MB-09

Fertilizer by Weed Management Study:

1999
Annual Report

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FOREWORD

The Fertilizer by Weed Management Study was initiated to determine the effect of fertilizer timing and placement in conservation tillage with weed management.

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Note: The data presented within this report are preliminary in nature and should not be taken out of context from other research. Basic agronomic and weed management data are presented in this report. Additional information will become available from further laboratory analysis of 1998 samples. The data from other years and further statistical analysis are required before the data can be generalized. The data should not be used without the permission of the authors.

EXECUTIVE SUMMARY

1999 saw the completion of year four of the Fertilizer by Weed Management Study, a joint venture among Agriculture and Agri-Food Canada, the Canadian Fertilizer Institute, Novartis Canada Inc, and Monsanto Canada Inc. Management studies were conducted at Brandon, Melfort, and Beaverlodge to address the issue of the effect of timing, placement, and soil disturbance level of nitrogen fertilizer application on weed management.

Agronomic responses of fertilizer placement and reduced herbicide rates were evaluated at Brandon, Manitoba, Melfort, Saskatchewan and Beaverlodge, Alberta in 1999, the forth year of a 5-year study evaluating spring wheat and canola responses to N fertilizer placement and herbicide rates in a no-till canola-wheat rotation. Many of the crop responses recorded in 1999 were similar to those observed in previous years at each location, as well as across the three locations. Variation observed in crop establishment with N fertilizer placement was seldom reflected in final grain yields, indicating that large differences in crop stand are required before the final yield of spring wheat or canola are to be influenced. Fertilizer timing, fall vs spring application, did influence grain protein in many instances, with improved protein with spring application indicating that there were some over-winter losses of N from the system. Crop water use was rarely influenced by either fertilizer N placement or herbicide rates in the study. In fact, the lack of many significant crop development or yield effects due to herbicide rates used in this study indicates that reducing herbicides was of little agronomic importance. However, a closer evaluation of the herbicide rates will be part of the weed population data. The results of this study will provide information on best management practice over time, at these differing environments, despite the differences from each year. Best management practice in this study combines the net value of a system over twelve station years and environments, resulting in a probability of placing fertilizer and seed in the right place and time most of the time.

In general, reduced herbicide rates applied in 1998 did not result in greater weed recruitment prior to crop seeding or in-crop spraying. However, weed densities were greater in wheat at both Melfort and Beaverlodge after herbicide application in 1999. The impact of fertilizer timing, placement, and level of soil disturbance on weed density varied by site. In general, however, sweeps were weediest in both wheat and canola, frequently at both the time of in-crop spraying and in the July count. Except in wheat at Beaverlodge, weed density was unaffected by spacing (9" vs. 12"). In general, weed densities were unaffected by the number of passes, although some effects occurred in wheat at Beaverlodge. Climatically, 1999 was an extremely wet year on most of the Canadian Prairies and results should be interpreted cautiously as this climatic effect will likely override many (or all) treatment effects.

An initial economic analysis was conducted on the Brandon 1997 data to determine the appropriateness of using an economic contribution approach. This approach subtracts the costs of production from gross returns. The cost of production were determined by adding the cost of field operations based on the Saskatchewan Custom Rate Guide to the actual cost of purchased inputs. Gross returns were determined using crop yield and grade to calculate dollar returns per hectare. The analysis indicated similar returns for treatments in wheat with the nine inch side band treatment performing the best and good returns from canola seeded on random fall or spring fertilizer bands and the nine inch side band treatment.

Data from one field season on the impact of MAP and KCl on wild oat competition in wheat and flax indicated that the crops grown at the sandy loam site were more responsive to fertilizer than at the clay loam site. Wheat was more consistent in its fertilizer response than flax. As rates of fertilizer increased the expected yield decline did not occur. Side banding provided higher yields than seed placed fertilizer, and the presence of wild oats reduced crop yield. Detailed growth chamber research on the relative response of wheat, flax, and wild oat to MAP and KCl has been initiated.

The thesis by Kristen Callow (Impact of Monoammonim Phosphate and Potassium Chloride on Wild Oats (Avena fatua L.) in Direct-Seeded Spring Wheat and Flax.) was completed and defended. The abstract is included as Appendix 1 and a copy of the thesis is available upon request.

All research sites were toured by producers, agri-business, and researchers during the growing season.

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INTRODUCTION

Objectives:

1) To determine the impact of fertilizer placement and timing in direct-seeding systems on N fertilizer-use efficiency, herbicide usage, and weed communities. This objective is being met through the establishment of a short-term management study in three agroecological zones of the Black soil zone.

2)To determine the impact of P and K fertilizer on weed-crop competition. This objective was met through a graduate student MSC. thesis project.

Background:

Direct-seeding systems are the most rapidly evolving agricultural technology in western Canada. Direct economic and soil conservation benefits have been documented at the farm and research level and have become the driving forces behind producer adoption of these conservation-tillage systems. Because the term direct seeding encompasses a broad range of one- and two-pass fertilization and seeding systems, questions have arisen regarding the relative efficiency of these different approaches. The most commonly asked questions relate to the effects of soil disturbance and fertilizer placement on crop yields, weed management, and production economics.

Potential Impact and Benefits:

The project will provide a knowledge base for efficient fuel, fertilizer, and herbicide usage thereby optimizing net-returns at a cropping-systems level for the Black Soil Zone. The data generated from this research will be the largest data base dealing in an integrated manner with the impact of fertilizer placement on weeds in direct-seeding systems and will be of interest to producers and the agro-industry. The principles elucidated will have regional and national application. The commercialization of this knowledge will occur through field days, presentation at grower meetings, and through the publication of results in the farm press, industry and extension publications and scientific journals. As decision support systems are developed, this data will be useful for predicting the response of crops, weed communities, and soils to direct-seeding systems and recommending appropriate management options.

Project Description:

I) Protocol for Management Studies:

a) General description:

The management studies were set up in a split-split plot design with 4 replicates. Plots were 7.3m X 15.0m in size. Crops (wheat and canola) were the main plot, fertilizer placement was the sub-plot, and herbicide rate was the sub-sub plot. For the sake of statistical analysis, all agronomic data was

analysed by crop separately. Once several years of data are collected, weed community analysis by multivariate ordination will be done with using all plots in the analysis (wheat and canola plots used together).

In order to reduce site to site variability, seeding was done at all sites using identical seeders. Conservapak zero-tillage air seeders setup to seed on 9 inch and 12 inch row spacings were used (one pair of seeders at each site). For the sweep seeding, sweeps were purchased from a common sourse and used at all locations.

b) Core Treatments at each site:
-each of the following fertilizer treatment will be conducted in wheat and canola at 100% and 66% of in-crop herbicide rates with treatments being continuous (in same plot with crop rotating annually) for 5 years (1 startup year plus 2 cycles of crop rotation).

Treatment	Spacing of fertilizer (in)	Row spacing of seed (in)
fall band	12	9
spring band	12	9
side band at seeding	9	9
side band at seeding	12	12
one pass sweeps	9	9

Note; additional fertilizer treatments have been added at Melfort and Beaverlodge but are not summarized in this years report.

c) Agronomic Information:

i)Fertility: 66% of soil test recommendations for N
-approximately 85lb/ac at Melfort, 70 lb/ac at Beaverlodge, 65 lb/ac at Brandon
-P_2O_5: recommended rate (adjust N)
-S: elemental as required

ii)Crops: Teal wheat-common source from Melfort
Seed at 2 bu/ac (160 kg/ha)
Quest RR canola- common source from Monsanto
Seed at 7 kg/ha plus Furadan or Counter

iii)Herbicides: Pre-seeding, pre-harvest, and post-harvest as required at each site
In-crop use common treatments
Roundup in canola (1.24L/ha (0.5 l/ac) = 1X, 0.82L/ha=66%)

Horizon plus target in wheat
(Horizon rate wild oat rate 230ml/ha(56gai/ha)=1X and reduced rate of 172.5ml/ha=75%X and 60% of wild oat and green foxtial rate). Reduced rate for Horizon changed based on dose response information from Ciba's data base. Target is to be used as a tank mix (it should control most weeds at all sites). 1X rate = 1.0 L/ha and 66% =0.66L/ha (Note that 1.0l/ha is at the low end of the recommended range, but should still suppress cleavers and other difficult to control weeds).

iv)Fungicides: As needed at each site

d)Data Collection:

i)Crop data: -crop stand prior to tillering (4-1m row counts per plot for wheat & canola using 4-0.25 m2 quadrats per plot for sweeps)
-head count 4 1m row per plot in wheat
-crop height in canola and wheat

ii)Haun Stage (wheat only):
-Haun stage and depth of seeding at 5-6 lf stage (GS 32 start of elongation) in full and reduced rate herbicide plots. Collect 20 plants/plot at 5-6 leaf stage in wheat.

iii)Nutrient dynamics:
-biomass at heading of weeds and crop
-1 of $1m^2$ quadrat per plot (separate weeds and crop) dry weight (also give biomass data to Derksen for weeds) and send ground samples to Grant (need about 25 grams, but for weeds send what there is).

iv)Yield: -per plot
-seed quality (1000k count, protein, green seed in canola, etc?)
-oil content for canola at Beaverlodge ??

5) Soil Sampling:
-soil moisture: 0-6, 6-12, 12-24, 24-36 spring and fall
-archive samples each year
-soil fertility: fall for N and P
0-6 and 6-24

6) Weeds:
-for counts use 20 0.5 X 0.5 m^2 ($0.25m^2$) quadrats per plot (always take the same # crop rows per quadrat). For very dense weed species devide quadrat into 4, count in one quarter of the quadrat, and multiply by 4 for density per quadrat on input sheets.
-count all weeds by species (density/quadrat)
Pre-seeding, pre-spray (in-crop), and residual weed community (July)

-send electronic files to Derksen for analysis (format to be sent out)
-emergence: estimate number of days difference in emergence between each dominate weed and the crop (Derksen will do detailed emergence sampling)
-need a weedy check in each plot (make tarp to cover about $2m^2$ so that a $1m^2$ weedy quadrat remains after spraying. Need a weed count at spraying and in July in this quadrat that is separate from "20 quadrat" count. Harvest and thrash separately from main plot to obtain an estimate of crop yield loss due to weeds (i.e., sample of crop yield, weed yield)
-crop tolerance 7 DAT on 0-100 ECW scale for wheat and canola

CROP AGRONOMY

Wheat

Brandon

Significant placement effects were detected for crop stand, yield and grain protein in 1999 at Brandon. Wheat seedling establishment on 9" row spacing where fertilizer was pre-plant banded in the fall, spring or side banded at the time of seeding was 10% higher than when seed and fertilizer were spread under a sweep, and 36% higher than side banding with 12" row spacing (Table 1). Similar reductions in plant establishment were also observed with the sweep opener in 1997 and 1998, and with the 12" side band opener in 1998 (Table 2).

Pre-plant banded N applied in the fall of 1998 resulted in the highest wheat grain yields in 1999 at Brandon (Table 1). This was followed by the sweep treatment, spring pre-pant band, and 9" side banded treatments. Similar to the plant establishment results, side banding N on 12" row spacing resulted in a grain yield significantly lower than the other treatments. This poor grain yield response of the 12" side band treatment, which was also recorded in 1997 and 1998 (Table 2), is a concern to the authors and is being investigated in a related project. Seeding wheat with N side banded at 9" row space yielded 22% higher than side banded at 12" row space. Wheat yield was 13% higher when fertilizer was fall banded than when fertilizer was spring banded, a first time for this type of observation at the Brandon location.

Fertilizer placement was also found to affect grain protein at Brandon in 1999 (Table 1). When fertilizer was either pre-plant banded, or side banded at seeding, we recorded a 3.7% increase in grain protein compared to sweep seeding and fertilizing system. Only in 1998 were grain protein differences recorded at the Brandon location, and again the low protein treatment was the sweep treatment.

There was a significant fertilizer N placement by herbicide rate effects detected for water use by the wheat crop in 1999 (Table 1). The interaction occurred because of the higher water use with 2/3 herbicide rate in the fall band treatment, relative to the 2/3 herbicide rate, while the opposite was recorded for the 12" side banded fertilizer placement. This is the first occasion that a significant difference was recorded in the crop water use for any of the four year of the trial at Brandon (Table 2). In fact, it is the first time that we have recorded any significant response of any variable to herbicide rate at Brandon. While Brandon experienced an unusually wet year in 1999, these results are unusual and require further investigation.

Melfort

In 1999 a response similar to that recorded at Brandon was recorded for seeding establishment at Melfort. Application of N with the 12" side banding drill resulted in the lowest seedling count (Table 3). Similar reductions were also observed in 1997 and 1998 (Table 4). The sweep treatment also had inferior wheat seedling establishment relative to 9" side banded treatment in 1999, which was also observed in 1997 and 1998. A significant N fertilizer placement by herbicide rate interaction was recorded for wheat seedling establishment, reflecting changes in rank between the herbicide rates within each N treatment. These minor differences are of little agronomic importance.

Differences in crop stand establishment were not large enough to be reflected in final grain yield at Melfort in 1999 (Table 3). Wheat yields ranged from 2508 – 2612 kg/ha.
Grain protein was lowest with the sweep seeding system, and highest when N was either spring pre-plant banded or side banded at 12" row spacing (Table 2). The lower grain protein with fall, relative to spring, pre-plant banding has

been observed in a number of years at Melfort and indicates some over-winter loss of fall banded N (Table 4).

For the first time with this study at Melfort, crop water use for the 9" side banded and the sweep treatments were lower than the remainder (Table 3). These differences in crop water use were not large, however, were detectable within the experimental error of this project.

Beaverlodge

Significant N fertilizer placement effects were recorded for seedling establishment, grain yield and water use at Beaverlodge in 1999 (Table 5). Unlike Brandon and Melfort, crop stand was not significantly different when fertilizer N was side banded on 9" or 12" row spacing. However, as recorded in 1998 (Table 6), all treatments were significantly higher than the crop stand with sweep seeding (Table 5). Conditions were very dry at Beaverlodge in the spring of 1999 and placement of seed and fertilizer with the sweep resulted in a plant establishment that was only 30% of the other treatments (Table 5).

Wheat grain yield was also significantly affected by fertilizer N placement, with fall pre-plant banding resulting in higher wheat yields than side banding fertilizer on 9" row space at seeding (Table 5). The yield of wheat where seed and fertilizer was spread under the sweep was lower than all other treatments. While this was similar to the 1998 results, the sweep N placement treatment was grouped with the best yielding treatments at Beaverlodge in 1996 and 1997 (Table 6). The 9" side banded N treatment, and the sweep treatment; both had lower crop water use than the remaining treatments (Table 5). This was the first time that a significant difference was recorded for crop water use at Beaverlodge (Table 6).

Discussion

Combined data over the 1996-1999 period for Brandon, Melfort and Beaverlodge are presented in Table 7. Averaged over the years there was no placement effect on crop stand at any of the three locations, however there was a significant Year x Placement interaction at all three locations. This indicates crop establishment varied from year to year at all sites and some treatments will adversely affect crop emergence in some years and not others. Factors such as soil moisture at seeding, effectiveness of post-seeding packing of the sweep treatments, and seeding depth can all contribute to the differences recorded. Combining all the information together from all of the sites may provide insight into why this occurs. A similar situation was recorded with grain yield and grain protein (Table 7). While there were minor differences in a few years, there didn't seem to be any trend in crop water use. This indicates that for the most part the crops were using all of the profile water at each trial location. Analyzing the data for water use efficiency may provide some insight as to how these fertilizer N treatments affect the relationship of water use with crop yield. Wheat yields were generally lower at Beaverlodge than either Melfort or Brandon; however, water use was generally lower than at Brandon and higher than Melfort. The analysis of the other data accumulated throughout the study may provide the reasons for this observation.

Table 1. Agronomic response of wheat to fertilizer placement and herbicide rate at Brandon, 1999.

	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement				
1. Fall Band - FBd	173 a	1865 a	12.5 a	52.0
2. Spring Band - SBd	167 a	1644 b	12.6 a	45.5
3. Sideband 9" - SB9	159 ab	1660 b	12.4 a	42.5
4. Sideband 12" - SB12	122 c	1364 c	12.7 a	35.1
5. Sweep - SW	151 b	1744 ab	12.1 b	42.7
Herbicide Rate				
1. Full Rate - F	154	1645	12.5	31.2
2. 2/3 Rate - R	155	1666	12.4	34.3
Placement x Herb Rate				
FBd x F	171	1872	12.4	23.8
FBd x R	174	1857	12.5	43.2
SBd x F	165	1692	12.6	31.8
SBd x R	169	1597	12.6	31.0
SB9 x F	166	1673	12.4	30.4
SB9 x R	152	1647	12.4	29.7
SB12 x F	119	1325	12.8	35.8
SB12 x R	125	1403	12.5	29.3
SW x F	148	1663	12.1	34.4
SW x R	154	1824	12.0	38.5
Study Mean	155	1655	12.4	32.7
Pr > F				
Placement	0.0001	0.0001	0.0041	0.3528
Herbicide	0.8632	0.7191	0.4371	0.1421
Plmt x Herb	0.6607	0.6545	0.8346	0.0185
C.V.	10	11	2	13
Treatment Comparisons				
FBd vs. SBd	0.4780	0.0210	0.4821	0.5066
SB9 vs. SB12	0.0001	0.0027	0.0860	0.4405
SBd vs. SW	0.0428	0.2783	0.0017	0.1306
SB9 vs SW	0.2896	0.3594	0.0284	0.0652

Table 2. Agronomic response of wheat to fertilizer placement and herbicide rate at Brandon 1996, 1997 and 1998.

	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
	------- 1996 -------				------- 1997 -------				------- 1998 -------			
Fertilizer Placement												
1. Fall Band - FBd	170 b	3623	14.3	34.1 a	175 a	2573	14.2	29.8	214 a	3650 a	15.4 a	41.7
2. Spring Band - SBd	168 b	3616	14.0	31.5 ab	168 a	2644	14.0	30.2	215 a	3610 a	14.6 bc	40.6
3. Sideband 9" - SB9	164 b	3622	13.8	31.0 ab	173 a	2662	14.1	29.5	214 a	3571 a	14.4 cd	43.0
4. Sideband 12" - SB12	158 b	3692	13.9	27.6 b	182 a	2479	14.2	29.1	149 c	3170 b	14.9 b	40.8
5. Sweep - SW	228 a	3592	13.6	29.1 b	138 b	2588	14.0	30.6	176 b	3474 a	14.2 d	40.0
Herbicide Rate												
1. Full Rate - F	179	3648	14.0	31.0	166	2603	14.0	31.0	195	3573	14.8	41.1
2. 2/3 Rate - R	176	3610	13.8	30.3	168	2576	14.2	28.6	192	3417	14.6	41.3
Placement x Herb Rate												
FBd x F	184	3699	14.2	34.8	173	2499	14.2	30.4	214	3715	15.4	40.8
FBd x R	155	3547	14.3	33.4	177	2647	14.3	29.1	214	3586	15.4	42.6
SBd x F	168	3605	14.3	32.5	167	2679	13.9	30.0	218	3657	14.9	41.1
SBd x R	167	3627	13.7	30.5	170	2610	14.0	30.4	213	3561	14.3	40.1
SB9 x F	161	3649	14.0	30.2	172	2660	14.0	28.8	214	3623	14.5	44.0
SB9 x R	167	3596	13.6	31.8	174	2664	14.1	30.3	213	3520	14.3	41.9
SB12 x F	160	3682	13.8	26.1	177	2531	14.1	32.1	147	3193	14.8	39.4
SB12 x R	155	3702	14.1	29.1	186	2427	14.4	26.2	152	3148	15.0	42.3
SW x F	223	3605	13.8	31.5	140	2644	14.0	33.9	185	3676	14.2	40.3
SW x R	234	3580	13.4	26.7	135	2532	14.1	27.2	168	3271	14.1	39.7
Study Mean	177	3629	13.9	30.7	167	2589	14.1	29.8	194	3495	14.7	41.2
Pr > F												
Placement	0.0001	0.8300	0.0655	0.0360	0.0001	0.1373	0.3345	0.9443	0.0001	0.0204	0.0001	0.1193
Herbicide	0.5370	0.5012	0.2171	0.5675	0.6408	0.5672	0.1902	0.0527	0.4971	0.1037	0.1701	0.8035
Plmt x Herb	0.2875	0.8535	0.1996	0.3516	0.9558	0.3928	0.9659	0.1283	0.7241	0.7508	0.2282	0.1938
C.V.	11	5	3	13	10	6	2	12	9	8	2	6
Treatment Comparisons												
FBd vs. SBd	0.8290	0.9325	0.2002	0.2093	0.4370	0.3413	0.0814	0.8285	0.8937	0.7800	0.0001	0.3458
SB9 vs. SB12	0.4908	0.4287	0.4991	0.1101	0.2828	0.0194	0.3154	0.8300	0.0001	0.0107	0.0074	0.0761
SBd vs. SW	0.0001	0.7905	0.0982	0.2408	0.0008	0.4538	0.5862	0.8342	0.0001	0.3626	0.0149	0.5969
SB9 vs SW	0.0001	0.7363	0.3993	0.3657	0.0002	0.3252	0.9379	0.5767	0.0001	0.5098	0.2174	0.0150

Table 3. Agronomic response of wheat to fertilizer placement and herbicide rate at Melfort, 1999.

	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement				
1. Fall Band - FBd	269 a	2518	14.3 bc	23.7 ab
2. Spring Band - SBd	258 a	2530	14.6 a	24.1 a
3. Sideband 9" - SB9	251 a	2612	14.6 ab	21.8 b
4. Sideband 12" - SB12	186 c	2508	14.8 a	25.0 a
5. Sweep - SW	224 b	2518	14.3 c	21.8 b
Herbicide Rate				
1. Full Rate - F	237	2515	14.5	23.1
2. 2/3 Rate - R	238	2559	14.5	23.5
Placement x Herb Rate				
FBd x F	291	2521	14.3	24.5
FBd x R	247	2514	14.3	23.0
SBd x F	249	2509	14.5	24.3
SBd x R	268	2550	14.7	23.9
SB9 x F	242	2571	14.7	21.0
SB9 x R	261	2653	14.5	22.5
SB12 x F	191	2472	14.8	24.7
SB12 x R	180	2543	14.9	25.4
SW x F	213	2503	14.4	21.1
SW x R	235	2533	14.2	22.4
Study Mean	238	2537	14.5	23.3
Pr > F				
Placement	0.0001	0.4952	0.0019	0.0131
Herbicide	0.9187	0.2961	0.9558	0.6041
Plmt x Herb	0.0265	0.9629	0.4673	0.5840
C.V.	9	5	2	9
Treatment Comparisons				
FBd vs. SBd	0.3406	0.8556	0.0294	0.7250
SB9 vs. SB12	0.0001	0.1184	0.0741	0.0044
SBd vs. SW	0.0054	0.8571	0.0242	0.0344
SB9 vs SW	0.0233	0.1574	0.0430	0.9906

Table 4. Agronomic response of wheat to fertilizer placement and herbicide rate at Melfort 1996, 1997 and 1998.

	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
	------- 1996 -------				------- 1997 -------				------- 1998 -------			
Fertilizer Placement												
1. Fall Band - FBd	265	3819 ab	13.2 ab	24.9	240 b	2598 d	10.5 b	22.6	237 a	3292	13.0 b	20.8
2. Spring Band - SBd	266	3669 b	12.8 bc	22.7	229 b	3315 a	11.4 a	23.1	234 ab	3135	13.1 b	21.0
3. Sideband 9" - SB9	245	3607 b	13.2 ab	24.6	274 a	3032 bc	11.5 a	24.4	227 ab	3418	13.6 a	22.9
4. Sideband 12" - SB12	266	3599 b	13.6 a	24.8	158 d	2798 cd	11.2 a	24.2	212 bc	3265	13.3 ab	23.3
5. Sweep - SW	316	3938 a	12.5 c	23.1	199 c	3143 ab	11.5 a	23.9	190 c	3243	13.0 b	21.9
Herbicide Rate												
1. Full Rate - F	275	3764	13.2	24.1	221	2939	11.2	23.8	221	3382 a	13.3	22.1
2. 2/3 Rate - R	268	3689	12.9	24.0	219	3015	11.2	23.5	220	3159 b	13.1	21.8
Placement x Herb Rate												
FBd x F	261	3766	13.1	23.4	231	2573	10.6	21.7	230	3355	13.0	22.8
FBd x R	270	3873	13.3	26.4	249	2622	10.4	23.5	245	3229	12.9	18.8
SBd x F	281	3719	12.9	23.5	231	3275	11.3	24.3	243	3157	13.2	20.1
SBd x R	251	3620	12.7	21.9	227	3356	11.6	21.9	224	3113	13.1	21.9
SB9 x F	258	3692	13.8	25.5	276	2832	11.3	25.1	234	3588	13.8	23.3
SB9 x R	231	3522	12.7	23.6	272	3231	11.6	23.7	221	3247	13.3	22.5
SB12 x F	260	3711	13.9	26.0	154	2779	11.3	24.1	216	3498	13.4	22.8
SB12 x R	272	3486	13.4	23.7	162	2816	11.2	24.2	208	3032	13.2	23.9
SW x F	317	3934	12.6	21.9	214	3235	11.7	23.5	180	3310	13.1	21.7
SW x R	315	3943	12.5	24.3	184	3051	11.2	24.2	200	3175	12.9	22.0
Study Mean	272	3726	13.1	24	220	2977	11.2	23.6	220	3270	13.2	22.0
Pr > F												
Placement	0.0836	0.0166	0.0038	0.2704	0.0001	0.0001	0.0002	0.7642	0.0014	0.0548	0.0101	0.3538
Herbicide	0.6061	0.2837	0.0538	0.9294	0.7166	0.3679	0.6540	0.8063	0.8937	0.0005	0.0676	0.7491
Plmt x Herb	0.8029	0.5627	0.2107	0.1101	0.2943	0.3127	0.3219	0.6813	0.3234	0.1284	0.7495	0.3490
C.V.	11	6	4	10	10	9	4	13	10	5	3	14
Treatment Comparisons												
FBd vs. SBd	0.9752	0.1818	0.1694	0.0903	0.3222	0.0001	0.0001	0.7414	0.7456	0.0863	0.3246	0.9039
SB9 vs. SB12	0.3540	0.9435	0.1444	0.8336	0.0001	0.0872	0.2427	0.8843	0.1814	0.0951	0.1632	0.7621
SBd vs. SW	0.0487	0.0205	0.3473	0.7787	0.0125	0.2015	0.7675	0.6320	0.0006	0.2327	0.3973	0.5393
SB9 vs SW	0.0098	0.0053	0.0151	0.2502	0.0001	0.4066	0.9058	0.7444	0.0025	0.0575	0.0027	0.5130

Table 5. Agronomic response of wheat to fertilizer placement and herbicide rate at Beaverlodge, 1999.

	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement				
1. Fall Band - FBd	253 a	1667 a	14.6	14.5 a
2. Spring Band - SBd	261 a	1582 ab	14.7	13.6 a
3. Sideband 9" - SB9	255 a	1371 bc	14.6	10.7 b
4. Sideband 12" - SB12	236 a	1482 abc	14.8	14.5 a
5. Sweep - SW	71 b	1232 c	15.0	11.4 b
Herbicide Rate				
1. Full Rate - F	213	1528	14.8	12.7
2. 2/3 Rate - R	217	1405	14.6	13.2
Placement x Herb Rate				
FBd x F	251	1707	14.7	13.7
FBd x R	254	1628	14.4	15.4
SBd x F	250	1648	14.7	13.4
SBd x R	272	1517	14.7	13.8
SB9 x F	257	1473	14.4	10.0
SB9 x R	252	1268	14.8	11.4
SB12 x F	224	1496	15.1	14.6
SB12 x R	248	1467	14.5	14.3
SW x F	84	1318	15.2	12.0
SW x R	57	1146	14.7	10.9
Study Mean	215	1467	14.7	12.9
Pr > F				
Placement	0.0001	0.0243	0.1954	0.0006
Herbicide	0.8307	0.1550	0.1160	0.4781
Plmt x Herb	0.8562	0.9654	0.0822	0.5554
C.V.	25	18	3	15
Treatment Comparisons				
FBd vs. SBd	0.7511	0.5285	0.4637	0.3420
SB9 vs. SB12	0.4831	0.4122	0.2607	0.0005
SBd vs. SW	0.0001	0.0139	0.1673	0.0320
SB9 vs SW	0.0001	0.3074	0.0396	0.4472

Table 6. Agronomic response of wheat to fertilizer placement and herbicide rate at Beaverlodge 1996, 1997 and 1998.

	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
	------- 1996 -------				------- 1997 -------				------- 1998 -------			
Fertilizer Placement												
1. Fall Band - FBd	135 a	1003	13.5	36.8	N/A	1254 ab	13.2	29.5	167 bc	2351 a	15.1	25.5
2. Spring Band - SBd	155 a	1244	13.7	39.4	N/A	1422 a	13.5	29.2	186 ab	2260 ab	15.3	28.0
3. Sideband 9" - SB9	139 a	1237	14.1	39.3	N/A	1147 b	13.8	30.8	185 ab	2359 a	15.2	28.2
4. Sideband 12" - SB12	91 b	1077	13.7	37.8	N/A	755 c	13.7	31.7	211 a	1967 b	15.2	27.0
5. Sweep - SW	156 a	1308	13.7	37.2	N/A	1430 a	13.4	33.3	137 c	1977 b	14.9	25.5
Herbicide Rate												
1. Full Rate - F	144	1179	13.7	38.2	N/A	1289 a	13.6	30.2	179	2151	15.0	26.8
2. 2/3 Rate - R	126	1168	13.8	38.0	N/A	1114 b	13.5	31.6	175	2215	15.2	26.9
Placement x Herb Rate												
FBd x F	148	1026	13.7	38.7	N/A	1352	13.2	29.0	179	2481	14.9	25.2
FBd x R	123	979	13.3	34.8	N/A	1156	13.2	29.9	154	2220	15.3	25.9
SBd x F	164	1187	14.1	39.4	N/A	1536	13.4	28.7	182	2126	15.2	25.9
SBd x R	145	1301	13.4	39.3	N/A	1308	13.6	29.8	191	2394	15.5	30.1
SB9 x F	157	1217	13.9	39.1	N/A	1101	13.8	32.3	191	2298	15.3	29.6
SB9 x R	120	1258	14.3	39.6	N/A	1193	13.8	29.4	179	2420	15.1	26.9
SB12 x F	97	1155	13.4	39.2	N/A	874	14.0	28.3	223	1901	15.2	26.7
SB12 x R	84	1000	13.9	36.5	N/A	636	13.4	35.2	198	2032	15.2	27.3
SW x F	153	1310	13.3	34.5	N/A	1583	13.5	33.0	119	1946	14.7	26.4
SW x R	159	1305	14.0	39.8	N/A	1278	13.2	33.7	154	2008	15.0	24.5
Study Mean	135	1174	13.7	38.1	N/A	1202	13.5	30.9	177	2183	15.1	26.8
Pr > F												
Placement	0.0005	0.0796	0.5371	0.5430	N/A	0.0001	0.1836	0.3979	0.0108	0.0237	0.5518	0.1718
Herbicide	0.0559	0.8875	0.6622	0.8913	N/A	0.0351	0.5022	0.3656	0.7496	0.5073	0.3710	0.8716
Plmt x Herb	0.6353	0.8312	0.1953	0.1795	N/A	0.5548	0.4573	0.3634	0.4910	0.5109	0.7716	0.1492
C.V.	21	20	5	10	N/A	21	4	15	22	14	4	10
Treatment Comparisons												
FBd vs. SBd	0.1691	0.0508	0.5138	0.1881	N/A	0.1877	0.2917	0.9240	0.3213	0.5548	0.3766	0.0896
SB9 vs. SB12	0.0020	0.1863	0.2357	0.4366	N/A	0.0040	0.6127	0.7070	0.1908	0.0153	0.8239	0.3911
SBd vs. SW	0.9318	0.5941	0.7989	0.2638	N/A	0.9495	0.6485	0.0897	0.0159	0.0733	0.1079	0.0851
SB9 vs SW	0.2227	0.5574	0.2092	0.2718	N/A	0.0307	0.1025	0.2918	0.0193	0.0180	0.2190	0.0619

Table 7. Agronomic response of wheat to fertilizer placement and herbicide rate at Brandon, Melfort and Beaverlodge, 1996 to 1999.

	----- BRANDON, 1996 TO 1999 -----				----- MELFORT, 1996 TO 1999 -----				----- BEAVERLODGE, 1996 TO 1999 -----			
	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement												
1. Fall Band - FBd	183	2928	14.1 a	35.0	251	3057	12.7	23.0	185	1569	14.1	26.6
2. Spring Band - SBd	180	2878	13.8 bc	33.7	244	3162	13.0	22.7	201	1627	14.3	27.5
3. Sideband 9" - SB9	177	2879	13.7 bc	33.9	250	3167	13.2	23.4	193	1529	14.4	27.3
4. Sideband 12" - SB12	153	2676	13.9 ab	32.5	197	3042	13.2	24.3	179	1320	14.3	27.7
5. Sweep - SW	173	2850	13.5 c	33.7	220	3210	12.8	22.7	121	1487	14.2	26.9
Herbicide Rate												
1. Full Rate - F	174	2867	13.8	33.9	233	3150	13.1	23.3	179	1537	14.3	27.0
2. 2/3 Rate - R	173	2817	13.8	33.5	232	3105	12.9	23.2	173	1476	14.3	27.4
Placement x Herb Rate												
FBd x F	185	2946	14.1	33.7	252	3054	12.7	23.1	193	1641	14.1	26.6
FBd x R	180	2909	14.1	36.2	250	3060	12.7	22.9	177	1496	14.0	26.5
SBd x F	180	2908	13.9	34.1	247	3165	13.0	23.1	199	1624	14.3	26.9
SBd x R	179	2849	13.6	33.3	241	3160	13.0	22.4	203	1630	14.3	28.2
SB9 x F	178	2901	13.7	33.8	252	3171	13.4	23.7	202	1522	14.3	27.7
SB9 x R	176	2857	13.6	33.9	248	3163	13.0	23.1	184	1535	14.5	26.8
SB12 x F	151	2683	13.9	33.0	198	3115	13.3	24.4	181	1357	14.4	27.2
SB12 x R	154	2670	14.0	32.1	196	2969	13.2	24.3	177	1284	14.2	28.3
SW x F	174	2897	13.5	35.1	219	3245	12.9	22.1	119	1539	14.2	26.5
SW x R	173	2802	13.4	32.2	222	3176	12.7	23.3	123	1434	14.3	27.2
Study Mean	173	2842	13.8	33.7	232	3128	13.0	23.2	176	1506	14.3	27.2
Pr > F												
Year	0.1390	0.0001	0.0003	0.0064	0.0660	0.0001	0.0001	0.4826	0.1298	0.0011	0.5532	0.0079
Placement	0.4745	0.0754	0.0094	0.5202	0.1397	0.5991	0.1093	0.1928	0.3877	0.2596	0.1859	0.8429
Herbicide	0.5647	0.2750	0.4235	0.9732	0.2114	0.5578	0.1381	0.6466	0.4364	0.3416	0.9110	0.2721
Plmt x Herb	0.8419	0.8998	0.0849	0.3801	0.9695	0.6440	0.3517	0.7463	0.6394	0.4559	0.8819	0.8252
Year x Placement	0.0001	0.0155	0.0186	0.8647	0.0072	0.0055	0.0152	0.5692	0.0002	0.0008	0.8188	0.4374
Year x Herbicide	0.7462	0.1775	0.1482	0.4976	0.9737	0.0470	0.3366	0.9603	0.3679	0.0730	0.6149	0.8830
Year x Plmt x Herb	0.6096	0.7659	0.6874	0.0005	0.0370	0.2636	0.3317	0.2437	0.7672	0.8719	0.1268	0.0868
C.V.	10	7	3	10	10	6	3	12	23	18	4	13
Treatment Comparisons												
FBd vs. SBd	0.8574	0.5580	0.0477	0.3192	0.7521	0.4108	0.2362	0.7017	0.7081	0.6694	0.1084	0.4168
SB9 vs. SB12	0.1811	0.0296	0.0916	0.5219	0.0443	0.3349	0.8407	0.2174	0.7497	0.1448	0.4573	0.6941
SBd vs. SW	0.7247	0.7318	0.0558	0.6524	0.4721	0.7048	0.4355	0.9160	0.0884	0.3142	0.4432	0.5649

SB9 vs SW	0.8152	0.7271	0.2220	0.6321	0.4006	0.7321	0.0916	0.3232	0.1197	0.7605	0.1388	0.7288

CANOLA

Brandon

Significant fertilizer N placement and herbicide rates effects were detected for canola seedling stands at Brandon in 1999. Sweep seeding resulted in lower canola plant establishment than the other treatments (Table 8), a response that has been observed in 1997 and 1998 as well (Table 9). However, unlike all previous years of the study at Brandon, side banding N on 12" rows did not result in a reduced crop establishment relative to side banding on 9" spacing. The elastic nature of the canola plant allows it to respond to thin stands, branching and increasing pod numbers enough to support normal canola yields (Table 8). Given that herbicides have not been applied when the crop emergence is determined, the reduced herbicide rate appears to have lowered crop stand as a result of previous weed populations. This response is small and generally unexpected.

Canola grain yields at Brandon in 1999 were unaffected by N fertilizer treatment or herbicides rate (Table 8). From lowest to highest grain yields only differed by 14%. Grain protein was lowest when fertilizer and seed were side banded on 9" row spacing at the time of seeding, and highest when fertilizer was fall banded (Table 8). Fall banding fertilizer resulted in higher grain protein than spring banding fertilizer, and sweep seeding and fertilizing resulted in protein content that was higher than side banding fertilizer on 9" row spacing. Canola crop water use was unaffected by the fertilizer and herbicides treatments.

Melfort

At the Melfort location in 1999 significant N fertilizer placement effects were recorded for crop establishment and grain protein (Table 10). At this site, placement of fertilizer at the time of seeding, either in a side band or with the seed under a sweep, reduced canola stand compared to pre-plant banding of the fertilizer in the fall or spring. The reduced emergence with side banding on 12" rows, relative to 9" rows that was recorded in 1998 and 1997 was not present in 1999 (Table 11). As recorded at Brandon, even with a 40% difference in crop emergence there was no grain yield effect at Melfort in this below average yielding year. Given the way growing conditions supported plant disease on canola in 1999, we may be beginning to see the negative impact of this tight canola-wheat rotation on grain yield loss due to disease.

While significant differences in canola grain protein were recorded in 1999 at Melfort, these were never larger than 4%, and not really of agronomic significance (Table 10). However, protein content of canola that had fertilizer side banded at seeding was significantly higher than pre-plant banded fertilizer or spread with the seed in the sweep treatment (Table 10). Protein content was higher from the 12" row space than from the 9" row space ($P>0.0854$), a reflection of slightly lower grain yields with the 12" row spacing (Table 10). These results are similar to those recorded in 1998 at Melfort, indicating some advantage in final seed N content to side banding fertilizer at seeding. There were no placement or herbicide effects on water use.

Beaverlodge

Significant placement effects were detected for crop stand and yield at Beaverlodge in 1999 (Table 12). Fall banded fertilizer resulted in higher canola emergence than spring banded fertilizer ($P>0.0825$) and 12" row space had higher canola emergence than 9" row space ($P>0.0662$). The sweep treatment resulted in canola emergence that was 4-5 fold lower than placing seed in a row (Table 12). It would appear that problems were encountered at the Beaverlodge location in 1999 with the establishment of canola using the sweep seeding system. Similar poor crop establishment was also recorded in 1997 and 1998 (Table 13). Dry soil conditions both at and after seeding in 1999 obviously were not conducive to canola establishment with the sweep seeding, given that the low stand was reflected in lower grain yield. Banding fertilizer produced higher canola yield than spreading in the seed row with the sweep (Table 12). There were no significant effects of placement or herbicide on grain protein or water use.

Discussion

Canola followed a similar trend as wheat averaged over all the years and is presented for the individual sites in Table 14. Averaged over all the years there was no significant difference in crop stand at Brandon and Melfort, although individual years produced results that showed differences in emergence with the different N fertilizer placement treatments. There was a significant difference in canola stand at Beaverlodge, largely a result of poor emergence with the sweep treatment in several years (Tables 12 and 13). There was a Year x N Placement interactions for crop stand at all locations indicating that differences were apparent under different seeding conditions for the placement of fertilizer and seed. Again this indicates that there may not be one system for all locations in Western Canada over all years and that an indication of the probability of success may be more suitable. Similar results were recorded for grain yield. A significant N placement x Herbicide rate interaction was recorded for Brandon grain yields in the combined analysis (Table 14). Lower canola grain yields were recorded for the reduced herbicide rate with the fall pre-plant banding and sweep treatments, indicating that these treatments may have stimulated greater weed growth and increased crop competition.

It appears that at Brandon, grain protein is adversely affected by 9" row spacing compared to the other treatments, while at Melfort or Beaverlodge N placement treatments did not influence protein content as indicated by the lack of interaction with placement and year. It is interesting that reducing herbicide rate had very little impact on yield in this study. Rather it was fertilizer N placement that had a bigger impact from year to year, likely as a result of environmental variation.

Table 8. Agronomic response of canola to fertilizer placement and herbicide rate at Brandon, 1999.

	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement				
1. Fall Band - FBd	103 ab	855	21.6 a	34.8
2. Spring Band - SBd	108 a	849	20.8 bc	33.2
3. Sideband 9" - SB9	91 b	936	20.6 c	27.6
4. Sideband 12" - SB12	98 ab	924	21.0 bc	31.6
5. Sweep - SW	66 c	823	21.4 ab	31.2
Herbicide Rate				
1. Full Rate - F	98 a	928	21.1	32.3
2. 2/3 Rate - R	88 b	827	21.1	31.1
Placement x Herb Rate				
FBd x F	103	958	21.7	38.5
FBd x R	102	752	21.6	31.2
SBd x F	120	877	21.0	32.6
SBd x R	95	821	20.7	33.9
SB9 x F	92	1041	20.9	29.7
SB9 x R	90	830	20.3	25.4
SB12 x F	108	868	21.1	29.6
SB12 x R	88	981	20.9	33.6
SW x F	68	894	20.9	31.1
SW x R	64	752	21.9	31.4
Study Mean	93	877	21.1	31.7
Pr > F				
Placement	0.0001	0.6367	0.0110	0.1383
Herbicide	0.0354	0.0813	0.8255	0.4772
Plmt x Herb	0.3274	0.3399	0.0764	0.2514
C.V.	16	20	3	11
Treatment Comparisons				
FBd vs. SBd	0.5018	0.9470	0.0100	0.5440
SB9 vs. SB12	0.3605	0.8975	0.1980	0.1449
SBd vs. SW	0.0001	0.7698	0.0756	0.4508
SB9 vs SW	0.0022	0.2095	0.0151	0.1814

Table 9. Agronomic response of canola to fertilizer placement and herbicide rate at Brandon 1996, 1997 and 1998.

	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
	------- 1996 -------				------- 1997 -------				------- 1998 -------			
Fertilizer Placement												
1. Fall Band - FBd	145 b	1830	N/A	28.6	61 a	1320 a	22.6 ab	26.5	84 a	912 a	24.3	43.5
2. Spring Band - SBd	127 b	1893	N/A	29.8	65 a	1190 a	21.5 c	25.3	81 a	807 a	24.3	42.6
3. Sideband 9" - SB9	120 bc	1875	N/A	32.3	60 a	1281 a	22.0 bc	27.7	78 a	1030 a	23.2	43.9
4. Sideband 12" - SB12	97 c	1894	N/A	28.8	42 b	907 b	22.9 a	25.4	43 b	488 b	24.6	42.5
5. Sweep - SW	246 a	1802	N/A	29.9	19 c	408 c	22.8 a	24.2	44 b	544 b	24.0	46.9
Herbicide Rate												
1. Full Rate - F	146	1844	N/A	29.2	50	1027	22.4	26.1	66	703	24.1	44.8
2. 2/3 Rate - R	148	1873	N/A	30.6	49	1015	22.3	25.5	66	809	24.0	43.0
Placement x Herb Rate												
FBd x F	135	1822	N/A	29.3	66	1378	22.3	27.3	80	907	24.0	44.4
FBd x R	155	1838	N/A	27.8	54	1262	22.8	25.7	88	916	24.6	42.5
SBd x F	127	1886	N/A	30.3	59	1217	21.9	26.0	86	739	24.2	42.7
SBd x R	126	1900	N/A	29.2	70	1163	21.1	24.5	76	874	24.4	42.6
SB9 x F	128	1855	N/A	34.0	61	1278	21.9	26.1	76	951	23.2	46.6
SB9 x R	113	1895	N/A	30.6	59	1284	22.1	29.2	80	1108	23.1	41.2
SB12 x F	106	1861	N/A	24.1	43	810	23.0	25.2	45	411	24.9	44.2
SB12 x R	89	1927	N/A	33.4	41	1004	22.7	25.5	41	565	24.2	40.8
SW x F	233	1797	N/A	28.1	19	452	22.7	26.0	43	506	24.4	45.9
SW x R	259	1807	N/A	31.8	18	364	22.9	22.4	45	581	23.6	48.0
Study Mean	147	1859	N/A	29.9	49	1021	22.3	25.8	66	756	24.1	43.9
Pr > F												
Placement	0.0001	0.2594	N/A	0.2774	0.0001	0.0001	0.0011	0.3594	0.0001	0.0006	0.1002	0.4176
Herbicide	0.7773	0.3571	N/A	0.2355	0.6135	0.8452	0.9242	0.5433	0.9598	0.1642	0.6125	0.2838
Plmt x Herb	0.4181	0.9759	N/A	0.0116	0.0435	0.4792	0.2723	0.4244	0.5278	0.9610	0.5910	0.6230
C.V.	19	5	N/A	12	13	18	3	14	15	26	4	10
Treatment Comparisons												
FBd vs. SBd	0.2032	0.2091	N/A	0.5162	0.1597	0.1686	0.0030	0.4930	0.5609	0.3756	0.9744	0.7509

SB9 vs. SB12	0.1118	0.7003	N/A	0.0611	0.0001	0.0004	0.0131	0.2034	0.0001	0.0002	0.0126	0.5911
SBd vs. SW	0.0001	0.0748	N/A	0.9162	0.0001	0.0001	0.0006	0.5309	0.0001	0.0356	0.6083	0.1038
SB9 vs SW	0.0001	0.1474	N/A	0.2055	0.0001	0.0001	0.0240	0.0580	0.0001	0.0005	0.1073	0.2368

Table 10. Agronomic response of canola to fertilizer placement and herbicide rate at Melfort, 1999.

	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement				
1. Fall Band - FBd	166 a	1474	24.2 b	19.6
2. Spring Band - SBd	161 a	1340	24.0 b	19.6
3. Sideband 9" - SB9	116 b	1407	24.4 ab	20.9
4. Sideband 12" - SB12	136 b	1373	24.7 a	21.0
5. Sweep - SW	120 b	1464	24.2 b	20.9
Herbicide Rate				
1. Full Rate - F	138	1391	24.2 b	20.7
2. 2/3 Rate - R	141	1432	24.4 a	20.2
Placement x Herb Rate				
FBd x F	160	1499	24.1	19.5
FBd x R	172	1449	24.3	19.8
SBd x F	159	1349	23.9	18.7
SBd x R	164	1332	24.2	20.6
SB9 x F	107	1357	24.2	22.1
SB9 x R	125	1458	24.6	19.7
SB12 x F	143	1309	24.5	21.9
SB12 x R	128	1438	24.9	20.1
SW x F	123	1442	24.2	21.1
SW x R	116	1486	24.3	20.8
Study Mean	140	1412	24.3	20.4
Pr > F				
Placement	0.0002	0.5963	0.0103	0.4888
Herbicide	0.7050	0.5035	0.0239	0.5004
Plmt x Herb	0.5912	0.8717	0.8556	0.3280
C.V.	17	14	1	11
Treatment Comparisons				
FBd vs. SBd	0.6912	0.1789	0.3614	0.9910
SB9 vs. SB12	0.1049	0.7275	0.0854	0.9551
SBd vs. SW	0.0013	0.2122	0.2631	0.2387
SB9 vs SW	0.7614	0.5641	0.3989	0.9910

Table 11. Agronomic response of canola to fertilizer placement and herbicide rate at Melfort 1996, 1997 and 1998.

	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
	------- 1996 -------				------- 1997 -------				-------- 1998 -------			
Fertilizer Placement												
1. Fall Band - FBd	93 b	2259	25.9	23.5	60 ab	1184 b	23.6	19.2	156 a	1642	23.2 b	19.8
2. Spring Band - SBd	90 b	2221	25.8	24.3	67 a	1434 a	23.5	22.4	141 b	1834	23.8 ab	22.2
3. Sideband 9" - SB9	92 b	2224	25.7	25.3	69 a	1503 a	23.7	22.7	146 ab	1920	24.2 a	18.8
4. Sideband 12" - SB12	127 a	2394	26.0	25.0	51 bc	1408 a	23.4	21.4	109 c	1763	24.1 a	19.6
5. Sweep - SW	72 c	2369	25.6	23.9	43 c	1478 a	23.6	21.9	108 c	1763	23.8 ab	19.2
Herbicide Rate												
1. Full Rate - F	96	2304	25.8	23.9	61	1403	23.7	21.6	134	1824	23.8	19.3
2. 2/3 Rate - R	94	2283	25.7	24.9	55	1400	23.5	21.5	130	1744	23.8	20.5
Placement x Herb Rate												
FBd x F	96	2274	25.6	22.8	64	1040	23.6	19.0	164	1686	23.2	19.8
FBd x R	91	2244	26.1	24.1	55	1329	23.6	19.4	148	1597	23.3	19.9
SBd x F	88	2195	25.9	20.9	73	1494	23.6	22.8	143	1839	23.9	21.9
SBd x R	91	2248	25.6	27.7	61	1375	23.4	22.0	139	1830	23.7	22.5
SB9 x F	98	2243	25.8	26.2	68	1549	23.9	21.9	142	1991	24.2	19.8
SB9 x R	85	2205	25.6	24.3	69	1457	23.5	23.5	150	1848	24.1	17.9
SB12 x F	131	2470	26.3	26.0	56	1463	23.4	22.6	119	1758	23.9	17.9
SB12 x R	124	2317	25.6	24.0	47	1353	23.4	20.3	99	1767	24.2	21.3
SW x F	66	2337	25.3	23.6	44	1467	23.9	21.5	104	1848	23.8	17.3
SW x R	78	2401	25.9	24.1	42	1489	23.4	22.2	112	1677	23.8	21.1
Study Mean	95	2293	25.8	24.4	58	1402	23.6	21.5	132	1784	23.8	19.9
Pr > F												
Placement	0.0005	0.1503	0.9306	0.2291	0.0006	0.0086	0.5999	0.0514	0.0001	0.3966	0.0463	0.1574
Herbicide	0.6537	0.7044	0.9062	0.8592	0.1066	0.9670	0.1055	0.8940	0.2072	0.3739	0.8403	0.1828
Plmt x Herb	0.5397	0.7217	0.6106	0.4311	0.7858	0.1306	0.7440	0.5538	0.0603	0.9574	0.9473	0.2508
C.V.	11	7	4	0.1618	20	12	2	11	9	16	3	14
Treatment Comparisons												
FBd vs. SBd	0.6342	0.6645	0.8108	0.6576	0.2375	0.0079	0.7324	0.0117	0.0181	0.1831	0.0695	0.1004

SB9 vs. SB12	0.0009	0.0579	0.5773	0.8951	0.0063	0.2820	0.1317	0.3044	0.0001	0.2759	0.7202	0.5659
SBd vs. SW	0.0369	0.0958	0.6901	0.8251	0.0004	0.6208	0.6085	0.6417	0.0001	0.6153	1.0000	0.0407
SB9 vs SW	0.0241	0.1018	0.7902	0.4680	0.0001	0.7733	0.7324	0.4944	0.0001	0.2760	0.2536	0.7871

Table 12. Agronomic response of canola to fertilizer placement and herbicide rate at Beaverlodge, 1999.

	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement				
1. Fall Band - FBd	213 a	1146 a	25.3	10.2
2. Spring Band - SBd	175 a	1077 a	24.7	10.0
3. Sideband 9" - SB9	171 a	1130 a	24.8	12.0
4. Sideband 12" - SB12	210 a	1020 a	24.6	11.4
5. Sweep - SW	40 b	754 b	24.8	11.0
Herbicide Rate				
1. Full Rate - F	161	1035	24.7	11.1
2. 2/3 Rate - R	162	1016	25.0	10.7
Placement x Herb Rate				
FBd x F	213	1195	24.8	9.5
FBd x R	212	1096	25.8	10.9
SBd x F	171	1091	24.5	10.6
SBd x R	180	1063	24.9	9.5
SB9 x F	181	1109	24.8	13.0
SB9 x R	161	1151	24.8	11.0
SB12 x F	213	1013	24.6	12.3
SB12 x R	208	1028	24.6	10.6
SW x F	28	767	24.7	10.3
SW x R	51	741	24.9	11.7
Study Mean	162	1025	24.8	10.9
Pr > F				
Placement	0.0001	0.0014	0.2725	0.3949
Herbicide	0.9383	0.7427	0.1549	0.5543
Plmt x Herb	0.8729	0.9532	0.5852	0.3637
C.V.	26	18	3	21
Treatment Comparisons				
FBd vs. SBd	0.0825	0.4633	0.0818	0.8599
SB9 vs. SB12	0.0662	0.2457	0.6168	0.6358
SBd vs. SW	0.0001	0.0016	0.7746	0.3867
SB9 vs SW	0.0001	0.0004	0.9144	0.3987

Table 13. Agronomic response of canola to fertilizer placement and herbicide rate at Beaverlodge 1996, 1997 and 1998.

	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m²)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
	------- 1996 -------				------- 1997 -------				------- 1998 -------			
Fertilizer Placement												
1. Fall Band - FBd	94 bc	306	16.5	37.8	N/A	660	19.4	35.4	117 b	705	19.2	28.2
2. Spring Band - SBd	115 ab	406	16.2	38.4	N/A	529	19.6	34.7	109 b	674	19.4	27.4
3. Sideband 9" - SB9	102 b	263	16.4	37.3	N/A	667	19.4	35.6	107 b	756	19.4	27.4
4. Sideband 12" - SB12	130 a	300	16.5	37.5	N/A	502	19.1	33.9	208 a	613	19.6	26.0
5. Sweep - SW	73 c	267	16.3	38.9	N/A	347	19.1	34.4	89 b	822	19.7	26.1
Herbicide Rate												
1. Full Rate - F	103	286	16.3	38.5	N/A	556	19.1	34.9	127	665	19.4	27.0
2. 2/3 Rate - R	102	332	16.5	37.5	N/A	526	19.5	34.7	125	762	19.6	27.0
Placement x Herb Rate												
FBd x F	94	266	16.3	37.2	N/A	797	18.9	34.1	126	637	19.1	26.8
FBd x R	94	346	16.8	38.4	N/A	524	19.8	36.8	107	773	19.4	29.5
SBd x F	108	396	16.0	38.2	N/A	418	19.3	34.7	108	683	19.0	26.1
SBd x R	122	417	16.4	38.6	N/A	640	19.9	34.8	111	665	19.7	28.6
SB9 x F	101	211	16.3	38.8	N/A	563	19.5	35.9	114	767	19.1	27.8
SB9 x R	102	315	16.6	35.8	N/A	771	19.3	35.4	100	744	19.8	27.1
SB12 x F	138	352	16.9	37.8	N/A	531	19.1	35.0	191	577	19.6	27.6
SB12 x R	123	249	16.1	37.2	N/A	473	19.1	32.8	226	648	19.6	24.3
SW x F	74	204	16.1	40.6	N/A	472	18.9	34.8	95	663	20.0	26.7
SW x R	71	330	16.5	37.2	N/A	223	19.4	34.1	84	980	19.4	25.5
Study Mean	103	309	16.4	38.0	N/A	541	19.3	34.8	126	714	19.5	27.0
Pr > F												
Placement	0.0013	0.2334	0.7530	0.7421	N/A	0.1792	0.6212	0.6747	0.0001	0.1254	0.9417	0.7533
Herbicide	0.9281	0.2894	0.4154	0.2183	N/A	0.7455	0.1278	0.8723	0.9127	0.0659	0.5236	0.9935
Plmt x Herb	0.8407	0.4583	0.2426	0.3160	N/A	0.2620	0.4478	0.4531	0.6243	0.2189	0.7497	0.4835
C.V.	24	44	4	7	N/A	53	4	8	30	22	6	14
Treatment Comparisons												
FBd vs. SBd	0.1083	0.1471	0.2625	0.6699	N/A	0.3660	0.4961	0.5924	0.6928	0.6958	0.8572	0.6849

SB9 vs. SB12	0.0297	0.5834	0.9033	0.8958	N/A	0.2572	0.4544	0.2007	0.0001	0.0844	0.7192	0.4643
SBd vs. SW	0.0023	0.0479	0.7770	0.6906	N/A	0.2141	0.1789	0.8286	0.2943	0.0746	0.5903	0.5081
SB9 vs SW	0.0277	0.9513	0.5720	0.2404	N/A	0.0336	0.4344	0.3745	0.3497	0.4168	0.6534	0.4919

Table 14. Agronomic response of canola to fertilizer placement and herbicide rate at Brandon, Melfort and Beaverlodge, 1996 to 1999.

	----- BRANDON, 1996 TO 1999 -----				----- MELFORT, 1996 TO 1999 -----				----- BEAVERLODGE, 1996 TO 1999 -----			
	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)	Crop Stand (plants/m^2)	Grain Yield (kg/ha)	Grain Protein (%)	Water Use (cm)
Fertilizer Placement												
1. Fall Band - FBd	99	1250	22.7	32.3	122	1640	24.2	20.5	141 a	704	20.1	27.9
2. Spring Band - SBd	96	1210	22.0	31.9	118	1708	24.3	22.1	133 ab	672	20.0	27.6
3. Sideband 9" - SB9	88	1297	21.8	32.8	108	1764	24.5	21.9	127 ab	704	20.0	28.1
4. Sideband 12" - SB12	72	1091	22.7	31.3	103	1734	24.5	21.8	183 a	609	19.9	27.2
5. Sweep - SW	97	918	22.6	32.3	88	1768	24.3	21.5	67 b	548	20.0	27.6
Herbicide Rate												
1. Full Rate - F	92	1154	22.4	32.3	109	1731	24.4	21.4	130	636	19.9 b	27.9
2. 2/3 Rate - R	89	1153	22.3	31.9	106	1715	24.4	21.8	130	659	20.1 a	27.5
Placement x Herb Rate												
FBd x F	97	1290	22.5	33.6	125	1625	24.1	20.3	144	724	19.8	26.9
FBd x R	101	1210	22.9	31.1	120	1655	24.3	20.8	138	685	20.5	28.9
SBd x F	99	1209	22.2	32.2	120	1719	24.3	21.1	129	647	19.7	27.4
SBd x R	93	1210	21.8	31.6	117	1696	24.2	23.2	137	696	20.2	27.9
SB9 x F	90	1304	21.9	33.8	105	1785	24.5	22.5	132	662	19.9	28.9
SB9 x R	86	1291	21.7	31.8	111	1742	24.4	21.4	121	746	20.1	27.3
SB12 x F	78	1026	22.8	29.9	110	1750	24.5	22.1	181	618	20.0	28.2
SB12 x R	66	1156	22.5	32.7	96	1719	24.5	21.4	185	599	19.9	26.2
SW x F	94	939	22.5	32.0	87	1774	24.3	20.9	66	526	19.9	28.1
SW x R	100	896	22.7	32.6	88	1763	24.3	22.1	69	569	20.0	27.1
Study Mean	90	1153	22.4	32.1	108	1723	24.4	21.6	130	647	20.0	27.7
Pr > F												
Year	0.0058	0.0001	0.0041	0.0002	0.0001	0.0001	0.0001	0.1132	0.0972	0.0002	0.0066	0.0001
Placement	0.8292	0.0844	0.0587	0.9140	0.1011	0.3281	0.3317	0.2650	0.0430	0.2295	0.8210	0.6303
Herbicide	0.4900	0.8984	0.2190	0.4998	0.3225	0.5815	0.9283	0.4028	0.6768	0.4863	0.0099	0.1867
Plmt x Herb	0.3251	0.0125	0.5746	0.2842	0.2247	0.9298	0.7944	0.3197	0.6486	0.8069	0.0607	0.0124
Year x Placement	0.0001	0.0001	0.2843	0.4621	0.0001	0.0901	0.1390	0.6585	0.0004	0.1732	0.3397	0.3329
Year x Herbicide	0.3965	0.0047	0.9269	0.5582	0.4559	0.5001	0.1999	0.6212	0.9771	0.5819	0.8589	0.6744

Year x Plmt x Herb	0.4974	0.9842	0.2064	0.1016	0.7840	0.7518	0.8434	0.2131	0.8474	0.2283	0.9073	0.9113
C.V.	19	14	3	12	15	12	3	13	27	31	4	10
Treatment Comparisons												
FBd vs. SBd	0.9126	0.7478	0.0768	0.6754	0.7482	0.3187	0.7271	0.0475	0.7907	0.6708	0.3525	0.6347
SB9 vs. SB12	0.5266	0.1199	0.0205	0.5884	0.9924	0.6621	0.8540	0.8274	0.0879	0.2295	0.7479	0.1567
SBd vs. SW	0.9589	0.0535	0.1362	0.8139	0.0303	0.3712	0.8540	0.3859	0.0531	0.1252	0.9849	0.9803
SB9 vs SW	0.8117	0.0146	0.0324	0.8770	0.1168	0.9433	0.3049	0.5460	0.0755	0.0597	0.7911	0.4275

WEED COMMUNITY ANALYSIS

Broadleaf and grass weeds species were present within the study. Species perennation included annual, biennial, and perennial. Both native and introduced species were present. The weed communities were reflective of the agroecological zone in which the research was conducted.

The number of individual weeds were counted by species prior to seeding, at the seedling stage, and at maturity. Counts were conducted in twenty quadrats randomly placed quadrats following a "W" pattern across each plot. Total weed densities were calculated as the average density of all individuals of all species per metre squared in each plot. In order to assess spacial as well as density aspects of the weed community, relative abundance values were calculated by species per plot and averaged by experimental factor, such as fertilizer treatment. Relative abundance was calculated as: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Summary of Results

In general, reduced herbicide rates applied in 1998 did not result in greater weed recruitment prior to crop seeding or in-crop spraying. However, weed densities were greater in wheat at both Melfort and Beaverlodge after herbicide application in 1999.

The impact of fertilizer timing, placement, and level of soil disturbance on weed density varied by site. In general, however, sweeps were weediest in both wheat and canola, frequently at both the time of in-crop spraying and in the July count. Except in wheat at Beaverlodge, weed density was unaffected by spacing (9" vs. 12"). In general, weed densities were unaffected by the number of passes, although some effects occurred in wheat at Beaverlodge.

Climatically, 1999 was an extremely wet year on most of the Canadian Prairies and results should be interpreted cautiously as this climatic effect will likely override many (or all) treatment effects.

Brandon

Prior to crop seeding, weed densities were similar in all canola treatments and most wheat treatments (Tables 1, 4-18). However, weed densities in wheat were higher in fall band than spring band treatments. Reducing herbicide rates did not significantly increase weed densities in either wheat or canola.

Prior to in-crop herbicide, weed densities were similar in all canola treatments and most wheat treatments. In canola, reducing herbicide rates did not significantly increase weed densities. In wheat, the side band 9" treatment had more weeds than the sweeps, and the reduced herbicide rate treatment had fewer weeds than the full herbicide rate treatment.
In the July weed counts, weed densities were similar in most wheat and canola treatments. In wheat and canola, the sweeps had the highest weed densities. Reducing herbicide rates did not significantly increase weed densities in either wheat or canola.

Melfort

Prior to crop seeding, weed densities were similar in all wheat treatments and most canola treatments. In canola, the reduced herbicide treatment had more weeds than the recommended rate. At the reduced herbicide rate, spring-banded canola had greater weed densities than fall-banded canola. Reducing herbicide rates did not significantly increase weed densities in wheat.
Prior to in-crop herbicide, weed densities were similar in most wheat and canola treatments. In wheat, sweeps and fall-banded plots had the greatest weed densities. Reducing herbicide rates did not significantly increase weed densities in either

wheat or canola.

In the July weed counts, weed densities were higher in wheat, but not canola, with reduced herbicide rates. In canola, sweeps had the highest weed densities while side-band 9" treatments had the lowest weed densities.

Beaverlodge

Prior to crop seeding, weed densities were similar in all canola treatments and most wheat treatments. In wheat, fall banding resulted in fewer weeds than spring banding at the recommended herbicide rate. Reducing herbicide rates did not significantly increase weed densities in either wheat or canola.

Prior to in-crop herbicide, sweeps were weediest in both wheat (especially at reduced herbicide rate) and canola. Side banding resulted in greater weed densities than random (spring + fall) banding. Reducing herbicide rates did not significantly increase weed densities in either wheat or canola.

In the July weed counts, weed densities were similar in all canola treatments and most wheat treatments. Reducing herbicide rates did not significantly increase weed densities in canola but did in wheat (although the effect was greatest in the sweeps). Side-banding at 9" spacing resulted in lower weed densities than at 12" spacing or with sweeps.

The following Tables 1.0 - Table 48 describe the weed community analysis that the above summaries were derived for each location.

Table 1.0 Average total density (+/- SE) of all weed species at Brandon in 1999.

Crop	Fertilizer application	Herbicide Rate	Pre-seeding Count	Pre-spray Count	July Count
Wheat	Fall Band	100 %	210.6 ± 9.8	43.0 ± 5.7	73.5 ± 3.0
Wheat	Fall Band	66 %	214.1 ± 17.5	39.1 ± 4.1	76.7 ± 1.9
Wheat	Spring Band	100 %	131.6 ± 34.2	38.5 ± 8.7	66.7 ± 14.4
Wheat	Spring Band	66 %	175.6 ± 56.1	29.0 ± 1.8	62.0 ± 8.3
Wheat	Side Band 9"	100 %	157.3 ± 39.8	34.1 ± 1.8	64.3 ± 6.4
Wheat	Side Band 9"	66 %	181.4 ± 55.7	31.0 ± 3.1	76.7 ± 6.5
Wheat	Side Band 12"	100 %	164.9 ± 26.2	39.5 ± 5.3	63.3 ± 11.0
Wheat	Side Band 12"	66 %	181.2 ± 33.8	29.7 ± 2.4	70.6 ± 4.4
Wheat	Sweeps	100 %	186.0 ± 26.8	54.8 ± 9.0	96.0 ± 12.9
Wheat	Sweeps	66 %	150.0 ± 20.6	36.0 ± 4.0	91.0 ± 14.2
Canola	Fall Band	100 %	132.6 ± 35.2	34.3 ± 4.4	54.3 ± 9.1
Canola	Fall Band	66 %	151.4 ± 22.9	39.0 ± 6.3	77.5 ± 7.1
Canola	Spring Band	100 %	80.8 ± 13.8	30.4 ± 5.0	59.7 ± 7.1
Canola	Spring Band	66 %	94.5 ± 6.4	38.4 ± 5.5	66.3 ± 6.4
Canola	Side Band 9"	100 %	83.8 ± 9.0	36.7 ± 2.0	54.9 ± 3.7
Canola	Side Band 9"	66 %	94.6 ± 13.9	33.3 ± 6.1	64.6 ± 2.7
Canola	Side Band 12"	100 %	118.8 ± 12.3	35.7 ± 5.0	64.9 ± 10.1
Canola	Side Band 12"	66 %	99.8 ± 8.3	33.1 ± 7.8	61.7 ± 7.1
Canola	Sweeps	100 %	105.6 ± 16.1	46.9 ± 10.3	79.0 ± 6.1
Canola	Sweeps	66 %	99.6 ± 10.3	43.2 ± 7.2	81.6 ± 8.0

Table 1.1 Orthogonal contrasts comparing the average total density of all weeds at Brandon in 1999.

Orthogonal contrasts	Pre-seed Counts	Pre-spray Counts	July Counts
	p value	p value	p value
Wheat (Rec. vs low herbicide)	ns	<0.0030	ns
Canola (Rec. vs low herbicide)	ns	ns	ns
Wheat (rec. herb) Fall vs Spring band	<0.0293	ns	ns
Wheat (rec. herb) Fall + Spring vs Side band	ns	ns	ns
Wheat (rec. herb) Side band (9" vs 12")	ns	ns	ns
Wheat (rec. herb) Side band 9" vs Sweep	ns	<0.0023	<0.0044
Wheat (low herb) Fall vs Spring band	ns	ns	ns
Wheat (low herb) Fall + Spring vs Side band	ns	ns	ns
Wheat (low herb) Side band (9" vs 12")	ns	ns	ns
Wheat (low herb) Side band 9" vs Sweep	ns	ns	ns
Canola (rec. herb) Fall vs Spring band	ns	ns	ns
Canola (rec. herb) Fall + Spring vs Side band	ns	ns	ns
Canola (rec. herb) Side band (9" vs 12")	ns	ns	ns
Canola (rec. herb) Side band 9" vs Sweep	ns	ns	<0.0279
Canola (low herb) Fall vs Spring band	ns	ns	ns
Canola (low herb) Fall + Spring vs Side band	ns	ns	ns
Canola (low herb) Side band (9" vs 12")	ns	ns	ns
Canola (low herb) Side band 9" vs Sweep	ns	ns	ns

Table 2.0 Average total density (+/- SE) of all weed species at Melfort in 1999.

Crop	Fertilizer application	Herbicide Rate	Pre-seeding Count	Pre-spray Count	July Count
Wheat	Fall Band	100 %	16.1 ± 3.9	9.2 ± 5.9	18.0 ± 2.4
Wheat	Fall Band	66 %	22.4 ± 6.5	3.9 ± 0.8	24.4 ± 4.8
Wheat	Spring Band	100 %	10.1 ± 1.7	3.8 ± 0.7	24.1 ± 1.6
Wheat	Spring Band	66 %	11.7 ± 3.6	4.5 ± 1.0	28.7 ± 4.1
Wheat	Side Band 9"	100 %	11.8 ± 1.8	2.9 ± 0.4	18.7 ± 2.5
Wheat	Side Band 9"	66 %	11.9 ± 2.2	2.8 ± 0.6	21.5 ± 1.5
Wheat	Side Band 12"	100 %	14.1 ± 2.4	5.5 ± 1.7	26.9 ± 4.1
Wheat	Side Band 12"	66 %	16.3 ± 3.0	5.5 ± 1.4	30.0 ± 5.6
Wheat	Sweeps	100 %	8.2 ± 1.4	9.2 ± 2.6	22.5 ± 5.2
Wheat	Sweeps	66 %	8.6 ± 1.3	9.2 ± 2.9	27.7 ± 5.7
Canola	Fall Band	100 %	33.7 ± 8.3	8.5 ± 1.3	25.5 ± 6.2
Canola	Fall Band	66 %	28.9 ± 4.0	9.8 ± 1.4	27.5 ± 3.6
Canola	Spring Band	100 %	30.8 ± 4.9	9.0 ± 1.9	28.5 ± 4.7
Canola	Spring Band	66 %	63.3 ± 10.6	8.8 ± 1.0	33.5 ± 6.0
Canola	Side Band 9"	100 %	21.1 ± 2.9	6.5 ± 2.8	20.0 ± 1.1
Canola	Side Band 9"	66 %	42.0 ± 5.0	8.1 ± 1.6	26.0 ± 4.3
Canola	Side Band 12"	100 %	35.3 ± 10.9	9.7 ± 0.8	24.4 ± 4.0
Canola	Side Band 12"	66 %	55.5 ± 12.7	9.0 ± 1.3	26.2 ± 2.6
Canola	Sweeps	100 %	27.6 ± 3.0	12.8 ± 4.8	35.4 ± 6.5
Canola	Sweeps	66 %	38.5 ± 3.6	16.0 ± 4.5	38.5 ± 6.9

Table 2.1 Orthogonal contrasts comparing the average total density of all weeds at Melfort in 1999.

Orthogonal contrasts	**Pre-seed Counts**	**Pre-spray Counts**	**July Counts**
	p value	p value	p value
Wheat (Rec. vs low herbicide)	ns	ns	<0.0795
Canola (Rec. vs low herbicide)	<0.0001	ns	ns
Wheat (rec. herb) Fall vs Spring band	ns	<0.0821	ns
Wheat (rec. herb) Fall + Spring vs Side band	ns	ns	ns
Wheat (rec. herb) Side band (9" vs 12")	ns	ns	ns
Wheat (rec. herb) Side band 9" vs Sweep	ns	<0.0416	ns
Wheat (low herb) Fall vs Spring band	ns	ns	ns
Wheat (low herb) Fall + Spring vs Side band	ns	ns	ns
Wheat (low herb) Side band (9" vs 12")	ns	ns	ns
Wheat (low herb) Side band 9" vs Sweep	ns	<0.0401	ns
Canola (rec. herb) Fall vs Spring band	ns	ns	ns
Canola (rec. herb) Fall + Spring vs Side band	ns	ns	ns
Canola (rec. herb) Side band (9" vs 12")	<0.0905	ns	ns
Canola (rec. herb) Side band 9" vs Sweep	ns	<0.0401	<0.0072
Canola (low herb) Fall vs Spring band	<0.0001	ns	ns
Canola (low herb) Fall + Spring vs Side band	ns	ns	ns
Canola (low herb) Side band (9" vs 12")	ns	ns	ns
Canola (low herb) Side band 9" vs Sweep	ns	<0.0119	<0.0274

Table 3.0 Average total density (+/- SE)of all weed species at Beaverlodge in 1999.

Crop	Fertilizer application	Herbicide Rate	Pre-seed Count	Pre-spray Count	July Count
Wheat	Fall Band	100 %	64.0 ± 14.3	255.6 ± 38.9	64.9 ± 19.6
Wheat	Fall Band	66 %	90.5 ± 16.1	223.2 ± 19.8	59.4 ± 15.7
Wheat	Spring Band	100 %	151.2 ± 70.5	338.1 ± 50.8	28.1 ± 3.3
Wheat	Spring Band	66 %	156.7 ± 58.2	300.2 ± 45.5	69.1 ± 37.8
Wheat	Side Band 9"	100 %	151.6 ± 39.8	325.7 ± 52.6	26.0 ± 4.1
Wheat	Side Band 9"	66 %	86.1 ± 19.3	291.6 ± 63.9	20.1 ± 6.5
Wheat	Side Band 12"	100 %	91.9 ± 38.3	420.0 ± 80.8	72.2 ± 33.7
Wheat	Side Band 12"	66 %	96.8 ± 47.3	344.4 ± 64.2	66.1 ± 28.3
Wheat	Sweeps	100 %	142.1 ± 105.8	380.7 ± 16.2	17.3 ± 3.8
Wheat	Sweeps	66 %	145.0 ± 52.3	657.2 ± 90.4	93.7 ± 39.1
Canola	Fall Band	100 %	37.8 ± 12.0	304.2 ± 44.5	20.7 ± 5.6
Canola	Fall Band	66 %	53.6 ± 17.1	333.8 ± 62.0	26.2 ± 5.5
Canola	Spring Band	100 %	20.5 ± 5.4	321.3 ± 37.7	36.1 ± 4.3
Canola	Spring Band	66 %	21.6 ± 5.6	387.5 ± 43.5	57.6 ± 23.1
Canola	Side Band 9"	100 %	16.1 ± 10.0	338.5 ± 86.3	37.0 ± 1.4
Canola	Side Band 9"	66 %	24.4 ± 15.0	325.2 ± 76.9	17.5 ± 3.8
Canola	Side Band 12"	100 %	14.2 ± 8.3	325.4 ± 49.8	20.3 ± 4.7
Canola	Side Band 12"	66 %	42.0 ± 23.4	352.9 ± 38.0	54.3 ± 14.5
Canola	Sweeps	100 %	45.7 ± 25.8	573.9 ± 109.2	77.7 ± 7.5
Canola	Sweeps	66 %	33.2 ± 18.1	504.2 ± 59.6	49.1 ± 12.9

Table 3.1 Orthogonal contrasts comparing the average total density of all weeds at Beaverlodge in 1999.

Orthogonal contrasts	**Pre-seed Counts**	**Pre-spray Counts**	**July Counts**
	p value	p value	p value
Wheat (Rec. vs low herbicide)	ns	ns	<0.0861
Canola (Rec. vs low herbicide)	ns	ns	ns
Wheat (rec. herb) Fall vs Spring band	<0.0878	ns	ns
Wheat (rec. herb) Fall + Spring vs Side band	ns	ns	ns
Wheat (rec. herb) Side band (9" vs 12")	ns	ns	<0.0763
Wheat (rec. herb) Side band 9" vs Sweep	ns	ns	ns
Wheat (low herb) Fall vs Spring band	ns	ns	ns
Wheat (low herb) Fall + Spring vs Side band	ns	<0.0072	ns
Wheat (low herb) Side band (9" vs 12")	ns	ns	<0.0770
Wheat (low herb) Side band 9" vs Sweep	ns	<0.0001	<0.0056
Canola (rec. herb) Fall vs Spring band	ns	ns	ns
Canola (rec. herb) Fall + Spring vs Side band	ns	ns	ns
Canola (rec. herb) Side band (9" vs 12")	ns	ns	ns
Canola (rec. herb) Side band 9" vs Sweep	ns	<0.0013	ns
Canola (low herb) Fall vs Spring band	ns	ns	ns
Canola (low herb) Fall + Spring vs Side band	ns	ns	ns
Canola (low herb) Side band (9" vs 12")	ns	ns	ns
Canola (low herb) Side band 9" vs Sweep	ns	<0.0128	ns

Table 4.0 Weed relative abundance and density by crop prior to crop seeding at Brandon in 1999.

Weed Species	Wheat RelAb	Wheat #/m^2	Canola RelAb	Canola #/m^2
Sowthistle species	24.5	54.3	30.1	42.5
Canada thistle	14.4	23.3	22.1	24.6
Wild mustard	9.9	15.9	10.2	12.3
Wild buckwheat	8.3	15.9	7.5	6.3
Volunteer canola	8.2	15.6	2.3	1.9
Wild oat	7.6	13.0	4.4	4.2
Shepherds purse	5.2	14.4	2.1	1.6
Green foxtail	4.4	9.4	1.7	2.1
Volunteer wheat	4.3	4.0	2.4	1.1
Dandelion	3.6	2.0	4.3	1.8
Quackgrass	0.8	1.3	0.2	0.1
Lambsquarters	0.8	0.8	1.9	2.0
Canada fleabane	0.7	0.6	0.5	0.3
Rough cinquefoil	0.7	0.4	0.8	0.4
Foxtail barley	0.6	0.3	0.2	0.1
Panicled aster	0.6	0.3	1.0	0.5
Stinkweed	0.5	0.6	1.1	0.9
Broadleaved plantain	0.5	0.2	0.6	0.2
Narrow leaved hawks beard	0.4	0.6	0.2	0.1
Biennial wormwood	0.4	0.2	0.6	0.3
Smartweed species	0.4	0.3	0.3	0.2
Purple leaved willowherb	0.4	0.2	0.9	0.6
Goldenrod species	0.4	0.2	0.5	0.2
Curled dock	0.4	0.2	1.1	0.4
Round leaved mallow	0.3	0.5	0.1	0.1
Smooth brome	0.2	0.2	0.1	0.0
Goats beard species	0.2	0.1	0.2	0.1
Many flowered aster	0.2	0.1	0.3	0.1
Rayless aster	0.1	0.1	0.4	0.1
Bluebur	0.1	0.1	0.0	0.0
Nightflowering catchfly	0.1	0.1	0.0	0.0
Barnyard grass	0.1	0.1	0.1	0.0
Marsh yellow cress	0.1	0.0	0.0	0.0
Redroot pigweed	0.1	0.1	0.1	0.0
American dragonhead	0.1	0.0	0.0	0.0
Worm seed mustard	0.1	0.0	0.0	0.0
Prickly lettuce	0.1	0.0	0.0	0.0
Siberian elm	0.0	0.0	0.0	0.0
Mustard species	0.0	0.0	1.4	0.8
Wood whitlow grass	0.0	0.0	0.0	0.0
Prostrate pigweed	0.0	0.0	.	.
Vetch species	0.0	0.0	0.0	0.0
Black medic	0.0	0.0	.	.
Philadelphia fleabane	0.0	0.0	0.0	0.0
Mouse ear chickweed	0.0	0.0	.	.
Flixweed	0.0	0.0	0.0	0.0
Common speedwell	0.0	0.0	0.1	0.0
Common burdock	0.0	0.0	.	.
Hempnettle	0.0	0.0	0.0	0.0
Bicknells geranium	0.0	0.0	0.1	0.0
Manitoba maple	.	.	0.0	0.0
Common yarrow	.	.	0.0	0.0
Pygmy flower	.	.	0.0	0.0
Geranium species	.	.	0.1	0.1
Volunteer barley	.	.	0.1	0.0
Common groundsel	.	.	0.0	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 5.0 Weed relative abundance and density by crop prior to in-crop spraying at Brandon in 1999.

Weed Species	Wheat RelAb	Wheat #/m^2	Canola RelAb	Canola #/m^2
Dandelion	27.7	13.4	32.0	16.8
Sowthistle species	14.9	5.1	13.1	4.2
Wild buckwheat	14.6	5.4	14.0	4.5
Canada thistle	13.8	4.1	4.2	0.9
Wild mustard	13.1	4.4	4.3	1.4
Stinkweed	4.8	1.6	5.8	2.0
Volunteer canola	3.9	1.3	1.2	0.2
Shepherds purse	2.6	1.1	1.6	0.4
Green foxtail	1.7	0.4	1.2	0.4
Wild oat	1.5	0.4	4.9	1.2
Lambsquarters	0.5	0.1	1.3	0.3
Redroot pigweed	0.3	0.1	0.1	0.0
Round leaved mallow	0.2	0.1	0.0	0.0
Worm seed mustard	0.1	0.0	0.0	0.0
Smartweed species	0.1	0.0	0.8	0.2
Broadleaved plantain	0.0	0.0	.	.
Curled dock	0.0	0.0	0.1	0.0
Clover species	0.0	0.0	.	.
Rough cinquefoil	0.0	0.0	0.1	0.0
American dragonhead	.	.	0.1	0.0
Purple leaved willowherb	.	.	0.1	0.0
Poplar species	.	.	0.0	0.0
Goldenrod species	.	.	0.0	0.0
Volunteer wheat	.	.	14.8	4.5
Vetch species	.	.	0.0	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 6.0 Weed relative abundance and density by crop in July at Brandon in 1999.

Weed Species	Wheat RelAb	Wheat #/m^2	Canola RelAb	Canola #/m^2
Dandelion	33.6	33.9	30.9	26.8
Canada thistle	19.5	12.6	6.9	3.0
Sowthistle species	18.1	12.8	18.1	12.1
Wild buckwheat	13.2	7.8	11.7	6.6
Wild mustard	6.0	2.7	10.3	6.2
Wild oat	3.1	1.2	7.8	3.9
Green foxtail	2.7	1.7	1.2	0.6
Shepherds purse	1.4	0.6	1.2	0.7
Redroot pigweed	0.7	0.2	0.1	0.0
Volunteer canola	0.5	0.2	.	.
Lambsquarters	0.3	0.1	2.2	1.1
Smartweed species	0.2	0.1	0.4	0.2
Stinkweed	0.2	0.1	0.9	0.7
Round leaved mallow	0.1	0.1	0.1	0.0
Narrow leaved hawks beard	0.1	0.0	0.1	0.0
Prostrate pigweed	0.1	0.0	0.0	0.0
Rough cinquefoil	0.0	0.0	.	.
Biennial wormwood	0.0	0.0	0.1	0.0
Thyme leaved spurge	0.0	0.0	.	.
Northern willowherb	0.0	0.0	.	.
Barnyard grass	.	.	0.1	0.1
Purple leaved willowherb	.	.	0.0	0.0
Canada fleabane	.	.	0.1	0.0
Geranium species	.	.	0.0	0.0
Bluebur	.	.	0.0	0.0
Nightflowering catchfly	.	.	0.1	0.0
Goldenrod species	.	.	0.1	0.0
Volunteer wheat	.	.	7.8	4.0

Relative Abundance values(RelAb)were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 7.0 Weed relative abundance and density by fertilizer treatment in wheat prior to crop seeding at Brandon in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Sowthistle species	22.6	67.0	25.5	41.1	26.0	56.1	24.9	54.6	23.4	52.6
Wild mustard	11.3	23.7	8.3	9.0	6.2	7.9	14.1	25.3	9.7	13.6
Wild buckwheat	10.5	23.3	8.2	16.0	9.1	19.9	6.2	8.4	7.5	12.1
Volunteer canola	9.9	18.7	7.1	17.3	11.7	23.6	4.2	6.5	7.9	12.0
Canada thistle	9.5	18.1	16.7	24.6	16.4	26.7	14.0	21.2	15.2	26.1
Wild oat	9.1	19.9	8.7	13.1	4.2	4.9	9.0	16.2	7.1	11.0
Volunteer wheat	6.2	8.0	4.8	3.9	3.1	2.0	3.9	3.1	3.6	2.9
Green foxtail	6.0	14.9	3.0	5.5	5.5	12.9	3.4	6.2	4.2	7.4
Shepherds purse	3.8	9.0	5.7	16.1	2.2	3.6	6.3	21.3	8.1	21.9
Dandelion	2.6	1.5	3.1	1.5	3.8	2.1	3.7	2.0	4.6	2.8
Stinkweed	1.1	2.4	0.4	0.2	0.4	0.3	0.5	0.2	0.3	0.1
Purple leaved willowherb	0.7	0.5	0.3	0.2	0.3	0.1	0.4	0.2	0.2	0.1
Rough cinquefoil	0.7	0.5	0.5	0.3	0.9	0.5	0.9	0.5	0.6	0.4
Canada fleabane	0.6	0.5	0.9	0.6	0.4	0.3	1.0	1.1	0.6	0.5
Lambsquarters	0.6	0.7	0.5	0.5	0.9	0.7	0.8	0.8	1.3	1.4
Smartweed species	0.5	0.4	0.8	0.6	0.1	0.1	0.3	0.2	0.3	0.2
Panicled aster	0.4	0.3	0.6	0.2	0.8	0.4	0.5	0.2	0.5	0.3
Broadleaved plantain	0.4	0.2	0.8	0.3	0.8	0.4	0.3	0.2	0.1	0.1
Quackgrass	0.4	0.6	0.4	0.8	1.2	1.3	1.8	3.0	0.4	0.7
Round leaved mallow	0.4	0.5	0.2	0.1	0.3	1.2	0.3	0.3	0.3	0.3
Foxtail barley	0.3	0.2	0.6	0.2	0.8	0.4	0.6	0.2	0.5	0.2
Curled dock	0.3	0.2	0.6	0.3	0.4	0.2	0.2	0.1	0.2	0.1
Redroot pigweed	0.3	0.4	.	.	.	.	0.1	0.0	0.1	0.0
Goldenrod species	0.3	0.3	0.4	0.2	0.6	0.3	0.4	0.3	0.2	0.1
Narrow leaved hawks beard	0.2	0.2	0.6	0.8	0.6	1.4	0.2	0.3	0.4	0.5
Biennial wormwood	0.2	0.1	0.5	0.2	0.6	0.3	0.3	0.1	0.4	0.2
Nightflowering catchfly	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.3	0.1	0.1
Many flowered aster	0.2	0.1	0.1	0.0	0.3	0.1	0.2	0.1	0.2	0.1
Philadelphia fleabane	0.1	0.1	.	.	.	.	.	.	.	.
Bluebur	0.1	0.2	0.1	0.1	0.2	0.4	0.1	0.1	0.1	0.1
Rayless aster	0.1	0.1	.	.	0.2	0.1	0.1	0.1	0.3	0.1
Mustard species	0.1	0.0	.	.	0.2	0.1	.	.	.	.
Worm seed mustard	0.0	0.0	.	.	0.0	0.0	0.0	0.0	0.2	0.1
Wood whitlow grass	0.0	0.0	.	.	0.0	0.0	0.1	0.1	.	.
Prickly lettuce	0.0	0.0	0.1	0.1	0.1	0.1	.	.	0.1	0.0
Barnyard grass	0.0	0.0	.	.	0.1	0.2	.	.	0.3	0.4
Goats beard species	0.0	0.0	.	.	0.3	0.2	0.3	0.2	0.4	0.2
Smooth brome	0.0	0.0	.	.	0.7	0.7	0.4	0.4	0.1	0.1
American dragonhead	0.0	0.0	0.1	0.1	0.1	0.1	.	.	0.1	0.0
Marsh yellow cress	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.1	.	.
Prostrate pigweed	.	.	0.1	0.0	.	.	.	.	0.1	0.0
Common burdock	.	.	.	.	.	.	.	.	0.1	0.0
Mouse ear chickweed	.	.	.	.	0.1	0.1	.	.	.	.
Flixweed	.	.	.	.	.	.	0.1	0.1	.	.
Hempnettle	.	.	.	.	0.1	0.1	.	.	.	.
Bicknells geranium	.	.	0.0	0.0	.	.	.	.	.	.
Black medic	.	.	0.0	0.0	.	.	.	.	0.1	0.1
Siberian elm	.	.	0.1	0.0	.	.	0.1	0.0	0.1	0.1
Common speedwell	.	.	.	.	0.1	0.0	.	.	.	.
Vetch species	.	.	.	.	.	.	0.1	0.1	0.1	0.1

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 8.0. Weed relative abundance and density by fertilizer treatment in canola prior to crop seeding at Brandon in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Sowthistle species	27.1	57.2	30.1	34.4	31.4	35.7	30.6	44.5	31.1	41.0
Canada thistle	16.2	23.2	24.3	23.8	25.6	26.9	20.2	21.6	24.2	27.3
Wild buckwheat	11.7	15.4	7.7	5.6	6.4	3.6	6.3	4.0	5.5	3.2
Wild mustard	8.6	14.7	8.2	7.1	6.4	5.4	15.2	18.7	12.4	15.5
Wild oat	5.6	7.0	3.8	2.3	4.5	3.8	5.2	5.3	3.1	2.7
Shepherds purse	4.0	3.3	1.7	1.5	1.5	1.0	1.3	1.1	1.7	1.0
Volunteer canola	3.8	4.3	2.1	1.0	2.9	2.7	1.8	1.1	0.6	0.5
Volunteer wheat	3.7	2.3	1.8	0.7	2.3	1.0	1.8	0.7	2.2	0.8
Dandelion	3.6	1.9	4.3	1.5	4.7	1.9	3.1	1.6	5.7	2.0
Lambsquarters	2.8	3.8	1.6	1.7	1.2	0.7	2.1	2.3	1.6	1.7
Mustard species	2.0	1.2	0.8	0.4	2.1	1.1	0.6	0.2	1.7	1.1
Green foxtail	1.9	2.2	1.2	1.8	1.8	1.7	2.1	2.8	1.3	2.1
Stinkweed	1.7	1.6	1.1	0.7	0.9	0.3	1.3	1.5	0.5	0.4
Goldenrod species	0.8	0.4	0.6	0.2	0.3	0.1	0.5	0.2	0.5	0.2
Rough cinquefoil	0.8	0.4	1.0	0.7	0.6	0.2	0.6	0.3	0.8	0.3
Curled dock	0.7	0.3	1.6	0.6	1.6	0.5	0.6	0.2	0.9	0.4
Panicled aster	0.6	0.4	1.2	0.6	1.1	0.4	1.0	0.4	1.0	0.6
Biennial wormwood	0.6	0.4	1.3	0.5	0.1	0.0	0.5	0.2	0.5	0.3
Volunteer barley	0.5	0.2	.	.	.	.	.	.	.	.
Smartweed species	0.4	0.4	0.3	0.3	0.2	0.1	0.3	0.4	0.1	0.0
Purple leaved willowherb	0.4	0.2	1.0	0.8	1.6	1.5	0.7	0.2	0.8	0.4
Narrow leaved hawks beard	0.4	0.4	0.2	0.1	.	.	0.1	0.0	0.2	0.1
Broadleaved plantain	0.3	0.2	0.8	0.4	0.6	0.2	0.4	0.1	0.6	0.2
Goats beard species	0.3	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.3	0.1
Many flowered aster	0.3	0.1	0.4	0.1	0.4	0.1	0.1	0.0	0.2	0.1
Canada fleabane	0.2	0.1	0.7	0.2	0.4	0.2	1.0	0.8	0.5	0.2
Rayless aster	0.1	0.1	0.4	0.1	.	.	0.6	0.2	0.7	0.2
Foxtail barley	0.1	0.1	0.3	0.1	0.3	0.1	0.2	0.1	0.1	0.0
Redroot pigweed	0.1	0.1	.	.	.	.	0.2	0.1	.	.
Wood whitlow grass	0.1	0.1	.	.	.	.	.	.	.	.
Worm seed mustard	0.1	0.1	0.1	0.1	.	.	.	.	.	.
Hempnettle	0.1	0.2	.	.	.	.	.	.	.	.
Round leaved mallow	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.0
Prickly lettuce	0.1	0.0	0.0	0.0	.	.	.	.	.	.
Common speedwell	0.0	0.1	0.1	0.1	0.1	0.1	.	.	0.1	0.0
Bluebur	0.0	0.0	.	.	.	.	.	.	.	.
Manitoba maple	.	.	.	.	0.1	0.0	.	.	.	.
Common yarrow	.	.	.	.	.	.	0.1	0.0	0.1	0.0
Quackgrass	.	.	.	.	.	.	0.7	0.4	0.4	0.2
Pygmy flower	.	.	0.1	0.0	.	.	.	.	0.1	0.1
Smooth brome	.	.	0.2	0.1	0.1	0.1	.	.	.	.
Flixweed	.	.	.	.	.	.	0.1	0.0	.	.
American dragonhead	.	.	0.1	0.0	.	.	.	.	.	.
Barnyard grass	.	.	0.3	0.2	.	.	0.1	0.1	0.1	0.0
Philadelphia fleabane	.	.	0.1	0.0	.	.	.	.	.	.
Bicknells geranium	.	.	.	.	0.2	0.1	0.1	0.0	.	.
Geranium species	.	.	0.2	0.1	.	.	0.1	0.0	0.3	0.2
Nightflowering catchfly	.	.	0.1	0.0	.	.	0.1	0.0	.	.
Marsh yellow cress	.	.	0.0	0.0	.	.	0.1	0.0	.	.
Common groundsel	.	.	0.1	0.0	.	.	.	.	.	.
Siberian elm	.	.	0.1	0.0	.	.	.	.	.	.
Vetch species	.	.	0.1	0.0	.	.	0.1	0.0	0.1	0.1

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 9.0 Weed relative abundance and density by fertilizer treatment in wheat prior to in-crop spraying at Brandon in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Dandelion	28.2	14.6	25.2	10.5	24.0	9.6	26.4	11.5	34.5	21.0
Sowthistle species	18.7	8.6	14.4	4.6	18.6	6.1	13.7	3.8	9.2	2.6
Wild buckwheat	13.7	5.0	19.4	7.1	10.7	3.1	15.0	4.8	14.4	7.1
Canada thistle	13.3	4.2	11.7	3.2	19.3	5.9	14.3	4.2	10.3	3.1
Wild mustard	7.2	2.1	17.8	5.6	11.3	3.7	16.2	5.9	13.0	4.9
Volunteer canola	5.9	2.4	2.5	0.8	4.5	1.2	3.7	1.0	3.1	0.9
Stinkweed	4.0	1.5	2.3	0.6	5.0	1.5	5.3	1.4	7.3	2.8
Green foxtail	3.1	0.8	1.4	0.3	1.8	0.5	0.6	0.1	1.9	0.5
Shepherds purse	2.2	1.1	1.9	0.6	2.2	0.5	2.6	1.3	4.2	1.9
Wild oat	1.4	0.3	2.0	0.5	1.7	0.4	1.4	0.3	1.3	0.4
Lambsquarters	1.0	0.2	0.6	0.1	0.6	0.1	0.1	0.0	0.3	0.1
Redroot pigweed	0.8	0.2	0.6	0.1	.	.	.	.	.	.
Round leaved mallow	0.4	0.1	.	.	.	.	0.1	0.0	0.3	0.2
Rough cinquefoil	0.1	0.0	.	.	.	.	.	.	.	.
Worm seed mustard	.	.	0.1	0.0	0.2	0.0	0.4	0.1	.	.
Clover species	.	.	.	.	.	.	0.1	0.0	.	.
Broadleaved plantain	.	.	.	.	0.2	0.0	.	.	.	.
Smartweed species	.	.	0.3	0.1	.	.	.	.	0.2	0.1
Curled dock	.	.	.	.	0.1	0.0	.	.	.	.

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 10.0 Weed relative abundance and density by fertilizer treatment in canola prior to in-crop spraying at Brandon in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Dandelion	34.2	17.9	29.6	13.9	37.0	18.1	29.9	15.0	29.4	19.2
Sowthistle species	16.7	5.6	9.0	2.8	12.0	3.6	15.5	4.7	12.2	4.4
Wild buckwheat	14.2	4.2	14.4	4.6	14.6	4.5	13.2	4.1	13.9	5.2
Volunteer wheat	6.8	1.8	19.7	5.8	13.9	3.6	14.8	3.8	19.1	7.5
Stinkweed	6.0	2.1	5.3	1.6	3.5	0.8	7.1	2.2	7.2	3.4
Canada thistle	5.8	1.3	3.5	0.8	4.1	0.9	4.5	1.0	3.2	0.8
Wild mustard	3.4	0.9	5.6	2.1	3.8	1.1	4.7	1.4	4.2	1.8
Wild oat	3.0	0.5	5.9	1.2	4.9	1.2	4.7	1.0	6.2	1.9
Volunteer canola	2.9	0.6	1.4	0.2	1.4	0.3	0.3	0.1	0.2	0.0
Shepherds purse	2.6	0.7	1.7	0.4	1.5	0.3	2.0	0.4	0.4	0.1
Green foxtail	1.5	0.4	1.4	0.5	0.2	0.1	1.6	0.5	1.3	0.4
Lambsquarters	1.2	0.3	1.0	0.2	1.4	0.4	0.6	0.1	2.2	0.5
Smartweed species	0.5	0.2	1.4	0.3	0.9	0.2	0.9	0.2	0.3	0.1
Purple leaved willowherb	0.3	0.1	.	.	0.1	0.0	0.2	0.1	.	.
American dragonhead	0.2	0.1	.	.	0.2	0.1	.	.	.	.
Redroot pigweed	0.2	0.1	.	.	0.2	0.1	.	.	0.1	0.0
Rough cinquefoil	0.2	0.0	0.2	0.0	.	.	.	.	0.2	0.0
Worm seed mustard	0.1	0.0	.	.	.	.	.	.	.	.
Goldenrod species	0.1	0.0	.	.	.	.	.	.	.	.
Poplar species	0.1	0.0	.	.	.	.	.	.	.	.
Curled dock	0.1	0.0	.	.	0.1	0.0	.	.	.	.
Round leaved mallow	.	.	.	.	.	.	0.1	0.0	.	.
Vetch species	.	.	.	.	0.1	0.0	.	.	.	.

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 11.0 Weed relative abundance and density by fertilizer treatment in wheat in July at Brandon in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Dandelion	31.9	30.6	26.1	20.8	35.3	32.7	35.6	33.3	38.9	52.2
Sowthistle species	19.0	15.2	23.1	16.8	16.3	9.9	14.4	8.1	17.8	14.0
Canada thistle	18.7	12.7	16.6	10.0	24.0	14.8	17.2	9.9	21.1	15.7
Wild buckwheat	13.6	8.6	15.6	9.1	12.2	7.5	13.9	7.6	10.4	6.2
Wild mustard	6.0	3.2	7.8	3.4	2.7	1.1	8.4	3.6	5.2	2.2
Green foxtail	3.6	2.2	2.3	1.4	3.4	2.5	1.9	1.0	2.4	1.4
Wild oat	2.6	1.0	3.3	1.2	2.8	0.9	4.5	1.9	2.2	1.0
Shepherds purse	1.3	0.6	1.3	0.6	1.6	0.6	1.7	0.9	1.3	0.6
Redroot pigweed	1.1	0.4	1.2	0.4	0.2	0.1	1.0	0.4	0.1	0.0
Volunteer canola	0.5	0.2	0.3	0.1	0.9	0.3	0.5	0.2	0.3	0.1
Prostrate pigweed	0.5	0.1	.	.	.	.	.	.	.	.
Stinkweed	0.5	0.2	0.1	0.0	0.3	0.1	0.2	0.1	.	.
Round leaved mallow	0.3	0.2	.	.	0.1	0.1	0.1	0.0	0.1	0.0
Rough cinquefoil	0.2	0.1	.	.	.	.	.	.	.	.
Narrow leaved hawks beard	0.2	0.1	0.3	0.1	.	.	.	.	.	.
Lambsquarters	0.1	0.0	0.5	0.1	0.1	0.1	0.4	0.1	0.1	0.1
Biennial wormwood	.	.	0.1	0.0	.	.	.	.	.	.
Thyme leaved spurge	.	.	0.1	0.0	.	.	.	.	.	.
Northern willowherb	.	.	.	.	.	.	0.1	0.0	.	.
Smartweed species	.	.	1.1	0.4	.	.	.	.	0.1	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 12.0 Weed relative abundance and density by fertilizer treatment in canola in July at Brandon in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Dandelion	36.7	32.9	29.1	22.5	36.2	29.5	28.1	23.0	24.7	26.1
Sowthistle species	19.7	12.4	16.2	9.0	16.2	9.2	17.6	11.0	20.7	18.9
Wild buckwheat	12.0	6.8	12.5	6.9	11.3	5.6	11.9	6.4	10.5	7.6
Canada thistle	10.0	4.4	4.4	1.7	6.9	2.4	4.8	2.3	8.4	4.0
Wild oat	6.0	2.4	8.2	3.6	8.5	4.1	7.8	3.8	8.2	5.5
Wild mustard	4.7	2.3	12.1	7.8	7.8	3.2	13.7	8.1	13.0	9.6
Volunteer wheat	4.0	1.9	9.2	4.4	8.4	4.0	8.7	4.1	8.6	5.9
Green foxtail	2.0	0.8	1.1	0.6	0.6	0.2	1.2	0.5	1.2	0.8
Lambsquarters	2.0	1.1	2.7	1.7	2.1	0.8	2.4	1.2	1.7	0.8
Shepherds purse	1.4	0.5	1.3	0.8	1.2	0.6	1.5	1.5	0.8	0.4
Goldenrod species	0.3	0.1	.	.	.	.	0.2	0.1	.	.
Smartweed species	0.3	0.1	0.5	0.3	0.3	0.1	0.2	0.1	0.7	0.2
Narrow leaved hawks beard	0.3	0.1	.	.	.	.	0.1	0.1	.	.
Stinkweed	0.2	0.1	1.7	1.7	0.1	0.1	1.4	1.2	1.1	0.5
Redroot pigweed	0.2	0.0	0.1	0.1	.	.	.	.	0.2	0.1
Canada fleabane	0.1	0.0	.	.	0.1	0.0	.	.	.	.
Biennial wormwood	0.1	0.0	0.1	0.0	.	.	0.1	0.1	.	.
Barnyard grass	0.1	0.1	0.2	0.2	0.1	0.0	.	.	.	.
Round leaved mallow	0.1	0.0	.	.	.	.	0.1	0.0	0.2	0.1
Prostrate pigweed	.	.	0.2	0.1	.	.	.	.	.	.
Purple leaved willowherb	.	.	0.1	0.0	.	.	.	.	.	.
Geranium species	.	.	.	.	.	.	.	.	0.1	0.0
Bluebur	.	.	0.1	0.0	.	.	.	.	.	.
Nightflowering catchfly	.	.	0.3	0.1	0.1	0.0	.	.	.	.

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 13.0 Weed relative abundance and density by herbicide treatment in wheat prior to crop seeding at Brandon in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Sowthistle species	24.1	49.9	24.8	58.6
Canada thistle	13.6	19.8	15.1	26.8
Wild mustard	10.4	15.9	9.5	16.0
Wild buckwheat	8.2	15.0	8.4	16.8
Volunteer canola	7.5	14.1	8.9	17.1
Wild oat	7.2	11.8	8.0	14.2
Shepherds purse	6.3	20.4	4.1	8.3
Green foxtail	4.7	9.4	4.1	9.3
Volunteer wheat	4.5	4.4	4.1	3.6
Dandelion	3.7	2.0	3.4	1.9
Canada fleabane	0.9	0.9	0.5	0.3
Lambsquarters	0.9	1.0	0.7	0.6
Stinkweed	0.7	1.1	0.3	0.2
Panicled aster	0.7	0.3	0.4	0.2
Foxtail barley	0.7	0.3	0.4	0.2
Quackgrass	0.7	1.0	1.0	1.6
Rough cinquefoil	0.7	0.4	0.7	0.5
Broadleaved plantain	0.5	0.3	0.4	0.2
Goldenrod species	0.4	0.3	0.3	0.2
Biennial wormwood	0.4	0.2	0.4	0.2
Narrow leaved hawks beard	0.4	0.5	0.4	0.7
Curled dock	0.3	0.2	0.4	0.2
Purple leaved willowherb	0.3	0.2	0.5	0.3
Smartweed species	0.2	0.1	0.5	0.5
Many flowered aster	0.2	0.1	0.2	0.1
Round leaved mallow	0.2	0.1	0.4	0.8
Barnyard grass	0.2	0.2	0.0	0.0
Bluebur	0.1	0.1	0.1	0.2
Redroot pigweed	0.1	0.2	0.0	0.0
Goats beard species	0.1	0.1	0.3	0.2
Rayless aster	0.1	0.1	0.1	0.1
Worm seed mustard	0.1	0.1	0.0	0.0
Nightflowering catchfly	0.1	0.1	0.1	0.1
American dragonhead	0.1	0.0	0.0	0.0
Marsh yellow cress	0.1	0.0	0.1	0.0
Siberian elm	0.1	0.0	0.0	0.0
Prostrate pigweed	0.1	0.0	.	.
Vetch species	0.1	0.1	.	.
Wood whitlow grass	0.0	0.0	0.0	0.0
Prickly lettuce	0.0	0.0	0.1	0.0
Common burdock	0.0	0.0	.	.
Hempnettle	0.0	0.0	.	.
Mouse ear chickweed	0.0	0.0	0.0	0.0
Smooth brome	.	.	0.5	0.5
Flixweed	.	.	0.0	0.0
Philadelphia fleabane	.	.	0.0	0.0
Bicknells geranium	.	.	0.0	0.0
Black medic	.	.	0.1	0.0
Mustard species	.	.	0.1	0.0
Common speedwell	.	.	0.0	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 14.0 Weed relative abundance and density by herbicide treatment in canola prior to crop seeding at Brandon in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Sowthistle species	29.5	43.2	30.7	41.9
Canada thistle	20.8	21.8	23.4	27.3
Wild mustard	9.6	11.4	10.7	13.1
Wild buckwheat	7.3	5.8	7.7	6.9
Dandelion	5.1	2.2	3.5	1.4
Wild oat	3.5	3.1	5.4	5.3
Volunteer canola	2.6	1.8	2.0	2.0
Volunteer wheat	2.4	1.1	2.3	1.1
Shepherds purse	2.2	1.8	2.0	1.3
Green foxtail	2.1	2.9	1.2	1.3
Lambsquarters	2.1	2.4	1.6	1.7
Mustard species	2.0	1.2	0.8	0.4
Panicled aster	1.3	0.6	0.7	0.3
Curled dock	1.2	0.4	1.0	0.4
Purple leaved willowherb	1.2	1.0	0.6	0.2
Stinkweed	1.1	0.9	1.1	0.9
Rough cinquefoil	1.0	0.5	0.6	0.2
Biennial wormwood	0.6	0.3	0.6	0.3
Broadleaved plantain	0.6	0.2	0.5	0.2
Canada fleabane	0.6	0.4	0.5	0.2
Goldenrod species	0.5	0.2	0.6	0.3
Many flowered aster	0.3	0.1	0.2	0.1
Rayless aster	0.3	0.1	0.4	0.1
Foxtail barley	0.3	0.1	0.2	0.1
Smartweed species	0.2	0.2	0.3	0.3
Goats beard species	0.2	0.1	0.2	0.1
Barnyard grass	0.2	0.1	.	.
Volunteer barley	0.2	0.1	0.0	0.0
Narrow leaved hawks beard	0.1	0.0	0.2	0.2
Round leaved mallow	0.1	0.1	0.1	0.1
Redroot pigweed	0.1	0.0	0.0	0.0
Smooth brome	0.1	0.0	0.1	0.0
Quackgrass	0.1	0.1	0.3	0.2
Worm seed mustard	0.1	0.0	.	.
Bicknells geranium	0.1	0.0	0.0	0.0
Common speedwell	0.1	0.0	0.1	0.0
Prickly lettuce	0.0	0.0	.	.
American dragonhead	0.0	0.0	.	.
Philadelphia fleabane	0.0	0.0	.	.
Common yarrow	0.0	0.0	0.0	0.0
Geranium species	0.0	0.0	0.2	0.1
Nightflowering catchfly	0.0	0.0	0.0	0.0
Wood whitlow grass	0.0	0.0	0.0	0.0
Pygmy flower	0.0	0.0	0.0	0.0
Vetch species	0.0	0.0	0.1	0.0
Marsh yellow cress	0.0	0.0	0.0	0.0
Manitoba maple	.	.	0.0	0.0
Flixweed	.	.	0.0	0.0
Hempnettle	.	.	0.0	0.1
Bluebur	.	.	0.0	0.0
Common groundsel	.	.	0.0	0.0
Siberian elm	.	.	0.0	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 15.0 Weed relative abundance and density by herbicide treatment in wheat prior to in-crop spraying at Brandon in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Dandelion	29.8	16.6	25.5	10.2
Wild buckwheat	15.6	6.4	13.7	4.4
Sowthistle species	14.0	5.1	15.8	5.2
Wild mustard	12.5	4.5	13.7	4.4
Canada thistle	12.1	3.8	15.5	4.4
Volunteer canola	4.3	1.4	3.6	1.1
Stinkweed	3.8	1.3	5.7	1.8
Shepherds purse	3.6	1.8	1.6	0.4
Wild oat	1.7	0.4	1.4	0.3
Green foxtail	1.4	0.4	2.1	0.5
Lambsquarters	0.4	0.1	0.6	0.1
Redroot pigweed	0.2	0.1	0.3	0.1
Worm seed mustard	0.2	0.1	0.1	0.0
Round leaved mallow	0.2	0.0	0.2	0.1
Smartweed species	0.1	0.0	0.1	0.0
Clover species	0.0	0.0	.	.
Rough cinquefoil	0.0	0.0	.	.
Broadleaved plantain	.	.	0.1	0.0
Curled dock	.	.	0.1	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 16.0 Weed relative abundance and density by herbicide treatment in canola prior to in-crop spraying at Brandon in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Dandelion	33.8	17.6	30.2	16.1
Volunteer wheat	15.0	4.6	14.6	4.4
Sowthistle species	13.1	4.3	13.1	4.1
Wild buckwheat	12.0	3.6	16.1	5.4
Stinkweed	5.8	2.0	5.8	2.1
Wild mustard	4.9	1.4	3.8	1.5
Wild oat	4.7	1.1	5.2	1.3
Canada thistle	3.3	0.7	5.1	1.1
Shepherds purse	1.9	0.4	1.4	0.3
Lambsquarters	1.6	0.4	0.9	0.2
Green foxtail	1.3	0.4	1.1	0.4
Volunteer canola	1.0	0.2	1.4	0.3
Smartweed species	0.7	0.2	0.8	0.2
Purple leaved willowherb	0.2	0.0	0.1	0.0
Rough cinquefoil	0.1	0.0	0.1	0.0
Curled dock	0.1	0.0	.	.
American dragonhead	0.1	0.0	0.1	0.0
Redroot pigweed	0.1	0.0	0.1	0.0
Worm seed mustard	0.1	0.0	.	.
Goldenrod species	0.1	0.0	.	.
Poplar species	0.1	0.0	.	.
Vetch species	0.0	0.0	.	.
Round leaved mallow	.	.	0.0	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 17.0 Weed relative abundance and density by herbicide treatment in wheat in July at Brandon in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Dandelion	34.1	34.4	33.0	33.4
Sowthistle species	18.5	12.9	17.8	12.7
Canada thistle	18.2	10.9	20.9	14.3
Wild buckwheat	12.6	7.4	13.7	8.2
Wild mustard	6.4	2.8	5.7	2.6
Wild oat	3.7	1.4	2.5	1.0
Green foxtail	2.4	1.5	3.1	1.9
Shepherds purse	1.9	0.9	1.0	0.4
Redroot pigweed	1.0	0.4	0.4	0.1
Volunteer canola	0.3	0.1	0.7	0.3
Lambsquarters	0.2	0.1	0.3	0.1
Stinkweed	0.2	0.1	0.2	0.1
Round leaved mallow	0.1	0.0	0.1	0.1
Prostrate pigweed	0.1	0.0	0.1	0.0
Biennial wormwood	0.1	0.0	.	.
Rough cinquefoil	0.0	0.0	0.0	0.0
Narrow leaved hawks beard	0.0	0.0	0.2	0.0
Northern willowherb	0.0	0.0	.	.
Smartweed species	0.0	0.0	0.4	0.2
Thyme leaved spurge	.	.	0.0	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 18.0 Weed relative abundance and density by herbicide treatment in canola in July at Brandon in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Dandelion	33.1	27.1	28.7	26.5
Sowthistle species	18.1	11.1	18.0	13.0
Wild buckwheat	10.8	5.7	12.5	7.6
Wild mustard	9.9	5.5	10.6	6.9
Volunteer wheat	7.1	3.6	8.4	4.5
Canada thistle	6.7	2.6	7.1	3.3
Wild oat	6.6	2.6	8.9	5.2
Lambsquarters	2.2	1.1	2.1	1.1
Shepherds purse	1.4	1.0	1.0	0.5
Green foxtail	1.4	0.7	1.1	0.5
Stinkweed	1.3	1.2	0.5	0.2
Smartweed species	0.5	0.2	0.3	0.1
Redroot pigweed	0.1	0.0	0.1	0.0
Goldenrod species	0.1	0.1	0.1	0.0
Canada fleabane	0.1	0.0	.	.
Nightflowering catchfly	0.1	0.0	0.1	0.0
Barnyard grass	0.1	0.1	0.1	0.0
Narrow leaved hawks beard	0.1	0.0	0.1	0.0
Biennial wormwood	0.0	0.0	0.1	0.0
Geranium species	0.0	0.0	.	.
Prostrate pigweed	0.0	0.0	0.1	0.0
Bluebur	0.0	0.0	.	.
Purple leaved willowherb	.	.	0.0	0.0
Round leaved mallow	.	.	0.2	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 19.0 Weed relative abundance and density by crop prior to crop seeding at Melfort in 1999.

Weed Species	Wheat RelAb	Wheat #/m^2	Canola RelAb	Canola #/m^2
Wild oat	44.4	6.3	20.5	8.9
Volunteer canola	29.0	3.6	5.4	1.3
Cleavers	8.4	1.1	34.7	17.1
Stinkweed	6.5	0.7	5.1	2.1
Wild buckwheat	5.8	0.6	9.3	2.3
Dandelion	3.2	0.3	13.3	3.2
Lambsquarters	0.8	0.1	1.4	0.3
Volunteer fall rye	0.6	0.1	.	.
Shepherds purse	0.5	0.1	0.6	0.1
Green foxtail	0.4	0.1	0.1	0.0
Flixweed	0.3	0.0	2.8	0.7
Meadow brome	0.1	0.0	.	.
Volunteer wheat	0.1	0.0	6.4	1.5
Bluebur	0.1	0.0	.	.
Canada thistle	.	.	0.2	0.0
Hempnettle	.	.	0.1	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 20.0 Weed relative abundance and density by crop prior to in-crop spraying at Melfort in 1999.

Weed Species	Wheat RelAb	Wheat #/m^2	Canola RelAb	Canola #/m^2
Volunteer canola	38.4	2.0	0.3	0.0
Wild oat	18.9	0.7	43.0	4.5
Green foxtail	18.2	1.5	12.8	1.1
Cleavers	8.4	0.7	9.6	1.0
Wild buckwheat	5.4	0.3	8.5	0.6
Dandelion	5.4	0.2	19.3	1.8
Stinkweed	2.3	0.1	3.1	0.4
Perennial sowthistle	1.8	0.1	0.8	0.1
Clover species	0.8	0.0	.	.
Lambsquarters	0.3	0.0	0.8	0.1
Canada thistle	0.1	0.0	1.0	0.1
Flixweed	0.1	0.0	0.1	0.0
Volunteer fall rye	.	.	0.2	0.0
Common chickweed	.	.	0.1	0.0
Volunteer wheat	.	.	0.4	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 21.0 Weed relative abundance and density by crop in July at Melfort in 1999.

Weed Species	Wheat RelAb	Wheat #/m^2	Canola RelAb	Canola #/m^2
Volunteer canola	28.6	6.6	.	.
Green foxtail	26.3	6.5	15.2	3.5
Cleavers	19.9	6.1	24.5	7.6
Stinkweed	7.8	1.8	13.9	5.5
Wild buckwheat	7.4	1.3	5.8	1.1
Redroot pigweed	3.8	0.8	0.6	0.1
Wild oat	2.7	0.5	33.5	9.5
Lambsquarters	1.7	0.3	2.5	0.5
Dandelion	1.1	0.2	2.8	0.5
Canada thistle	0.4	0.1	0.4	0.1
Perennial sowthistle	0.3	0.0	0.5	0.1
Hempnettle	0.0	0.0	0.0	0.0
Shepherds purse	.	.	0.1	0.0
Mustard species	.	.	0.0	0.0
Volunteer wheat	.	.	0.1	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 22.0 Weed relative abundance and density by fertilizer treatment in wheat prior to crop seeding at Melfort in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Wild oat	41.0	8.5	41.8	5.2	47.3	6.0	47.8	8.2	44.0	3.8
Volunteer canola	25.2	4.7	31.7	3.6	30.2	3.6	23.6	3.0	34.3	3.1
Stinkweed	12.1	1.7	6.2	0.4	5.7	0.4	4.2	0.7	4.3	0.3
Cleavers	10.8	2.6	7.7	0.5	4.2	0.5	10.0	1.5	9.1	0.7
Wild buckwheat	4.6	0.6	7.0	0.6	6.4	0.6	7.3	0.8	3.8	0.2
Dandelion	2.6	0.5	2.8	0.2	3.0	0.3	4.3	0.5	3.5	0.3
Green foxtail	1.8	0.3	.	.	.	.	.	.	.	.
Lambsquarters	0.7	0.1	0.3	0.0	0.9	0.1	1.3	0.2	0.7	0.1
Shepherds purse	0.4	0.1	1.4	0.3	0.3	0.0	0.5	0.1	.	.
Meadow brome	0.4	0.2	.	.	.	.	.	.	.	.
Volunteer wheat	0.3	0.1	.	.	.	.	.	.	.	.
Flixweed	.	.	.	.	0.7	0.1	0.3	0.0	0.3	0.0
Bluebur	.	.	0.3	0.0	.	.	.	.	.	.
Volunteer fall rye	.	.	0.9	0.1	1.3	0.2	0.7	0.2	.	.

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 23.0 Weed relative abundance and density by fertilizer treatment in canola prior to crop seeding at Melfort in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Wild oat	29.9	12.3	17.5	8.3	12.4	4.0	21.7	13.3	20.9	6.6
Cleavers	20.4	5.6	39.2	27.1	42.1	17.6	31.3	17.6	40.8	17.8
Wild buckwheat	13.6	3.3	9.2	2.3	8.8	1.7	6.0	2.3	9.0	2.2
Dandelion	9.9	2.0	15.9	3.8	17.0	4.0	13.3	4.3	10.6	2.1
Stinkweed	9.4	4.4	3.6	1.6	2.0	0.4	6.6	3.0	3.8	1.0
Volunteer canola	6.7	1.7	3.1	0.7	4.7	1.2	8.7	2.4	4.0	0.7
Volunteer wheat	5.8	1.3	5.7	1.6	9.1	1.9	6.7	1.3	4.5	1.2
Flixweed	1.6	0.3	4.3	1.2	2.2	0.7	2.9	0.7	3.1	0.8
Lambsquarters	1.5	0.3	1.3	0.4	1.3	0.2	0.8	0.2	2.3	0.4
Hempnettle	0.5	0.1	.	.	.	.	.	.	0.1	0.0
Shepherds purse	0.4	0.1	.	.	0.2	0.0	1.7	0.4	0.6	0.3
Canada thistle	0.3	0.1	0.3	0.1	.	.	0.2	0.1	0.3	0.1
Green foxtail	0.2	0.0	.	.	0.2	0.0	0.2	0.0	.	.

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 24.0 Weed relative abundance and density by fertilizer treatment in wheat prior to in-crop spraying at Melfort in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Green foxtail	34.4	4.2	9.1	0.4	17.6	0.6	17.8	1.1	12.1	1.3
Wild oat	24.3	0.7	14.6	0.6	31.2	0.9	24.6	1.2	.	.
Wild buckwheat	11.0	0.4	4.9	0.2	1.2	0.0	7.3	0.2	2.7	0.4
Volunteer canola	10.9	0.4	54.9	2.2	32.2	0.9	25.9	1.3	68.1	5.3
Cleavers	9.8	0.3	6.3	0.4	5.3	0.1	9.3	0.8	11.1	1.6
Dandelion	5.5	0.2	1.6	0.1	9.3	0.3	9.7	0.5	0.7	0.1
Stinkweed	2.3	0.2	3.0	0.2	2.4	0.1	1.7	0.1	2.3	0.2
Perennial sowthistle	0.9	0.0	2.1	0.1	0.8	0.0	3.0	0.2	2.1	0.2
Flixweed	0.5	0.0	.	.	.	.	.	.	.	.
Lambsquarters	0.3	0.0	0.4	0.0	.	.	.	.	0.6	0.1
Canada thistle	0.3	0.0	.	.	.	.	.	.	0.4	0.0
Clover species	.	.	3.1	0.1	.	.	0.8	0.0	.	.

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 25.0 Weed relative abundance and density by fertilizer treatment in canola prior to in-crop spraying at Melfort in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Wild oat	33.9	3.1	39.2	3.9	45.8	3.6	41.3	4.2	55.0	7.6
Dandelion	19.7	2.1	22.7	2.1	25.5	1.9	18.9	1.8	9.7	1.3
Green foxtail	19.3	1.8	11.5	0.9	9.0	0.4	14.4	1.3	9.8	1.1
Wild buckwheat	12.4	1.0	8.0	0.6	9.6	0.6	8.1	0.6	4.5	0.5
Cleavers	8.5	0.6	10.6	0.8	6.7	0.5	10.1	0.8	12.3	2.3
Stinkweed	2.5	0.2	3.8	0.4	1.3	0.1	2.7	0.2	4.9	1.2
Perennial sowthistle	1.3	0.2	2.2	0.2	.	.	0.6	0.1	.	.
Volunteer fall rye	1.0	0.1	.	.	.	.	.	.	.	.
Canada thistle	0.8	0.1	0.8	0.1	1.2	0.1	1.6	0.1	0.9	0.2
Lambsquarters	0.4	0.0	0.7	0.1	1.0	0.0	.	.	2.2	0.2
Flixweed	0.3	0.0	.	.	.	.	.	.	.	.
Volunteer canola	.	.	.	.	.	.	0.9	0.1	0.5	0.0
Common chickweed	.	.	.	.	.	.	0.6	0.1	.	.
Volunteer wheat	.	.	0.5	0.0	.	.	0.9	0.1	0.3	0.1

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 26.0 Weed relative abundance and density by fertilizer treatment in wheat in July at Melfort in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Green foxtail	26.7	5.2	25.0	7.3	25.1	5.3	31.8	10.0	23.0	4.9
Volunteer canola	23.6	4.5	33.5	9.3	33.4	6.8	22.9	5.2	29.8	7.4
Cleavers	23.3	6.7	16.0	4.6	19.1	4.5	18.4	7.2	22.7	7.5
Wild buckwheat	9.9	1.9	7.0	1.3	5.4	0.7	6.3	1.4	8.5	1.4
Stinkweed	7.6	1.4	8.0	1.7	7.4	1.4	5.5	1.3	10.5	3.2
Redroot pigweed	4.5	1.0	3.8	0.9	1.9	0.3	6.6	1.7	2.0	0.3
Lambsquarters	1.8	0.2	2.7	0.6	1.5	0.2	1.5	0.4	1.3	0.2
Wild oat	1.6	0.2	2.9	0.6	4.8	0.7	4.1	0.8	0.2	0.0
Dandelion	0.9	0.1	1.1	0.2	0.2	0.0	1.7	0.4	1.4	0.3
Canada thistle	0.2	0.0	.	.	0.6	0.1	0.8	0.1	0.4	0.1
Hempnettle	.	.	.	.	.	.	0.2	0.0	.	.
Perennial sowthistle	.	.	.	.	0.6	0.1	0.5	0.1	0.2	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 27.0 Weed relative abundance and density by fertilizer treatment in canola in July at Melfort in 1999.

Weed Species	Fall band		Spring band		Spring band 9"		Spring band 12"		Sweep	
	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2	RelAb	#/m^2
Wild oat	33.4	8.3	34.1	10.7	33.3	7.7	33.5	7.8	33.4	13.0
Cleavers	27.5	8.0	24.4	8.5	21.9	6.0	22.3	5.8	26.4	10.0
Green foxtail	16.8	3.6	17.0	4.2	14.6	3.0	13.6	3.0	14.1	3.9
Stinkweed	11.2	4.5	12.4	5.5	15.0	4.1	18.7	6.6	12.0	6.9
Wild buckwheat	4.8	1.1	6.6	1.2	6.7	1.0	5.4	1.1	5.6	1.3
Dandelion	2.2	0.4	1.4	0.2	3.5	0.5	3.9	0.7	2.8	0.6
Lambsquarters	1.8	0.3	3.0	0.6	2.5	0.5	1.3	0.2	3.9	0.9
Canada thistle	1.0	0.2	0.2	0.0	0.4	0.1	0.5	0.1	0.1	0.0
Perennial sowthistle	0.8	0.1	0.7	0.1	0.6	0.1	0.5	0.1	.	.
Shepherds purse	0.2	0.1	0.2	0.0	.	.	.	.	0.2	0.1
Redroot pigweed	0.2	0.0	0.1	0.0	0.8	0.1	0.3	0.0	1.5	0.3
Hempnettle	0.2	0.0	.	.	.	.	.	.	.	.
Mustard species	.	.	.	.	0.2	0.0	.	.	.	.
Volunteer wheat	.	.	.	.	0.6	0.2	.	.	.	.

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 28.0 Weed relative abundance and density by herbicide treatment in wheat prior to crop seeding at Melfort in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Wild oat	44.4	6.0	44.4	6.7
Volunteer canola	30.1	3.3	27.9	3.8
Cleavers	8.0	0.9	8.7	1.4
Stinkweed	6.3	0.7	6.6	0.7
Wild buckwheat	5.9	0.5	5.7	0.6
Dandelion	2.5	0.2	4.0	0.5
Lambsquarters	0.9	0.1	0.7	0.1
Volunteer fall rye	0.6	0.1	0.5	0.1
Green foxtail	0.6	0.1	0.1	0.0
Shepherds purse	0.3	0.0	0.8	0.2
Volunteer wheat	0.1	0.0	.	.
Bluebur	0.1	0.0	.	.
Flixweed	0.1	0.0	0.4	0.0
Meadow brome	.	.	0.2	0.1

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 29.0 Weed relative abundance and density by herbicide treatment in canola prior to crop seeding at Melfort in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Cleavers	30.2	9.8	39.3	24.5
Wild oat	20.5	8.5	20.4	9.3
Dandelion	14.1	2.7	12.6	3.8
Volunteer wheat	8.6	1.8	4.1	1.1
Wild buckwheat	8.6	1.8	10.1	2.9
Stinkweed	5.9	2.5	4.2	1.7
Volunteer canola	5.4	1.1	5.4	1.5
Flixweed	4.4	1.2	1.2	0.3
Lambsquarters	1.2	0.2	1.6	0.4
Shepherds purse	0.7	0.1	0.5	0.2
Canada thistle	0.3	0.0	0.2	0.0
Green foxtail	0.1	0.0	0.1	0.0
Hempnettle	.	.	0.3	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 30.0 Weed relative abundance and density by herbicide treatment in wheat prior to in-crop spraying at Melfort in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Volunteer canola	36.9	2.0	39.9	2.1
Wild oat	22.7	0.8	15.2	0.6
Green foxtail	19.5	2.0	16.9	1.0
Cleavers	7.7	0.6	9.1	0.7
Wild buckwheat	4.4	0.3	6.4	0.2
Dandelion	3.5	0.2	7.2	0.3
Stinkweed	3.0	0.2	1.7	0.1
Clover species	1.2	0.0	0.3	0.0
Perennial sowthistle	0.8	0.1	2.8	0.1
Lambsquarters	0.2	0.0	0.3	0.0
Canada thistle	0.1	0.0	0.1	0.0
Flixweed	.	.	0.2	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 31.0 Weed relative abundance and density by herbicide treatment in canola prior to in-crop spraying at Melfort in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Wild oat	47.2	4.8	38.9	4.2
Dandelion	14.5	1.3	24.0	2.4
Green foxtail	14.2	1.2	11.4	1.0
Wild buckwheat	9.0	0.6	8.0	0.7
Cleavers	7.8	0.8	11.5	1.2
Stinkweed	4.0	0.4	2.1	0.5
Lambsquarters	1.3	0.1	0.4	0.0
Canada thistle	1.3	0.1	0.8	0.1
Volunteer canola	0.6	0.1	.	.
Perennial sowthistle	0.1	0.0	1.5	0.2
Flixweed	.	.	0.1	0.0
Volunteer fall rye	.	.	0.4	0.0
Common chickweed	.	.	0.2	0.0
Volunteer wheat	.	.	0.7	0.1

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 32.0 Weed relative abundance and density by herbicide treatment in wheat in July at Melfort in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Volunteer canola	28.9	6.1	28.4	7.1
Green foxtail	28.7	6.4	23.9	6.7
Cleavers	17.4	4.7	22.3	7.5
Stinkweed	8.1	1.9	7.5	1.7
Wild buckwheat	6.8	1.1	8.0	1.5
Wild oat	3.7	0.6	1.7	0.3
Redroot pigweed	3.2	0.6	4.3	1.0
Lambsquarters	1.8	0.3	1.7	0.3
Dandelion	0.6	0.1	1.5	0.3
Canada thistle	0.5	0.1	0.3	0.1
Perennial sowthistle	0.2	0.0	0.3	0.1
Hempnettle	.	.	0.1	0.0

Relative Abundance values (RelAb) were calculated by plot for each weed species: (relative density + relative frequency)/2. Relative density was calculated as: number of individuals for a given species within the 20 quadrats for each plot divided by the total number of individuals within the plot. Relative frequency was calculated as the proportion of quadrats in which the species was present per plot divided by the total frequency of all species.

Table 33.0 Weed relative abundance and density by herbicide treatment in canola in July at Melfort in 1999.

Weed Species	Full rate		Reduced Rate	
	RelAb	#/m^2	RelAb	#/m^2
Wild oat	36.1	9.4	30.9	9.5
Cleavers	21.0	6.0	28.1	9.3
Green foxtail	15.8	3.4	14.6	3.7
Stinkweed	15.0	5.9	12.7	5.1
Wild buckwheat	6.0	1.1	5.6	1.1
Lambsquarters	3.3	0.5	1.7	0.4
Dandelion	1.9	0.3	3.6	0.7
Redroot pigweed	0.5	0.1	0.7	0.1
Canada thistle	0.3	0.0	0.6	0.1
Shepherds purse	0.1	0.0	0.2	0.1
Hempnettle	0.1	0.0	.	.
Mustard species	.	.	0.1	0.0
Perennial sowthistle	.	.	1.0	0.2
Volunteer wheat	.	.	0.2	0.1