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# **Quality of Western Canadian Flaxseed**

## **1997**

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## Summary

The 1997 western Canadian flaxseed crop was near average in oil and protein content, with an above average iodine value.

Warmer, drier weather compared to 1996 contributed to a crop with a lower iodine value and oil content but higher protein content (Table 1). The iodine value was 2 units higher, the oil content was 0.1 percentage units higher and the protein content 0.2 percentage units lower than the 10-year means. The fatty acid composition (Table 2) showed lower linolenic acid content and this resulted in lower iodine values than in 1996.

The warmer, drier areas had lower oil contents and iodine values than the reported means.

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**Table 1 • Quality data for harvest survey No. 1 Canada Western flaxseed**

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Quality parameter	1997	1996	1987–96 Mean
Oil content, % (dry matter basis)	43.9	44.3	43.8
Protein content, % (N x 6.25, dry matter basis)	23.5	21.9	23.7
Linolenic acid content, % in oil	58.0	58.7	57.1
Iodine value	193	194	191
Free fatty acids, %	0.2	0.2	0.2 <sup>1</sup>

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<sup>1</sup> free fatty acid data are for 1989-96

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**Table 2 • Fatty acid composition<sup>1</sup> of harvest survey No. 1 Canada Western flaxseed**

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Fatty acid <sup>1</sup>	1997	1996	1987–96 Mean
	%	%	%
Palmitic (C16:0)	5.2	5.4	5.2
Stearic (C18:0)	3.5	3.3	3.2
Oleic (C18:1)	18.1	17.6	19.0
Linoleic (C18:2)	15.1	14.7	14.7
Linolenic (C18:3)	58.0	58.7	57.1

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<sup>1</sup> percent of total fatty acids

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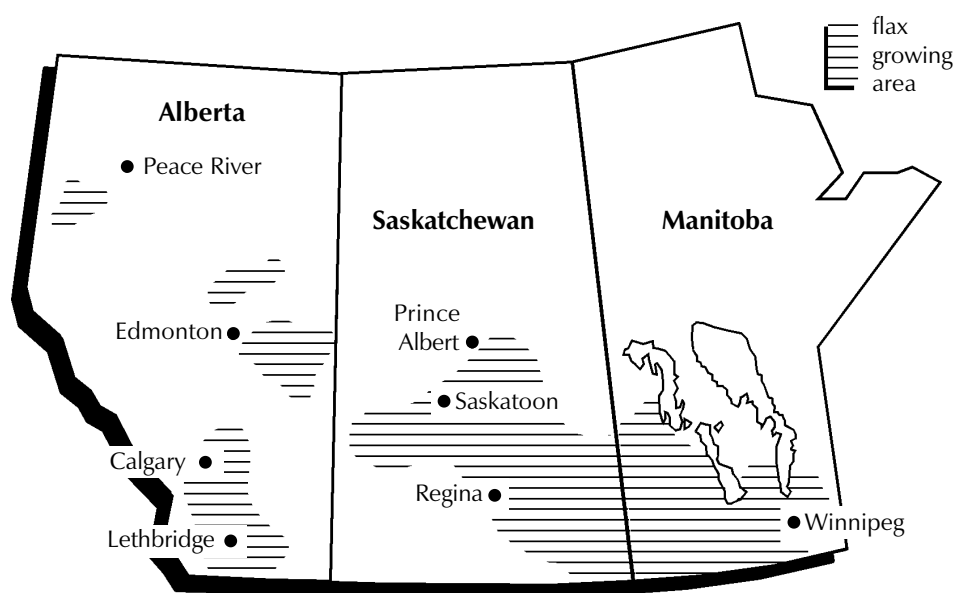
## Introduction

This report presents information on the major quality parameters for the 1997 crop of western Canadian flaxseed. Included is information on the oil, protein, and free fatty acid content and the fatty acid composition, including iodine value, of harvest samples. Quality data presented were obtained from analyses of flaxseed samples submitted to the Grain Research Laboratory throughout the harvest period by producers, grain companies and oilseed crushing plants.

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**Figure 1 • Map of Canadian prairies showing traditional growing area for flaxseed**

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## Weather and production review

Western Canadian farmers planted 834 000 hectares of flaxseed in 1997, an increase of 41% from the previous year (Table 3). Flaxseed production in western Canada is estimated to be 966 600 tonnes, an increase of 15% from 1996 production (Statistics Canada, *Field Crop Reporting Series No. 8*, December 5, 1997). Saskatchewan accounted for 58% of the total 1997 flaxseed production, Manitoba, for 39%, and Alberta, for 3%.

Cool, wet conditions over much of the prairies early in the 1997 season delayed the start of seeding. Seeding started in the western areas of the prairie region in the first half of May, while eastern and extreme northern regions had to wait until the last half of May to begin planting. Delays in seeding were caused by flooding in the Red River Valley of Manitoba, where seeding did not start until early to mid-June, and dryness in the eastern regions of Saskatchewan and western Manitoba.

June temperatures were warmer than normal in the eastern prairies, while western areas experienced mostly normal temperatures. Rainfall in June was variable, with western areas receiving close to normal amounts and eastern regions receiving below-normal amounts. The dry weather was particularly stressful for flaxseed in southwestern Manitoba and southeastern Saskatchewan. The dryness in these regions caused poor germination and limited the yield potential of the crop. The normal to above-normal rainfall in the western regions was welcomed in the south, but the northern areas of Alberta did not need the moisture.

July temperatures were normal initially, but were above normal in the latter half of the month. July rainfall was below normal in most of the prairie regions, with the exception of Manitoba. The combination of above-normal temperatures and reduced precipitation in the rest of the prairies caused crop conditions to decline in the last half of July. The dry, hot weather continued for the first two weeks in August, which caused stress to the flaxseed crop. Stress during flowering resulted in a reduced boll set which led to lower yields. Rains returned to the prairie region in mid-August, which helped to improve conditions in some northern areas but was too late to improve yields significantly.

The flaxseed harvest began in early September and close to 40% was combined by mid-September. As of October 7, 1997, the Weather and Crop Surveillance Department of the Canadian Wheat Board estimated that the 1997 flaxseed crop was 45% combined in Alberta and over 95% combined in Saskatchewan and Manitoba. The 1997 flaxseed yield (1160 kg/ha) was lower than both the 1996 yield (1470 kg/ha) and the ten-year average yield (1200 kg/ha).

**Table 3 • Seeded area and production for the 1997 and 1996 crops  
of western Canadian flaxseed and average annual flaxseed production  
for the 10-year period 1987 to 1996**

	Seeded area <sup>1</sup> thousand hectares		Production <sup>1</sup> thousand tonnes		Average production <sup>2</sup> thousand tonnes
	1997	1996	1997	1996	1987–96
Manitoba	304	231	379	358	309
Saskatchewan	506	348	556	473	344
Alberta <sup>3</sup>	24	14	32	20	38
<b>Western Canada</b>	<b>834</b>	<b>593</b>	<b>967</b>	<b>851</b>	<b>691</b>

<sup>1</sup> source—*Field Crop Reporting Series, No. 8*, December 5, 1997, Statistics Canada

<sup>2</sup> source—*Field Crop Reporting Series*, revised final estimates for 1987–96

<sup>3</sup> includes the part of the Peace River area that is in British Columbia

## Quality of 1997 flaxseed

Quality factors for flaxseed include oil content, protein content and iodine value (Table 4). Oil and protein content give quantitative estimates of the value of the seed as a source of oil and of the resulting meal as a source of protein for animal feed. Iodine value is a measure of the overall unsaturation of the oils. Oils with higher iodine values, that is, with more unsaturation, polymerize more rapidly in the presence of air. Iodine value is calculated from the fatty acid composition (Table 5). In flaxseed, the high level of linolenic acid is an important quality factor as it is this acid which is responsible for most of the drying properties. Linolenic acid is also the  $\omega$ -3 fatty acid which contributes to health aspects of flaxseed's increasing use as a component in some cereals and baked goods.

In Tables 4 and 5, the number of samples in each province may not be representative of the actual production or grade distribution. However, samples were drawn so as to provide good quality information for each province.

**Table 4 • Quality data for 1997 crop of No. 1 Canada western flaxseed by province**

	Number of samples tested	Oil content <sup>1</sup>			Protein content <sup>2</sup>			Iodine value		
		%			%					
		Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.
Manitoba	243	43.9	39.0	49.6	23.1	19.0	27.4	194	183	201
Saskatchewan	412	43.8	39.2	48.4	23.7	18.5	29.7	192	181	199
Alberta <sup>3</sup>	14	43.9	40.7	45.9	23.5	20.7	25.9	195	184	192
<b>Western Canada<sup>4</sup></b>	<b>669</b>	<b>43.9</b>	<b>39.0</b>	<b>49.6</b>	<b>23.5</b>	<b>18.5</b>	<b>29.7</b>	<b>193</b>	<b>181</b>	<b>201</b>

<sup>1</sup> dry matter basis

<sup>2</sup> dry matter basis, %N x 6.25

<sup>3</sup> includes the part of the Peace River area that is in British Columbia

<sup>4</sup> values are weighted averages based on estimated production by province (Statistics Canada)

**Table 5 • Fatty acid composition and free fatty acid content for the 1997 crop of No. 1 Canada Western flaxseed by province**

Province	Number of samples tested	Fatty acid composition <sup>1</sup>					Free fatty acids
		C16:0	C18:0	C18:1	C18:2	C18:3	
		%	%	%	%	%	%
Manitoba	243	5.1	3.4	17.9	14.7	58.8	0.24
Saskatchewan	412	5.3	3.6	18.3	15.3	57.4	0.14
Alberta <sup>2</sup>	14	4.9	3.6	17.7	14.8	58.9	0.23
<b>Western Canada<sup>3</sup></b>	<b>669</b>	<b>5.2</b>	<b>3.5</b>	<b>18.1</b>	<b>15.1</b>	<b>58.0</b>	<b>0.18</b>

<sup>1</sup> % of total fatty acids including: Palmitic (C16:0), Stearic (C18:0), Oleic (C18:1), Linoleic (C18:2), Linolenic (C18:3)

<sup>2</sup> includes the part of the Peace River area that is in British Columbia

<sup>3</sup> values are weighted averages based on estimated production by province (Statistics Canada)

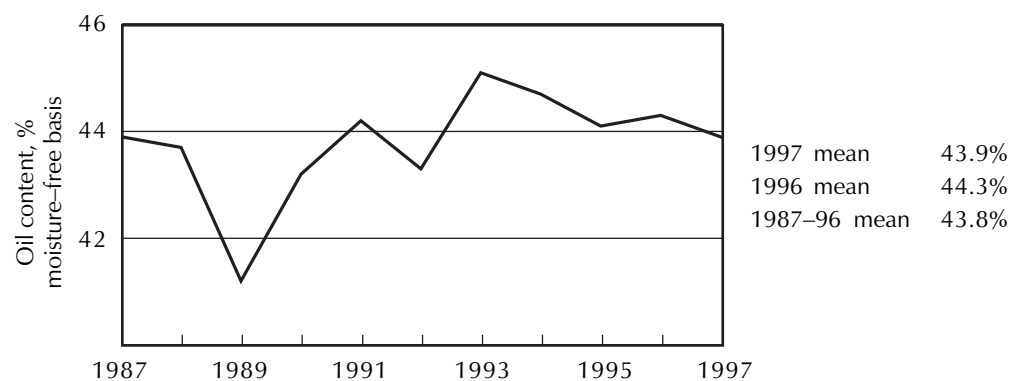
**Table 6 • Comparison of quality factors of No.1 Canada Western flaxseed from the 1997 crop with export shipments of No. 1 Canada Western flaxseed**

Quality parameter	1997 survey	1996/97 exports	October 1997 exports
Oil content, %	43.9	44.7	43.7
Protein content, %	23.5	21.3	23.4
FFA,%	0.2	0.7	0.6
Iodine value	193	196	192
C16:0, %	5.2	5.3	5.3
C18:0, %	3.5	3.2	3.6
C18:1, %	18.1	16.8	18.4
C18:2, %	15.1	14.9	15.2
C18:3, %	58.0	59.5	57.4

## Oil content

The mean oil content of No. 1 CW flaxseed at 43.9% was 0.4 percentage units lower than in 1996 but similar to the 10-year mean of 43.8%. Compared to 1996, mean oil contents decreased by 0.9 percentage units for Saskatchewan but increased by 0.2 percentage units for Manitoba (Table 4). The small number of samples received from Alberta each year make annual comparisons unreliable. The hot, dry growing conditions in southern Saskatchewan contributed to the lower oil contents for that province. The oil content of the October 1997 flaxseed exports averaged 43.7%, a decrease from the 1996–97 export mean of 44.7% (Table 6). This suggests that the oil content of 1997–98 flaxseed exports will be about one percentage unit lower than in the previous year.

**Oil content of harvest survey samples of No. 1 Canada Western flaxseed 1987–97**



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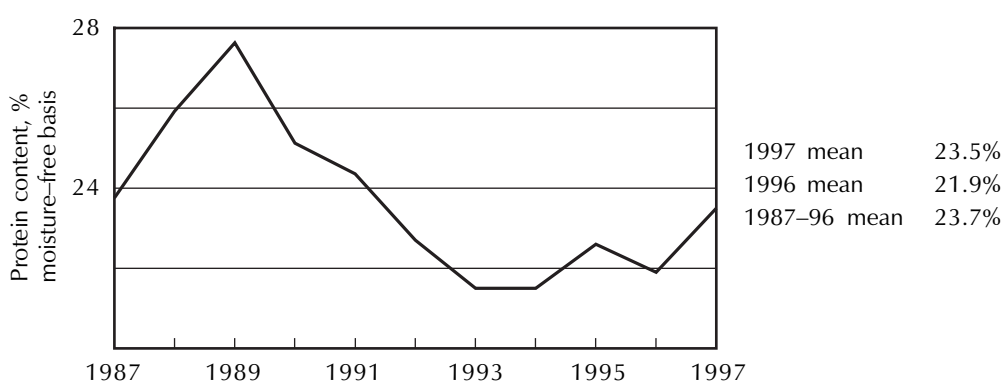
## Protein content

At 23.5%, the seed protein content of No. 1 CW flaxseed was 1.6 percentage units higher than in 1996 but was similar to the 10-year average of 23.7%. Protein content in Manitoba was only 0.2 percentage units higher, while in Saskatchewan it was 2.5 percentage units higher than in 1996. The higher protein content in Saskatchewan is characteristic of regions that have experienced heat stress. The protein content of flaxseed exports, which averaged 21.3% during the 1996/97 shipping season, increased to 23.4% by October 1997. The protein content of 1997–98 flaxseed exports may be as much as 2 percentage units higher than in 1996–97 (Table 6).

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### Protein content of harvest survey samples of No. 1 Canada Western flaxseed 1987–97

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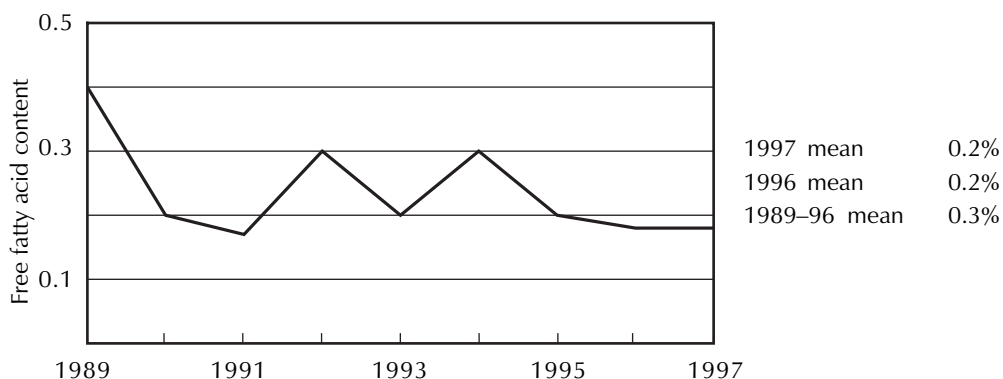
## Free fatty acid content

The free fatty acid (FFA) content of the 1997 flaxseed crop, 0.2 %, was similar to the 1996 and 10-year means. Regions that experienced delayed harvests had higher FFA levels than the mean. Because this is only the fifth year that FFA levels have been reported, FFA data for 1989 to 1992 were obtained from weekly composite reports to produce a 1989–96 mean (0.3%). As of October 1997, the FFA content of 1CW Flaxseed exports averaged 0.6%, similar to the 1996–97 exports at 0.7% (Table 6).

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### Free fatty acid content of harvest survey samples of No. 1 Canada Western flaxseed 1989–97

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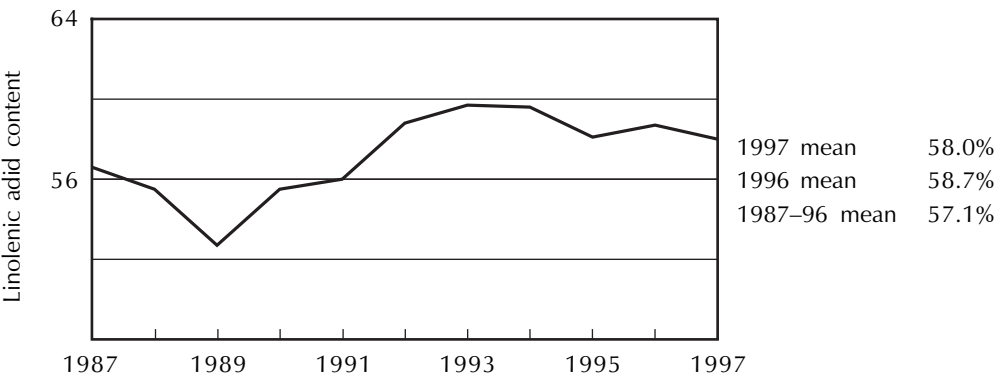
Fatty acid composition

The flaxseed oil from the 1997 survey was slightly lower in iodine value (193 units) than in 1996 (194 units) but above the 10-year mean (191 units). The linolenic acid content (58.0%) was also lower than in 1996 (58.7%) but well above the 10-year mean of 57.1%. Compared to 1996, the Saskatchewan crop was 1.9 percentage units lower in linolenic acid and 4 units lower in iodine value (Table 5). In Manitoba, linolenic acid increased by one percentage unit while the iodine value increased by two units compared to 1996.

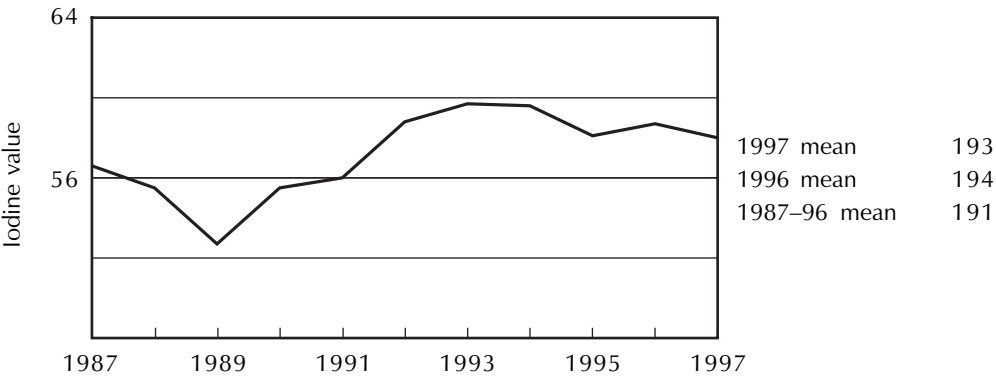
Iodine value is a measure of the total degree of unsaturation of an oil. Oils with high iodine value dry (polymerize) rapidly in the presence of oxygen. Oils with high iodine values (greater than 188 units) are desired for products in the coatings (paints, varnishes, inks) industry, while oils with lower iodine values (182–183) may be more desirable in the linoleum industry. Iodine value, like oil content, is influenced by growing temperatures and length of photoperiod. Generally, cooler growing conditions and longer photoperiods will result in both higher iodine value and oil content.

The linolenic acid (57.4%) and iodine value (192) of the October 1997 exports were lower than the 1996–97 mean exports values (Table 6). The No. 1 CW exports will likely produce oils with iodine values between 190 and 193 units.

Linolenic acid content of harvest survey samples of No. 1 Canada Western flaxseed 1987–97



Iodine value of harvest survey samples of No. 1 Canada Western flaxseed 1987–97



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# Methods and definitions

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Samples of flaxseed grown in 1997 were submitted to the Grain Research Laboratory by producers, grain handling offices and crushing plants across western Canada. The samples were cleaned to remove dockage and then were graded by the Canadian Grain Commission, Industry Services. Oil, protein and iodine value measurements were made on all individual samples using an NIRS 6500 scanning near infrared (NIR) spectrometer. The NIR instrument was calibrated and verified with the appropriate listed reference method. Composite samples were tested for free fatty acids and fatty acid composition. Composite samples were prepared by province for the No. 1 CW grade.

This year's harvest survey included 669 samples from across western Canada: 243 from Manitoba, 412 from Saskatchewan and 14 from Alberta. Samples were received during the harvest period from August 15 to October 31, 1997. Weighting factors used to calculate provincial and western Canadian mean values were derived from the previous five years' average production for each crop district and the 1997 provincial production estimate in Statistics Canada's *Field Crop Reporting Series No. 8*, December 5, 1997.

## Oil content

is determined by nuclear magnetic resonance according to International Organization for Standardization Method ISO 10565:1993(E), *Oilseeds—Simultaneous determination of oil and moisture contents—Method using pulsed nuclear magnetic resonance spectroscopy*. Results were obtained with a Bruker NMS 110 Minispec NMR Analyzer and are reported as percentage, calculated to a dry matter basis.

## Protein content

is determined by the AOCS *Official Method Ba 4e-93* using a LECO FP-428 Nitrogen Determinator. Results are reported as percentage protein (percentage of nitrogen x 6.25), calculated on a dry matter basis.

## Fatty acid composition

is determined by the International Organization for Standardization Method ISO 5508:1990 (E), *Animal and vegetable fats and oils—Analysis by gas chromatography of methyl esters of fatty acids*. A 15-m by 0.32-mm column with a 0.5-micrometer Supelcowax 10 coating is used.

## Iodine value

is calculated from the fatty acid composition, according to AOCS Recommended Practice Tz 1c-85. Major and important minor fatty acids are reported although samples may also contain as much as 1% of other minor fatty acids, which are included in the calculations.

## Free fatty acid content

is determined by a method adapted from the procedure of Ke et al. (1978) *Analytica Chimica Acta* 99:387–391, and is expressed as percent free fatty acids in the oil (as oleic acid).

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## Acknowledgments

The Grain Research Laboratory acknowledges the cooperation of flaxseed producers, grain companies and oilseed crushing plants in western Canada for supplying the samples of newly-harvested flaxseed. The assistance of the Canadian Grain Commission, Industry Services, in grading all of the producer survey samples is also acknowledged. A portion of the weather review was provided by the Weather and Crop Surveillance department of the Canadian Wheat Board. The technical assistance of the GRL staff, in particular Ken Howard, Michelle Kisilowsky, Barry Misener, and Bert Siemens is acknowledged.