, Agriculture and Agri-Food Canada, Regional 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.

<u>Research Study Projects</u>

Chickpea and lentil crop improvement project

In 2001, a five-year crop improvement project for chickpea and lentil was initiated at the Crop Diversification Centre South, in collaboration with the Crop Development Centre, University of Saskatchewan, Saskatoon, Saskatchewan, where F_1 and F_2 generations of both crop species raised. The main objective of this project is to develop new chickpea and lentil cultivars for southern Alberta under dryland conditions with specific selection criteria of high seed yield, early flowering and uniform maturity, resistance to common foliar and root diseases and desired market traits.

Seed of lentil and chickpea $F_{2:3}$ generation from the Crop Development Centre, University of Saskatchewan and seed of $F_{2:4}$ and $F_{2:5}$ generations of chickpea and lentil selected under field conditions in southern Alberta in previous years, were planted for further evaluation and selection at the Crop Diversification Centre South (CDCS), Brooks (52°9′ N Lat, 106 W Long.,515m Elevation) and Bow Island Sub Station (50°33′ N Lat, 111 51′ W Long, 758m Elevation) in 2003. The crops were seeded between May 15 and May 28, 2003.

Three hundred and thirty $F_{2:3}$ Desi and small Kabuli chickpea micro-plots were planted at CDCS. A total of 54 micro-plots were harvested based on desirable growth habits and crop maturity. Using seed quality and days to maturity, 5 lines of the small Kabuli-type and 24 of the Desi were selected for further evaluation in 2004. Twenty-eight chickpea $F_{2:4}$ small plots (6, 3-m long rows spaced 18-cm apart) were established at CDCS with single replication. Seed material derived partly from the $F_{2:3}$ in 2002 (6 Desi and1 Kabuli) and partly from the $F_{2:3}$ in 2001 (5 Desi and 6 Kabuli) were included. Using plant growth traits, yield components and plant maturity, 4 Desi and 3 Kabuli chickpeas were selected for further evaluation. Twenty-six chickpea $F_{2:5}$ standard plots (6, 6-m long rows spaced 18-cm apart) were planted at two locations, Bow Island sub station and CDCS with single replication at each location. Using plant growth traits, yield components and plant maturity, 6 Desi and 5 Kabuli chickpeas were selected for further evaluation in 2004.

One hundred and fifty-eight lentil $F_{2:3}$ micro-plots were planted at the Bow Island sub station. A total of 31 out of 79 small green entries and 41 out of 79 red lentil entries were harvested based on desirable growth habit and crop maturity characteristics. Using seed yield and quality, 17 entries from each small green and red lentil types were selected for further evaluation in 2004. Twenty-six lentil $F_{2:4}$ standard plots were planted at two locations, Bow Island sub station and CDCS, Brooks with one replication at each location. Using plant growth traits, yield components and plant maturity, 2 large green and 8 red lentil lines were selected for further evaluation. Twenty-six lentil $F_{2:5}$ standard plots were grown at two locations, Bow Island sub station and CDCS, Brooks with one replication at each location. All entries were of the red lentil type. Using plant growth traits, yield components and plant maturity, 6 lentil lines were selected for further evaluation in 2004.

Fall vs. spring seeding of desi chickpea

Fall seeding, or dormant seeding, refers to the planting of spring crop species in the fall, prior to freeze up. A field study was conducted in 2002/2003 cropping season at CDCS, using the desi chickpea cultivar Myles. Treatments included two seeding dates in late fall (Nov. 8 and Nov. 22, 2002) and two seeding dates in early spring (May 02 and May 21, 2003). Seeding for each fall seeded treatment was done using 1 time, 1.5 times and 2.0 times the recommended seeding rates for uncoated seed and the seeding rate recommended by Grow Tec Inc. Edmonton, Alberta, Canada for plastic polymer-coated seed. The recommended seeding rate was used for the spring-seeded treatments. Treatments were arranged in a randomized complete block design (RCBD) with 4 replications. Each plot was 6.0 m long and consisted of 6 rows, spaced 17.5 cm apart. The crop was grown under rain-fed conditions. Data collection included stand count at 5 weeks after spring seeding, date of first flowering, date of maturity, plant height at harvest, 1000-seed weight, number of seeds per plant at harvest, harvest index and plot seed yield after eliminating borders.

On average, fall-seeding treatments had no significant effect on final plant height, harvest index or mean seed weight of chickpea compared to the spring-seeded crop. However, on average, later spring-seeded crop produced significantly heavier seed than early spring-seeded crop. Increasing seeding rate of fall-seeded treatments consistently increased both plant population density and seed yield, but the effects were significant only in the later fall-seeded treatments. On average, plant population density of the fall-seeded, uncoated seed at recommended seeding rate was comparable with that of the fall-seeded plastic polymer seed coat treatment, which was about 69 per cent of the actually seeded density (55 seeds m^{-2}). This indicates that the plastic polymer seed coat treatment had no beneficial effect on seedling establishment of the fall-seeded chickpea crop. The earlier spring-seeded crop produced about 11.6 per cent higher seed yield than the later spring-seeded crop, but the difference was not significant. The earlier fall-seeded crop using the recommended seeding rate produced significantly lower seed yield than the earlier spring-seed crop, but it comparable with that of later spring-seeded crop. Lower stand establishment of the earlier fall-seeded crop may have been the main reason for this yield reduction. Higher soil moisture conditions due to a rainfall received after the earlier fall seeding may have injured some seeds during the ground freeing process. Among the later fall-seeded treatments, the treatments with 1.5 and 2.0 times seeding rates produced significantly higher seed yield, compared to the both spring-seeded crops. This indicates that for enhanced seed yield from the fall-seeded Myles chickpea, the crop should be seeded in vary late fall at 1.5 times recommended seeding rate. On average plants from the fall-seeded treatments flowered and attained maturity 15 days and 10 days, respectively earlier than spring–seeded.

In summary, these results indicate late fall seeding of desi chickpea can be practiced in southern Alberta. The early and uniform crop maturity from fall seeding is critical in years with above normal precipitation in August. Since the conclusions are based on results of two-season single-site study, comprehensive studies covering a wide range of soil and climatic conditions in the Brown and Dark Brown soil zones, are required before fall seeding can be recommended in southern Alberta.

Impact of seed size planted on crop phenology and seed yield

The size of the seeds planted has been shown to have a significant impact on seedling establishment, seedling vigor and crop growth of several small-seeded field crops such as mustard, coriander and carrot. In contrast, other studies have revealed that the seed size had no significant impact on plant growth and development, and final seed yield of large-seeded crops such as chickpeas. Two studies were conducted at Crop Diversification Centre South to examine the effect of size of seeds planted, on seedling growth, seed yield and seed size profile of the resulting crop of four kabuli chickpea and four pinto bean cultivars under field conditions in southern Alberta.

Kabuli chickpeas

Three large-seeded kabuli chickpea cultivars, Sanford, Evans and CDC Xena, and one small-seeded kabuli cultivar, CDC Chico were used for this study. Seed of each chickpea cultivar were screened into two size categories, for large-seeded cultivars, <8.7 mm and >8.7mm, and small-seeded cultivar, < 8.1, and > 8.1 mm. These treatments (cultivar x seed size) were seeded at the recommended seeding rate (55 seeds m^{-2}). In addition, another treatment using smaller seed category of all chickpea cultivars at 1.2 x recommended seeding rate was included. The treatments were arranged in a RCBD with 4 replications. Each plot was 6.0 m long and consisted of 6 rows, spaced 17.5 cm apart. The crop was grown under rain-fed conditions using recommended cultural practices. Data collection included stand establishment at 5 weeks after seeding, date of first flowering, plant height at first flowering, date of maturity, number of seeds per plant at harvest, 1000-seed weight, harvest index, plot seed yield after eliminating borders.

The chickpea cultivars differed in plant height, seed yield components and seed size distribution, but the size of seed planted had no significant impact on most of the parameters measured. The large-seeded chickpea cultivars, Sanford and Evans were taller than the large-seeded cultivar CDC Xena and the small-seeded cultivar CDC Chico. All three large-seeded cultivars flowered simultaneously, but 7 days later than CDC Chico. Both Sanford and Evens cultivars matured simultaneously, but 7 days later than Chico, and Xena 4 days later than Chico. All three large-seeded chickpea cultivars produced fewer seeds plant^{-1}, compared to CDC Chico. The analysis of seed size distribution of the chickpeas indicates that over 81 per cent of total seed yield of the large-seeded cultivars had a diameter > 8.7 mm, whereas in the small-seeded cultivar CDC Chico, over 96 per cent of the seed yield had a diameter < 8.1 mm. Despite these phenological differences, the lack of a significant impact of seed size planted, on plant growth, seed yield components and seed yield suggests that smaller seed of kabuli chickpea can be used for planting without affecting seed yield or the seed size profile of the resulting crop. Moreover, the use of smaller seed category at higher seeding rate (1.2 x recommended seeding rate) had no significant effect on seed yield. This assumes the reduction in seed size not due to disease infected seed or immature seed. A germination test should be done. If smaller seed category is used for planting purpose, the grower could reduce their seed cost due to reduced seeding rate and transportation cost. At the same time, the larger- seeded portion of the crop can be sold at a premium for human consumption.

Pinto Bean

The seeds of the four cultivars (Othello, Fargo, CDC Pintium and CDC Pinnacle) were screened into four size categories (<7.1 mm, 7.1-7.9 mm, 7.9-8.7 mm and > 8.7 mm in diameter). These seed categories of the 4 bean cultivars were seeded at the recommended seeding rate (55 seeds m^{-2}). In addition, a treatment using the 7.1 –7.9 mm seed category at 1.3 x recommended seeding rate was also included. The crop was seeded at a spacing of 0.18 m between rows on May 26, 2003 and was grown under irrigation using recommended cultural practices. Treatments were arranged in a 4 (cultivar) x 5 (4 seed size + 1 smaller seed category at higher seeding rate) factorial structure in a Randomized Complete Block Design (RCBD) with 4 replications. Plant population density at five weeks after seeding, plant height at harvest, 1000-seed weight, test weight, plot seed yield and seed size distribution of the resulting crop were determined. Data were subjected to ANOVA and treatment means were compared using an LSD test.

Pinto bean cultivars differed in plant height, mean seed weight, seed density, and seed yield. On average, CDC Pinnacle and Fargo produced the tallest plants whereas Othello produced the shortest plants. Regardless of cultivar or size of seed planted, all the bean cultivars flowered on July 18, 2002. There was a difference in crop maturity among cultivars, but size of seed planted had no impact on crop maturity. Among bean cultivars, CDC Pintium matured earliest (107 days after seeding) whereas CDC Pinnacle matured latest (120 days after seeding). Both Othello and Fargo matured 115 days after seeding. On average, CDC Pinnacle produced the heaviest seed (408 mg/seed) and Othello produced the lightest seed (386 mg/seed). On average, the size of seed planted had no significant impact on seed yield, final plant height, test weight or plant population density. These results indicate that smaller seed categories can be used for seed purpose without having any adverse impact on seed yield, while larger seed categories can be used for human consumption purpose. Moreover, use of the 7.1 –7.9 mm seed category at 1.3 x recommended seeding rate had no benefit to seed yield of the resulting crop.

Evaluation of rosemary as a potential medicinal plant for Alberta

Rosemary (*Rosmarinus officinalis* L.), a member of the *Labiatae* or mint family, is a slow growing, cold sensitive, woody perennial cultivated for the aromatic foliage. Rosemary is used primarily as a culinary herb with meats, vegetables and in soups. In traditional medicine, the plant is used as an astringent and diuretic, and to increase menstrual flow. Interest has been increased in using rosemary extracts as a source of anti-oxidants in commercial food preparations. The information, however, on production feasibilities and growing requirements of rosemary under prairie conditions is limited. Several field studies were conducted:

- To evaluate the possibilities of growing rosemary as an annual crop under field conditions at CDCS;
- To evaluate the impact of freezing temperatures exposed in the field, and killing frost on plant growth and antioxidant content in rosemary;
- To evaluate effect of age of the rooted stem cutting planted in field, on growth and productivity of rosemary;
- To evaluate the effect of planting density and soil nitrogen content on plant growth, productivity and product quality of rosemary.

In a cultivar evaluation study, seven promising of rosemary cultivars, namely Apr, Blue Boy, Majorca, Santa Barbara, Severn Sea, Standard and Rex were planted using 8-week-old rooted stem cuttings at CDCS at a spacing of 30 cm x 20 cm (166,666 plants ha^{-1}) on June 10, 2003. The field was fertilized with 12:51:0 (N:P:K) fertilizer mixture at a rate of 42 kg ha^{-1}, prior to the final land preparation. The crop was grown under irrigation. Data collections included, plant height and plant diameter, total above ground dry weight, leaf and stem dry weights, and total activity (TA = carnosic acid+carnosol+12-methoxy carnosonic acid content, expressed as a percentage of leaf dry weight) before and after light and killing frosts. All the compound extractions and chemical analysis were carried out at Norac Technologies Inc., Edmonton, AB, Canada.

Rosemary cultivars Standard and Arp were the tallest (38 –40cm), Rex, Majorca and Severn Seas were intermediate (26-38 cm) and Santa Barbara and Blue Boy were the shortest (8-11 cm) at 13 weeks of age. Rosemary cultivars Rex, Majorca and Severn Seas produced significantly higher total aboveground biomass, whereas Blue Boy produced significantly lower biomass, compared to Standard. In rosemary, foliage portion is the most important plant part since it contains over 85 per cent the total antioxidant content (TA = total activity). The leafiness (dry weight ratio between foliage portion and the total above ground portion) is more important than the total aboveground biomass production. Results also suggest that leafiness of both rosemary cultivar Blue boy (88 per cent) and Santa Barbara (81 per cent) are significantly higher than the cultivar Standard (75 per cent) when those cultivars are 18 weeks old. The total antioxidant contents were comparable (varied from 3.9 per cent for Blue Boy to 4.8 per cent for Standard) among cultivars when they were 13 weeks old. However, following a light frost at 18 weeks of age and killing frost at 20 weeks of age the antioxidant content slightly reduced in Standard, Rex, Apr and Severn Seas, but the antioxidant contents in Majorca, Santa Barbara and Blue Boy did not change, compared to that of 13-week-old plants. The total antioxidant yield in foliage per plant basis was also calculated. Results indicated that despite the fact that antioxidant content slightly lowered as a result of aging, light or killing frosts in aforementioned cultivars, Rex (2.08-2.26 per cent), Majorca (1.88-1.86 per cent) Standard (1.51-1.59 per cent) and Severn Seas (1.57-1.43 per cent) were still superior in terms of total antioxidant production under field production, due mainly to higher foliage production. These cultivars can also be harvested with no adverse impact on the total antioxidant yield, even after light or killing frosts.

A study to evaluate the impact of age of rooted stem cutting in plugs, on plant growth, productivity and plant mortality of rosemary cultivar Majorca was conducted using 4-, 6- and 8-week-old rooted stem cuttings. The stem cuttings were transplanted at a spacing of 60 cm x 20 cm. Cultural practices adopted were similar to that of the rosemary cultivar study. Data collections included plant height, plant diameter, total above ground biomass, and leaf and stem dry weights at 13 weeks after transplanting. Results indicated that age of rooted stem cuttings in nursery had no significant effect on plant height or diameter of filed-grown 13-week-old plants. The total above ground biomass production of the plants raised from 8-week-old plants was significantly higher (13 per cent) than that of the plants raised from the 4-week-old stem cuttings. However, age of rooted stem cuttings had no impact on leaf production, but those plants raised from 8-week-old stem cuttings produced significantly higher stem dry weight than that of the plants raised from 4-week-old rooted stem cuttings. This suggests that the above ground biomass increase in the plants raised from 8-week-old stem cuttings, was mainly due to enhanced stem production. Results also indicate that rosemary stems contain very low amounts of antioxidants, compared to that of the foliage. Thus, the use of 8-week-old rooted stem cuttings, as a planting material for field establishment, appears to have no additional benefits in terms of leaf production, compared to the use of 4-week-old rooted stem cuttings. Results suggest that 4-week-old rooted stem cuttings can be used as a planting material for field production of rosemary.

A study was conducted to evaluate the effect of planting density and soil nitrogen content on crop growth and antioxidant yield in rosemary cultivar Majorca. The cultural practices were similar to that of the cultivar evaluation study. A basal fertilizer mixture (N:P:K = 12:51:0 at a rate of 42 kg/ha) was applied at prior to final land preparation. Treatments included two plant population densities (60 cm x 20 cm = 83,333 plants ha^{-1} and 30 cm x 20 cm = 166,666 plants ha^{-1}) and two nitrogen rates (50 and 100 N kg ha^{-1}) arranged in factorial structure and control plots with a plant population density of 83, 333 plants ha^{-1} with the basal fertilizer application. Each plot consisted of three rows and each row consisted of 15 plants. The treatments were arranged in a RCBD with 3 replications and data were collected from the middle row plants. Data collections included plant height and diameter; total biomass production, leaf and stem dry weights and TA and antioxidant productivity, at 13 weeks after transplanting. Results indicated that both applied nitrogen and plant population density had no significant effect on plant height, diameter, total aboveground biomass leaf and stem production, and antioxidant content. The highest leaf production and antioxidant yield were observed from the plants grown at a spacing 30 cm x 20 cm at 50 N kg ha^{-1} and increasing N rates from 50 to 100 N kg ha^{-1} had no beneficial effect on either leaf production or antioxidant production.

Evaluation of field pepperweed (*Lepidium campestre* L.) cultivars for glucoraphanin production

Recent studies have shown a reduction in blood pressure, atherosclesrotic-like changes and a reduction in stroke and heart diseases in a rodent system model, following the ingestion of broccoli sprouts with high levels of glucoraphanin. Furthermore, field pepperweed (*Lepidium campestre* L.), a member of the *Brassicaceae* family was found to contain a significant level of glucoraphanin in leaves. Several studies were conducted to evaluate and select most promise field pepperweed accession/s, in terms of biomass productivity and glucoraphanin content under greenhouse conditions, to determine the best growing condition and processing practices for higher glucoraphanin yield.

A greenhouse study was conducted using seven accessions received from USDA, ARS, Iowa State University and a local collection from Acadia Valley to evaluate for glucoraphanin content and productivity. Results indicated that aboveground biomass production of different accessions varied from 5.2 to 35.6g/ plant, where the accession Ames 13179 produced the highest biomass and the local collection produced the lowest biomass. Glucoraphanin content of accessions varied from 3.1to 180.8 μm/FW g. The accession Ames 13179 contained the highest and the local collection contained the lowest glucoraphanin content among the accessions. The accessions Ames 13179, Ames 15718 and Ames 13180 were found to be most promise accessions in terms of glucoraphanin production under greenhouse conditions.

A growth chamber study was conducted to determine the impact of growing conditions (12/12h day/night, 24/6°C; 12/12h day/night, 24/12°C; 16/8h day/night, 24/6°C and 16/8h day/night, 24/12°C) on plant growth and glucoraphanin content. On average, under short day conditions (12/12h day/night), field pepperweed produced significantly higher number of leaves/plant, and lower aboveground biomass when plants were grown under warmer nights (12°C) than those grown under cooler nights (6°C). Under long day conditions, cooler nights (6°C) were favorable for leaf production compared to warmer nights (12°C), but night temperatures had no impact on above ground biomass production.

On average, plant growing under short day conditions, had significantly higher glucoraphanin content when grown under cooler nights than those grown under warmer nights. However, under long day conditions, night temperatures had no significant impact on glucoraphanin content. On average, accession Ames 15718 was superior in terms of glucoraphanin production compared to other accessions, and for higher glucoraphanin production, Ames 15718 should be grown under short day with cooler night conditions.

A study was conducted to examine the impact of crop growth stage on glucoraphanin content using Ames 13179. Results indicated that young seedlings at the 1-2 true leaf stage did not contain glucoraphanin in leaves. However, as the plant attained 40 days of age, the leaf glucoraphanin content had reached 874 μg/DW g, but as seedlings get older (50 days old), the glucoraphanin content has reduced by 44 per cent, indicating that 40-day-old seedling would be the most suitable growth stage of harvest for the highest glucoraphanin content.

Two separate studies were conducted to determine the impact of pre- and post-harvest stresses imposed on plants, on glucoraphanin content of field pepperweed. The pre-harvest stress study was conducted using Ames 13180. The post-harvest stress study was conducted using 3 field pepperweed accessions Ames 13179, Ames 13180 and Ames 15718. The pre-harvest stress treatment imposed at full-rosette stage by maintaining water content at 50 per cent field capacity for 3 or 6 days, or irrigating plants with 75 mM NaCl for 3 or 6 days, prior to harvest. Drying the harvested leaves at room temperature for 4 days, prior to extract glucoraphanin, imposed the post-harvest stress. The salt treatment applied for 3 and 6 days enhanced the leaf glucoraphanin content by 39 per cent and 66 per cent, respectively over the water control. Conversely, water stress treatment applied for 3 and 6 days reduced glucoraphanin content by 15.5 per cent and 18 per cent, respectively, compared to the water control. On average, desiccation treatment enhanced glucoraphanin content by over 3.4 times compared to that of fresh leaves. The response to the desiccation treatment, however, was accession specific. The treatment enhanced the glucoraphanin content by 6, 3 and 2 times in Ames 15718, Ames 13180 and Ames 13179, respectively, compared to the corresponding controls. It was concluded that salt stress imposed through 75 mM NaCl treatment for 6 days prior to harvest the crop could be used as a means of enhancing the glucoraphanin content in field pepperweed. Moreover, desiccation of leaves at room temperatures prior to extract could enhance the glucoraphanin content. Ames 15718 was the most promise accession in terms of glucoraphanin productivity, thus this accession may be useful for further evaluation.

Evaluation of the effect of rhizobacterial isolates on the activity of Rhizobial inoculants and growth promotion of field pea, lentil and chickpea

Pulse crops play a vital role in crop rotations on the Canadian Prairies. They increase profitability by eliminating the need for nitrogen fertilizer due to their ability to fix atmospheric nitrogen. An industry sponsored field studies were conducted at CDCS, to examine the effect of Rhizobacterial isolates on the activity of Rhizobial inoculants in relation to root nodulation and seed yield in field pea, lentil and chickpea. The confidentiality agreement signed between the project sponsor (Becker Underwood, Saskatoon, SK.) and AAFRD does not allow publishing the results of these studies in this report.

Crop selection and improvement

The seed of Echinacea angustifolia, E. pallida, E purpurea and borage and the stolons of peppermint, spearmint and Alaskan mint were treated with mutagenic compound, Ethyl Methanesulphonate (EMS) in 2000. Treated seeds and stolons were planted in plugs or pots and placed in a greenhouse. In early spring, both Echinacea and mint species were transplanted in the field. Echinacea species are being visually evaluated for aster yellows disease resistance and medicinal quality. The mint species are being evaluated for over wintering ability and essential oil contents. Foliage of individual mint plants raised from the treated stolons was used to extract essential oil and crop selection based on essential oil content, oil composition and over-wintering ability is in progress.

The seed harvested from borage plants from EMS-treated seed were planted in spring 2003 in the field for selection and seed multiplication. Based on maturity, borage plants were categorized into several groups and further selection is in progress based on seed shattering, and seed oil content.

Regional cultivar evaluations

Newly recommended cultivars and promising lines of chickpeas, dry beans, field peas, lentils and fababean 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 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. Majority of bean cultivars/lines for this evaluation receives from the dry bean crop improvement programs at the Lethbridge Research Center, Agriculture and Agri-food Canada and the Crop Development Centre at the University of Saskatchewan.

Six field studies (five regional and one coop tests) with various dry bean lines/varieties were established in late May, 2003, at the Bow Island sub station (1 coop, 1 narrow row and 1 wide row under irrigation) and at CDCS (1 narrow row and 1 wide row under irrigation and 1 narrow under rain-fed conditions). Under both irrigation and rain-fed conditions, performance of most bean cultivars/lines was site-specific. However, under irrigation at both test sites, narrow row grown bean cultivar, Alert, UI 906, CDC Jet, Black Violet significantly out-yielded the standard cultivar Othello. Seed yields of most wide row grown bean cultivars were comparable with the standard cultivar Othello at both sites. However, both CDC Nighthawk and CDC Expresso produced significantly lower seed yield compared to the standard cultivar Othello. Relatively higher variability (CV = 25 per cent) in seed yield among bean cultivars was noted when grown under rain-fed conditions. Most bean cultivars produced comparable seed yields, but bean cultivar CDC Minto significantly out-yielded the standard cultivar Othello. In contrast, both AC Polaris and AC Black Diamond produced significantly lower seed yield.

Five field pea cultivar evaluations were conducted at CDCS (dry land and irrigated test sites) and the Bow Island sub station, to evaluate varieties/lines for regional adaptation. At both test sites, under rain-fed conditions, most yellow pea cultivars/lines produced comparable seed yields than the standard cultivars, Carrera and Swing, and SW Salute and CDC Golden produced significantly higher seed yield than the standard cultivars only at Bow Island. At CDCS, under irrigation, most yellow pea cultivars/lines produced over 3.5-fold higher seed yields than those produced under rain-fed conditions. The green pea cultivars evaluated at CDCS produced comparable seed yields, but at the Bow Island site, field pea cultivars/lines Nessie, Stratus, CO-96-901 all produced over 30 per cent higher seed yield than the standard cultivar Nitouche.

Different lines and registered varieties of other pulse crops, such as chickpeas, lentils, fababean, lupin and soybeans, were evaluated for regional adaptation. Two lentil test sites were established at CDCS and the Bow Island test sites. Most lentil cultivars/lines produced similar seed yields to the seed coat & yellow corresponding standard lentils Laird (large-seeded green seed coat with yellow cotyledons) and CDC Milestone (medium-seeded green seed coat with yellow cotyledons). However, the large-seeded green cotyledon cultivar CDC Plato produced a significantly higher seed yield than the standard. Two chickpea tests by including both kabuli and desi types, were established under dry land conditions at Bow Island and CDCS. At both test sites, seed yields of desi chickpeas were comparable with the standard cultivar Myles. Most Kabuli chickpea cultivars produced comparable seed yields with the standard cultivar Sanford at both test site, but chickpea cultivars CDC Frontier produced over 23 per cent seed yield than the standard only at CDCS.

Several 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 and pigeon pea (*Cajanus cajan* L. Millisp) were planted in the research field at CDCS in mid May, 2003. Mature seed from selected plants of all the new pulse species, except pigeon pea were harvested. Further evaluation and selection will be conducted in 2004.

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 evaluate new crops and to develop agronomic practices.