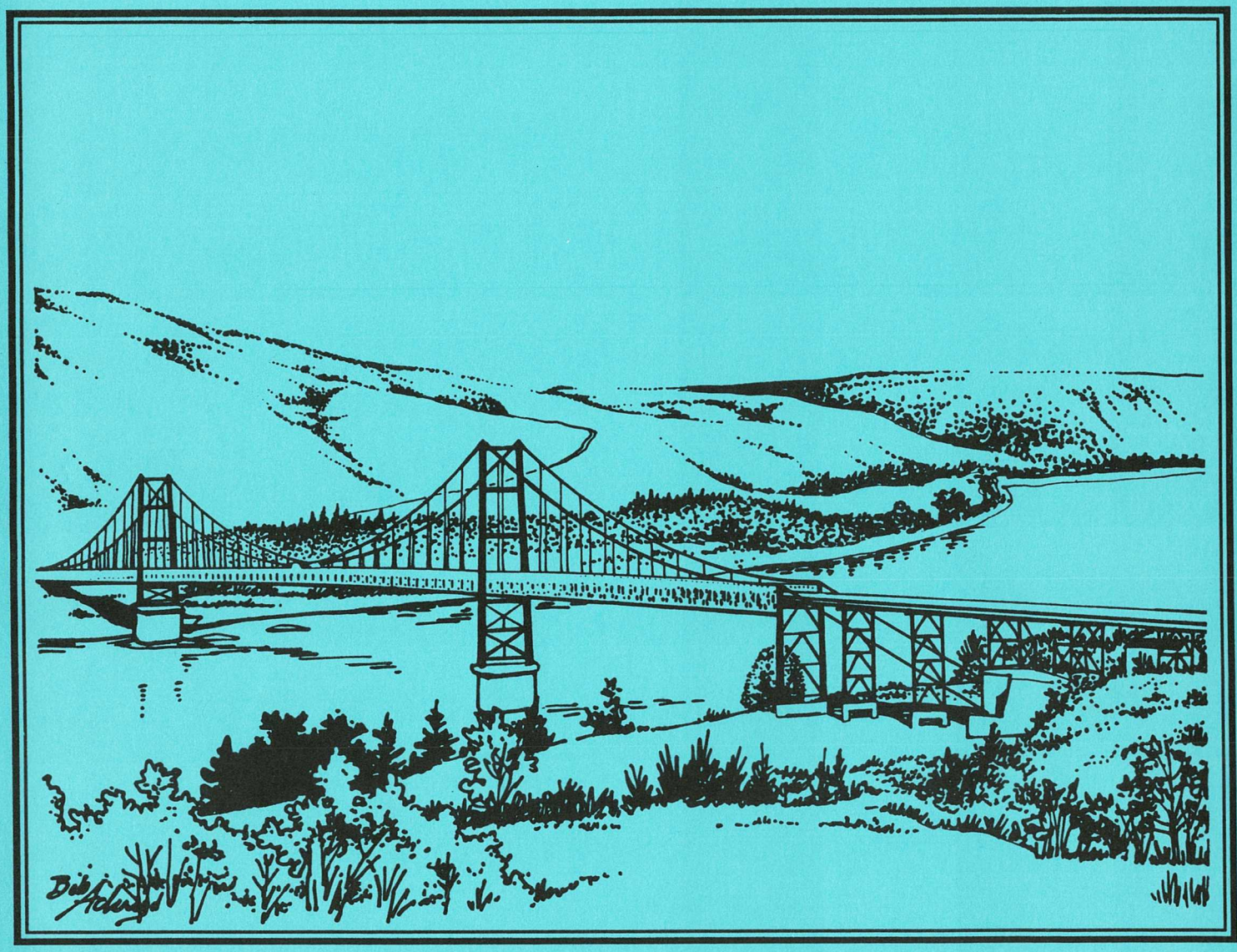
ALFALFA SEED PRODUCTION IN THE PEACE RIVER REGION

UPDATE 1988



PEACE RIVER BRANCH
ALBERTA ALFALFA SEED
PRODUCERS' ASSOCIATION

CONTINUING EDUCATION
FAIRVIEW
COLLEGE

ALFALFA SEED PRODUCTION IN THE PEACE RIVER REGION

UPDATE 1988

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PREFACE

The Annual Alfalfa Seed Production Seminar organized by the Peace River Branch of the Alberta Alfalfa Seed Producers' Association and Fairview College provide a unique forum for discussion among all participants of the alfalfa seed industry in the Peace River region. This publication contains some of the subjects that have been discussed at the 8th Annual Seminar. It is by no means a complete treatise on either alfalfa seed production or the proceedings of the seminar. It does however, highlight some areas of interest, and hopefully will give the reader some insight into the alfalfa seed industry in the Peace River region.

D.T. Fairey
Scientific Advisor
Peace River Branch
Alberta Alfalfa Seed
Producers' Association

A MESSAGE FROM THE EXECUTIVE, PEACE RIVER BRANCH, ALBERTA ALFALFA SEED PRODUCERS' ASSOCIATION

We would like to thank all our members for their interest and participation in the many issues that concern our Branch. It is this interest and co-operation that has enabled us to be involved in a number of activities including our survey for quality of leafcutting bee cells produced in our region, and our 8th Annual Seminar.

The following might be of interest to you. According to estimates from Alberta Agriculture, approximately 12,500 acres of alfalfa were grown for seed in the Peace River region of Alberta and British Columbia. Demands for leafcutting bee cells from our region have increased locally, in the other western provinces and overseas!

We wish you a successful growing season and thank you for your co-operation.

THE 1988 EXECUTIVE

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A SUMMARY FROM THE CANADIAN COCOON TESTING CENTRE

P. Tognet*

To date 335 samples have been processed compared with approximately 250 samples of last year. Over one half are from Alberta, the rest being from Saskatchewan and Manitoba and a few from Ontario.

Compared with earlier years the live prepupae categories are up somewhat. But also on the incline are Pteromalus venustus. Pollen balls are down in Alberta and Manitoba, but Saskatchewan and Ontario still have the odd problem. Female counts are higher on average than last year although fewer samples have been processed.

On the summary shown, ranges are included as averages on their own can be misleading. There are usually only one or two instances of each category that are very low or very high.

As in the case of chalkbrood, again southern Alberta is the only area showing chalkbrood. During the past five years it has shown a growing trend as illustrated below.

Year	No. of beekeepers with samples containing chalkbrood
1983	6
1984	14
1986	36
1987	60

Sixty out of the 72 beekeepers who have submitted samples (in 1987) from southern Alberta have chalkbrood.

Chalkbrood levels in samples submitted from southern Alberta

- Tilley, Rolling Hills area - 49 samples ranging from .17% to 22%
- Duchess, Rosemary area - 24 samples ranging from .16% to 16.83%
- Brooks area - 23 samples ranging from .16% to 17.51%
- South of Rolling Hills - 3 samples ranging from .17% to 1.38%

Total - 99 samples

As you can see the range is wide, and it is difficult to put a trend on chalkbrood. Some instances, from one season to the next, the disease has increased from 2% - 16%! And yet, in others it very gradually creeps upward or remains the same (although there are precious few that remain the same). Some who have dipped in bleach have had great success.

The summary shown should give you a good idea of what our records show.

* Ms. Penny Tognet, Technician, Canadian Cocoon Testing Centre, c/o Alberta Horticultural Research Centre, Brooks, Alberta

COCOON TESTING CENTRE SUMMARY
November 1, 1988 - March 9, 1988

No. of samples	Province/ Canada	Live Prepupae per lb.	Percent									Females	
			Prepupae			Dead Larvae	Pollen Balls	Second Generation	Parasites	Predators	Machine Damage	Percent	No. of samples
			Live	Immature	Dead								
171		3929	74.82	0.08	1.02	1.66	16.68	0.43	1.50	0.03	1.39	37.12	50
Range	Alta.	1907-5230	41.5-92.7	0-1.1	0-3.6	0-5.6	4.2-44.5	0-5	0-13.1	0-1.6	0-10.7	23-54.7	
70		4065	78.46	0.11	1.74	2.18	14.33	1.07	1.40	0	0.69	38.46	37
Range	Man.	2452-5203	39.8-90.7	0-1.1	0-7.5	0.2-9.8	5.8-53.8	0-12.1	0-12.2	0	0-3.4	28.7-54.9	
89		4120	74.42	0.14	1.82	2.94	17.93	1.10	1.03	0	0.65	41.18	44
Range	Sask.	2515-5275	44.1-94.7	0-1.4	0.2-10.1	0.3-7.6	0.9-40.2	0-17.9	0-10.1	0	0-4.7	27.4-57.0	
5		3463	67.91	0	1.63	3.01	13.81	10.93	1.83	0	0.87	34.68	4
Range	Ont.	1961-4458	37.8-88.8	0	0-3.9	0.7-5.0	8.7-17.7	0-33.8	0-7.9	0	0-3.6	15.6-46.3	
335	Canada	3894	73.91	0.08	1.95	2.45	15.69	3.38	1.44	0.01	0.90	37.9	

* Number of females was not determined in all samples. Only the number of samples specified were analyzed.

SEED PRODUCTION OF SOME FORAGE CROPS GROWN IN CANADA IN 1987[1]

D.T. Fairey*

The 1987 seed production of all the major forage crop species, except bromegrass, was higher than the five-year (1982-86) average (Tables 1 & 2). Seed production of most species was located exclusively in the western provinces. Thus, seed of the following legumes - alfalfa, single-cut red clover, alsike clover, sweet clover - and the grasses - creeping red fescue, bromegrass and crested wheatgrass - was produced in Manitoba, Saskatchewan, Alberta and British Columbia (Figs. 1 & 2).

The 1987 alfalfa crop in Alberta was significantly reduced as compared to that of 1986. Thus, in 1986 Alberta produced 42 percent of the total alfalfa seed as compared to 21 percent in 1987. This reduction has been attributed to lower yields rather than reduced acreage. The lower Alberta production was offset by an increase in Manitoba where 40 percent of the alfalfa seed crop was produced in 1987 as compared to 23 percent in 1986.

The principal area of production for double-cut red clover and birdsfoot trefoil was in Ontario. There was an increase in birdsfoot trefoil in all areas where seed of this crop was produced.

About 50 percent of the timothy seed crop was located in Manitoba, with another 32 percent in the other western provinces. The remaining 18 percent was produced in Ontario and Quebec.

* Dr. Daphne Fairey, Research Scientist, Agriculture Canada, Beaverlodge, Alberta

[1] Statistics obtained from Agriculture Canada, Plant Health and Plant Products Directorate (Preliminary Estimates).

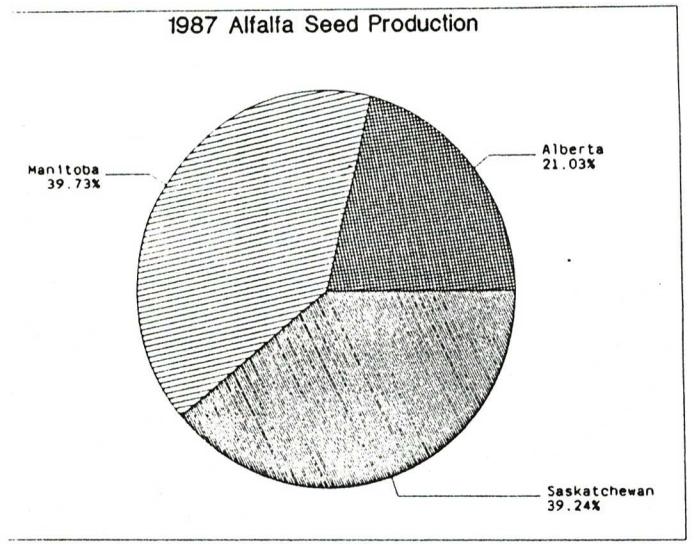
Table 1. Legume Seed Production in Canada

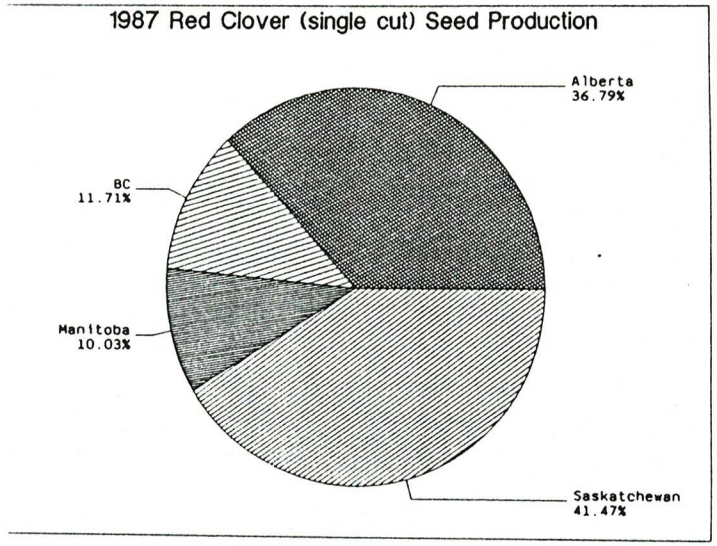
Year	Crop					
	Alfalfa	Red Clover (single cut)	Red Clover (double cut)	Alsike Clover	Sweet Clover	Birdsfoot Trefoil
	Production 000 kilograms					
1984	4,010	3,800	1,024	3,200	3,700	469
1985	3,095	2,287	950	1,650	3,350	377
1986	4,200	2,777	928	2,525	3,200	528
1987	4,279	2,990	1,644	2,746	4,535	757
1982-1986 (5-yr average)	3,659	2,910	1,114	2,283	3,320	446

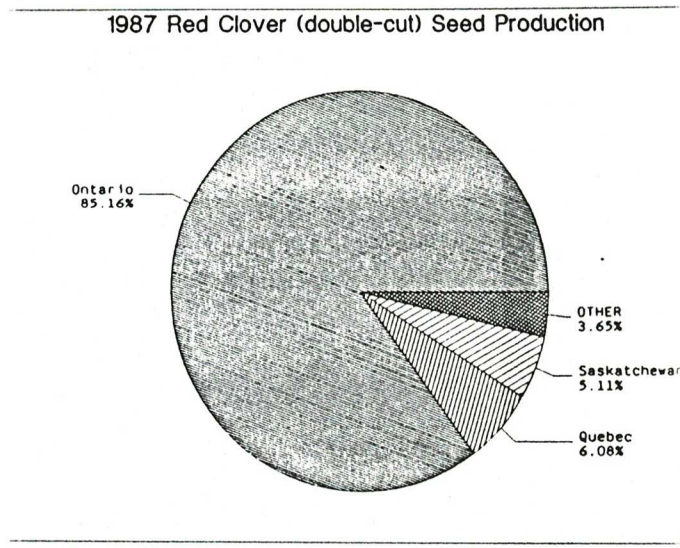
Table 2. Grass Seed Production in Canada

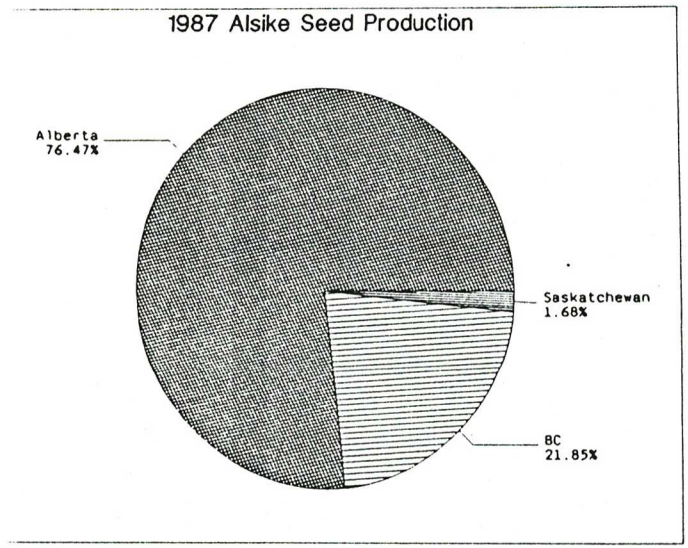
Year	Crop			
	Creeping Red Fescue	Timothy	Bromegrass	Crested Wheatgrass
	Production 000 kilograms			
1984	9,022	7,529	1,355	280
1985	5,500	6,213	950	145
1986	7,009	7,054	922	280
1987	7,000	6,845	914	400
1982-1986 (5-yr average)	6,366	6,502	987	259

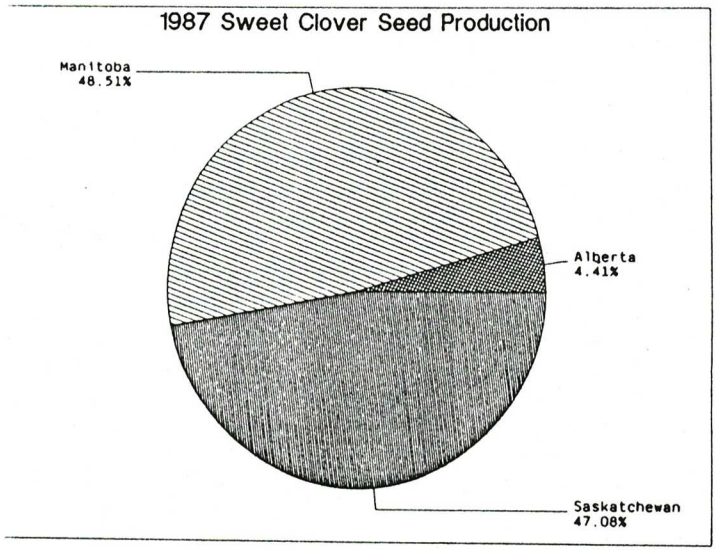
Figure 1. 1987 Seed Production in Some Legumes











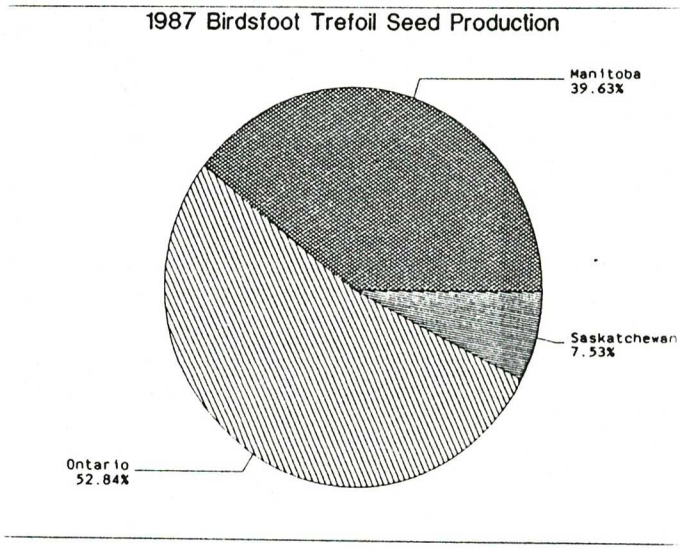


Figure 2. 1987 Seed Production in Some Grasses

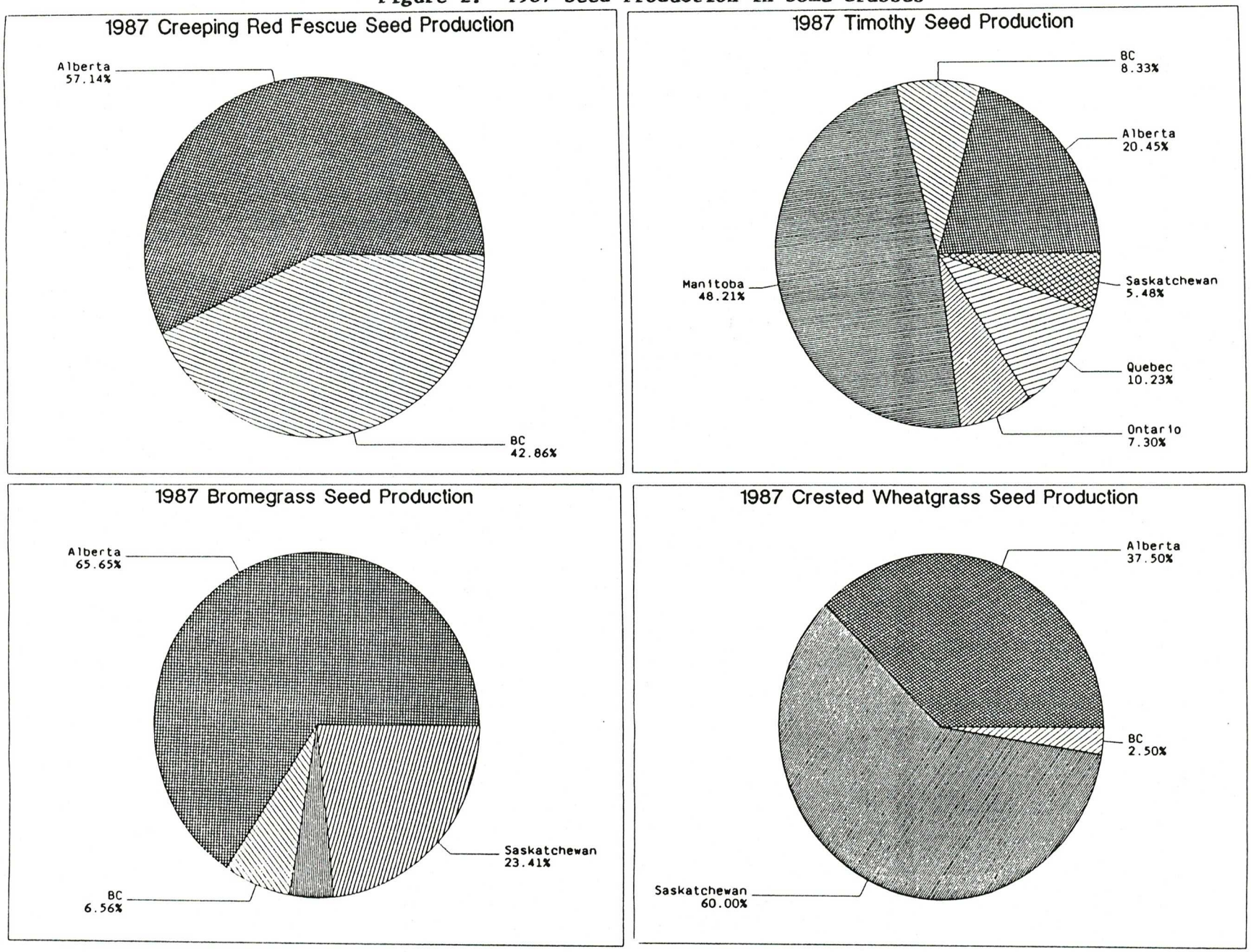
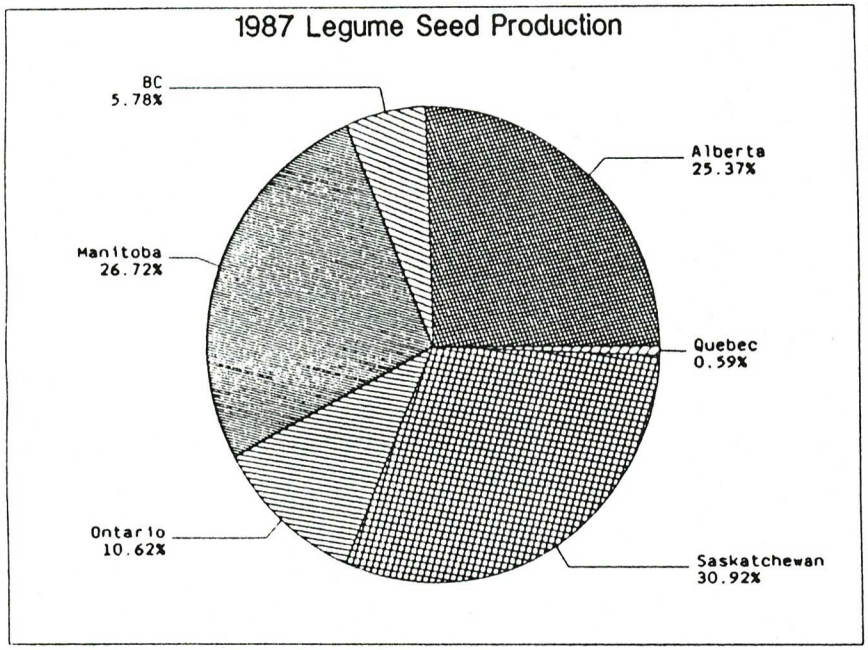
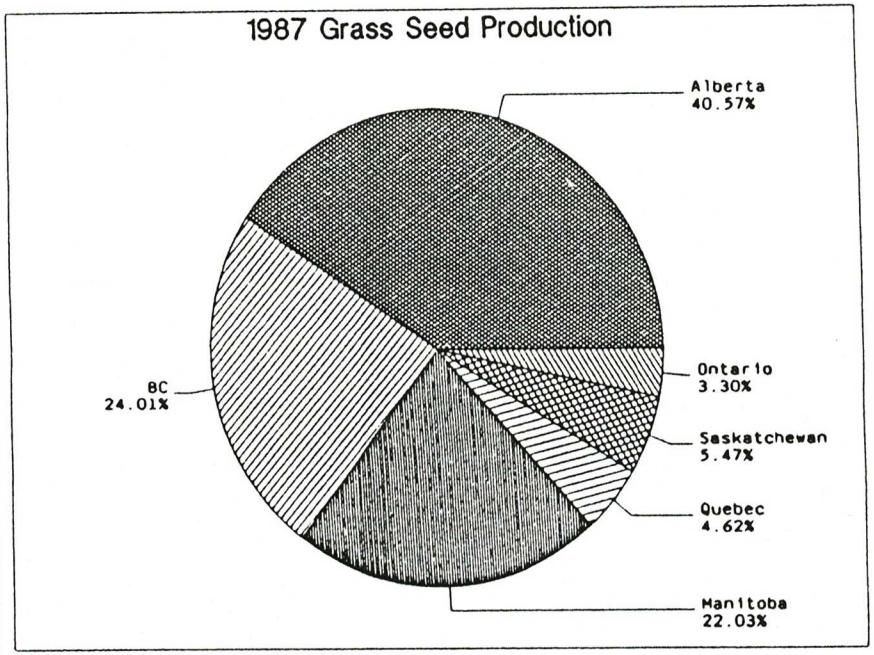
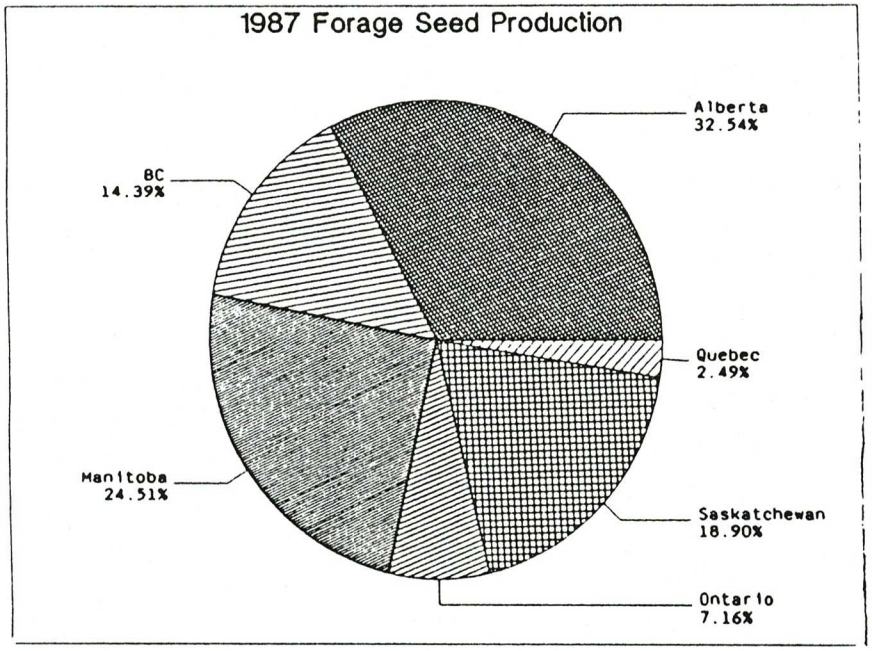


Figure 3. 1987 Forage Seed Production







BASIC PROCEDURES IN LEAFCUTTING BEE MANAGEMENT

P. Pankiw*

In this article, I will attempt to cover the main management procedures based on years of research and experience. This may solve problems being encountered by beginners, and in many cases, may even re-enforce the thinking of the more experienced (many of whose ideas are incorporated in shelter construction) and thus improve efficiency in both bee reproduction and quality and hopefully in seed production.

Sources of bees

Buy good quality bees (basis Brooks test) with a 33% female count, negligible parasites, no chalkbrood and preferably from the Peace River area. Bees from other areas e.g. southern Alberta, Manitoba and Saskatchewan take 3-4 years to acclimatize, resulting in lower reproduction and lower pollination efficiency during this period.

Equipment

1. Nesting material

There is a choice of wood (13 tunnels) or the 30 tunnel polystyrene and blue board which are also available in 1500 and in some cases 3000 tunnel blocks. The revolutionary pinmatic stripper cannot handle wood. Bee preference is old wood, old blue board or polystyrene, new wood, new blue board and polystyrene. However new polystyrene blocks (Beaver Plastic blocks with 10% zonolite) dipped in 3-5% bleach (sodium hypochlorite) was just as acceptable as old polystyrene (unbleached).

The nesting material face is spray painted black with solid color Olympic stain (or equivalent) let dry for 2 days and then lettered blue (no more than 3 tunnels wide) for orientation purposes.

Bleaching all nesting material yearly is a must as it will control leaf mold and is a precaution against chalkbrood and in areas where there is chalkbrood, hopefully this will prevent it from spreading.

Allow a minimum of 1 1/2 tunnels per female when first setting out in shelters with another 1/2 tunnel per female in reserve for a good summer of reproduction.

2. Hives.

Hives to hold 100 sheets of polystyrene or blue boards (2 blocks of 1500 tunnels (230 sheets of wood)) can be made of long-lasting material e.g. plywood and painted black. We use 5/8" on sides, 3/4" at ends and

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5/16" ft. backs (size 42" x 13 1/4" x 5"). A 1/2" hole is drilled at one end of the hive to hang inside shelter. Those using blocks may obtain ready made hives of tin or aluminum. Blocks may also be taped to ten-test, hardboard or plywood backs painted black.

3. Shelters

Although there are so many different shelters available now, I still recommend the nomadic 4 x 4 x 8 6-mil polyethylene shelter for beginners. It is sufficient for 40,000 bees, with 6 hives and a hectare (2.45 acres) of alfalfa.

For each shelter you need

6 boards 1" x 6" x 8'
1 board 2" x 2" x 4" tapered at ends to 1/2"
1 board 2" x 4" x 94 1/2"
4 stakes 1" x 2" x 2"
1 stake 1" x 2" x 5'
1 sheet plywood 5/16" (good for 7 shelters) cut into strips 3/4" wide
1 roll 10' x 100' light-resistant 6 mil polyethylene (good for 7 shelters)
6 1 1/2" double-headed nails
2 dozen 2" dry-wall screws
1 box of 3/8" staples and 1 box of 3/4" air hammer staples
white wood cement
1- 2 lb mallet

Rip the 1" x 6" boards in half (3"). You need 2 large panels 4' x 8' and two small panels 4' x 4'. The 2 large panels will each require two 8 foot pieces lap jointed and two 4-foot pieces lap jointed.

The lap-joint ends should be dipped in wood preservative as this is where most breakage occurs. After 24 hours glue and staple or nail the panels together and let dry for another day or so. Nail a strip of 5/16" plywood 3/4" x 46" on the outer ends of the large panels, with spaces at the corners and in the middle of the long pieces.

Staple the polyethylene (plastic) to the underside of the panels taking care at the corners and also cutting small holes in the large panels in the spaces left between the 5/16" plywood strips. This allows the bees to fly out. The plastic will last for 5 years if stored (when not in use, September to June) indoors out of sunlight, at temperatures slightly above freezing.

Attach the large back panel to the ends of the 2 small panels with 2 screws each. Inside the shelter attach the 94 1/2" x 2" x 4" (with double-headed nails) spaced 14" and first nail 12" from end) to the top of the side panels and 6" forward of the back panel with 2 screws at each end to hang the hives. Half way down attach a 1" x 2" x 8' to the side panels as a back rest for the hives. Attach the top large panel with 4 screws to the back panel and 2 screws each to the side panel. A cordless screw driver is very handy.

Place the ridge board 2" x 2" x 94" under the top panel to shed rain.

For anchoring the shelter we use the 4 pointed 1" x 2" x 2' driven 1 foot into the ground at a 45° angle, flush with the 4 corners of the shelter and fastened by 1 5/8" drywall screws. The last and most important anchoring device is the 5 foot 1 x 2 pointed stake driven 8-10" into the ground and attached to the middle front of the top panel with a 2" drywall screw.

Make certain the shelter is placed on a clipped area 12' x 12' and faces south. You can now hang the hive boxes. Place a small block (1/2 kg or 1 lb) of salt inside the shelter for mice, groundhogs, deer and hopefully bear.

Forage

Make certain you have adequate forage for your bees or they will abscond to other and more favorable plants. For maximum bee increase and seed set of 50-70% place at 7-10,000/acre (19-25000/ha). For a reasonable bee increase and adequate pollination place at 15-20,000/acre (35-50,000/ha).

Place bees in shelters when alfalfa is 15% in bloom and never less than 10% or you will encounter drift and bee loss. In a normal year this would be July 1-4 for older stands and a week later for new stands. Therefore incubation need not begin until June 12 as it takes 20 days from start of incubation until we have 10-20% females emerging.

Incubation

An incubation temperature of 85°F (29.4°C), a relative humidity of 50-60% and a continuous fan is recommended. An incubation tray rack, with 2" between trays, with the bottom tray about 6-8" off the floor and top tray at least 1 foot from the ceiling is advisable.

Incubation trays range from plastic trays (10,000 bees) medium size wooden trays (22" x 24" x 3') for 20,000 bees to larger trays holding up to 100,000 bees in bleed-off system. Most trays have the tops screen with wire cloth and with narrow lids in front which are left open until the males start emerging. The incubation room should be thermostatically controlled, with a continuous fan and a cooling unit (preferably refrigeration or secondly outside air). A window with blackout screen is also advisable to monitor emergence of parasites, predators, native bees and males.

As parasites emerge about the 8th day a 1/2 strip (per 1000 cu ft) of vapona is introduced (in front of the continuous fan) and kept until the end of the 12th day, after which the vapona is removed and incubation room aired out for 24 hours. A check should now be made of the alfalfa fields. If not in occasional bloom (2%) trays can be cooled to 20°C (68°F) and kept at this temperature for up to 2 weeks until alfalfa starts blooming, after which the temperature is raised back to 30°C.

Note very carefully that between the 14th and 18th day a heat build-up, called the heat of metabolism, occurs. If cooling isn't provided temperatures may build in 2-3 hours to the lethal temperature of 40°C (104°F). As an example in an incubation room (9' x 13' x 8') with 3,000,000 bees and a 1/2 HP compressor, temperatures rose to 34°C (93°F) overnight.

Usually about the 17th day when males start emerging, close the lids and black out the window and keep the room dark, to minimize bee activity. When 10-20% of females are hatched usually about the 20th day, the trays are taken to the shelters, early in the morning at least half an hour prior to flying. Place the trays on small 2 x 4 blocks and open 1/2" to let bees out but keep out mice. Trays can be covered with white coroplast or clear coroplast toned down with white undercoat. This diffuses the light and bees do not like to go back into the tray. It also keeps the trays warmer during the day and helps keep out cool air at night.

If the weather remains cool and cloudy, trays may be brought in after 2 days in the evening, reincubated for 36 hours and brought back to the shelters. Usually after 10 days a check is made of the cells for complete emergence. Trays are shaken and placed on top of the shelter facing the sun to rid trap of nesting females (if any) which may take 10-15 minutes. At this time clip all alfalfa inside shelter and for 2' on sides and back and 4' in front. The trays with empty cells are brought home. Sample cells for emergence and do a post-mortem of full cells. Burn all the cells and disinfect trays and covers with 2% bleach.

A check is made of the shelters at the end of July or earlier depending on the weather. Hives 60-70% full are brought in and replaced with 1 and not more than 2 empty hives. To mature, the newly-laid eggs and young larvae, and dry the hives, set store room temperature at 18-20°C (65-68°F) and with a continuous fan. Pull boards away at least 1" from back of hive. Blocks should be taken out and staggered in piles for better drying. Because parasites sometimes come in with the hives, we put in vapona strips (1/2 strip per 100 cu ft) for at least 12 hours in the storeroom each time we bring hives from the field. The remainder of the hives are brought in by the 3rd week of August. Keep temperatures at 18-20°C for a minimum of 6 weeks to allow larvae to complete development, spin their cocoons, allow cocoons to dry and turn brown. We do not strip till mid-October. With this procedure there is very little second generation and a low percentage of pollen balls. We had a low of 3.5% in 1984, 5% in 1987 and a high of 10% in 1982.

After stripping, cleaning is necessary to remove leaf plugs and surplus leaves. Air cleaning with a clipper cleaner will remove 15-18% by weight. Tumbling is beneficial although dockage is lower 10-14%. Check for the red checkered flour-beetle larvae and remove. Send a representative sample to Brooks for complete analysis. Cells may be stored in plastic pails with air holes, paper cartons. e.g. bushel apple boxes at 5°C (40°F) and R.H. of not more than 60%. We also check the cells in February or early March and give them an airing by moving from one container to another. During late April, May and part of June the storage

temperature may be difficult to hold at 5°C. We try to hold at 10°C (50°F) without any ill effects of incubation.

In closing, I may state that what I have mentioned is only meant to be a guideline and may be open to criticism by the more experienced beekeepers of which we have quite a large number in the Peace River region.

RESEARCH UPDATE ON FORAGE SEED PRODUCTION

D.T. Fairey*

Leafcutting Bees (Megachile rotundata Fab.) to Pollinate Legume Plots

Reports in the literature suggest that although leafcutting bees show a preference for pollinating alfalfa, these bees will also pollinate other legume crops. In experimental plots, the leafcutting bee has been used to pollinate alsike clover, red clover, sainfoin and birdsfoot trefoil. A summary of seed yield data from a number of years and locations in the Peace River region is presented in Table 1. It should be noted that while leafcutting bees were provided in plot areas, other pollinating insects could not be excluded.

Table 1. Average seed yields of some forage legumes provided with leafcutting bees for pollination

Crop	Cultivar	Seed yield kg/ha
Alsike clover	Aurora	220
	Dawn	256
Red clover	Altaswede	318
	Norlac	284
Birdsfoot trefoil	Cree	206
	Leo	215
Sainfoin	Melrose	320
	Nova	333

Leafcutting bees to pollinate red clover

The use of the leafcutting bee as a pollinator of diploid, single-cut red clover, Trifolium pratense L. was investigated in the Peace River region of northern Alberta over a 5-year period, 1983 to 1987 inclusive. Average seed yield with the use of this pollinator was 410 kg/ha as compared to 291 kg/ha for the control where the leafcutting bee was not used (Table 2). Furthermore, in four of the five years of study, provision of leafcutting bees was associated with higher seed production.

* Dr. Daphne Fairey, Research Scientist, Agriculture Canada, Beaverlodge, Alberta

Table 2. Red clover seed yield; for statistical comparisons use natural log yield and S.E.[+] in parentheses.

Year	Seed yield kg/ha 1 - with bees		2 - without bees	
1983	498	(6.163)	240	(5.431)
1984	466	(6.096)	256	(5.498)
1985	343	(5.791)	347	(5.803)
1986	390	(5.918)	306	(5.676)
1987	373	(5.875)	320	(5.719)
Mean	410	(5.968)	291	(5.625)

([+]S.E. of difference for treatment = 0.040; for Yr x treatment = 0.089)

Reproduction of leafcutting bees pollinating red clover was comparable to that obtained on alfalfa. For each crop, about 96 percent of the cells produced were viable. Also, about 32 percent of these cells were females, i.e., a 2:1 ratio of males to females. It should be noted however, that the ratio of cell increase was generally lower in bees pollinating red clover than in those pollinating alfalfa but that the lowest increase obtained was 1.5, i.e., there was no bee loss, only a minimum gain of 50 percent (Table 3).

Table 3. Ratio of cell increase

Year	Crop: Alfalfa	Crop: Red clover
1983	2.39 (0.216)[+]	1.50 (0.178)
1984	2.70 (0.106)	1.69 (0.149)
1985	2.16 (0.106)	2.23 (0.160)
1986	2.66 (0.104)	2.59 (0.082)
1987	3.24 (0.088)	2.12 (0.080)
Mean	2.63 (0.081)	2.03 (0.085)

[+] Standard error

The results of the present study indicate that management of the leafcutting bee as a pollinator of red clover merits further investigation.

Materials for leafcutting bee shelters

Loretex III* and Monarflex Ultra* were compared with Dura Film* polyethylene as covering materials for leafcutting bee shelters under growing conditions in the forage seed producing areas in north west Canada. Tests at two locations at lat. 55°12' N and 58°23' N, over five consecutive years indicated that all three materials were similar in performance. No differences were observed in the sex ratio of the leafcutting bees or their production of viable cells.

Table 4. Some properties of leafcutting bee shelter covering materials

Trade name	Thickness (mm)	Texture	Decrease in light transmittance (%) within shelter	Price per m^2 Can $+	Ratio of bee cell increase
C-I-L Dura Film polyethylene	0.152	Clear polyethylene	8.60	0.74	2.56
Loretex III	0.230	Woven, flexible polyester fibre	21.87	1.20	2.39
Monarflex Ultra	0.250	Monofil reinforced fibres, extrusion coated between two layers of flexible polyethylene film	11.38	1.88	2.55

+ Purchase price in 1982

* Mention of trade names is only for the purpose of identification and does not constitute a recommendation to the exclusion of other suitable products.

ALFALFA SEED INSECT PEST MANAGEMENT

M. Okuda*

Alfalfa seed insect pest management balances conservation of pollinators and beneficial insects with the need to prevent economic damage caused by insect pests. In the Peace River region Lygus species are the primary insect pests. The alfalfa plant bug and pea aphid are occasional pests.

LYGUS BUG

Lygus borealis, L. elisus and L. lineolaris are the principal species of lygus bug that damage alfalfa seed in the Peace River region.

Lygus bug adults are 4.5 to 6 mm long and 2.3 to 3 mm wide. The colour varies from pale green to light reddish brown. Approximately one third of the way down the back there is a light coloured triangle. The nymphs vary from less than 1 mm in length to the size of the adults. There are five nymphal stages, the first two being a bluish green in colour. As the nymphs mature the colour varies from a yellow-green to brownish red. The first three stages do not have wing pads while the fourth and fifth stages do. Lygus nymphs look a little like aphids but move much faster than them.

Damage

Lygus bugs have piercing-sucking mouthparts and feed on plant sap. While feeding they inject a substance which reacts with the plant tissue and kills it. Lygus bug damaged buds turn grey to white, die and may fall from the plants. Feeding on immature seeds cause them to shrivel, turn brown and later black, and prevents germination. Damaged seed is often lighter than healthy seed and may be lost during the harvesting process. Lygus bug feeding during the flowering stage can cause flower fall. Also, feeding on the growing points of the vegetative plant can cause the formation of deformed leaves as well as excessive branching.

The older nymphs in the fourth and fifth instars and the adults cause the most seed damage. It has been estimated that the older nymphs cause about twice as much damage as the adults. The nymphs in the first three instars cause negligible damage.

Life History

Lygus bug adults overwinter under litter and debris in bush and wasteland outside of alfalfa seed fields. They move into the alfalfa as soon as the crop is in the bud stage and lay their eggs about 10 days later. Nymphs reach the first to third instar in late June and early

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July. Fourth to fifth instar nymphs are found from late July to early August. New adults are common in the latter part of August and the beginning of September. When the alfalfa seed crop matures and starts to dry down the lygus bug adults move out of the fields to overwinter. In the Peace River region there is one generation a year.

Lygus bugs are general feeders and are found on many herbaceous host plants. These include canola, creeping red fescue, bromegrass, mustards and lambsquarters.

ALFALFA PLANT BUG

The alfalfa plant bug adult is a greenish yellow coloured insect with an oblong body 7 to 9 mm long and 2.5 to 3 mm wide. In general appearance it looks similar to some of the green coloured lygus bugs, but is slightly larger.

Damage

Like the lygus bug the alfalfa plant bug has piercing-sucking mouthparts. It causes similar damage to the lygus bug, causing bud blasting, flower drop and immature seed damage. Because of its slightly larger size it is suspected that it causes more seed damage than a lygus bug of the same developmental stage.

Life History

The alfalfa plant bug spends the winter in the egg stage in alfalfa stubble and straw left in the field at harvest. The nymphs hatch from the eggs during May and June and there are five nymphal stages. About 30 days are required for the insects to develop from the egg to the adult stage. There is one generation during the growing season.

Control

The economic threshold is 5 lygus bugs and/or alfalfa plant bugs per 90° sweep when the alfalfa is in bud or in bloom. Insecticides recommended for controlling the lygus bugs should be applied prior to the time the leafcutter bees are placed in the fields. It is important to allow enough time between application and bee placement to prevent any leafcutter bee kills. Also, harmful effects on honeybees should be minimized. The chemicals recommended for plant bug control by the Western Committee on Crop Pests include:

	Rate (g AI/ha)	Preharvest Interval
Deltamethrin	10	-
Dimethoate	560	28
Methidathion	280 - 560	10
Trichlorfon	560	14

In the fields that have been burned apply dimethoate or methidathion when flower-buds are beginning to form. Crop material from fields treated with deltamethrin cannot be fed to animals. Deltamethrin can only be applied once per year and cannot be applied by air.

Cultural

Burning in the spring will help control the alfalfa plant bug, but will not control lygus bugs. Burning destroys the alfalfa plant bug eggs that are in the alfalfa stubble and stems. Fortunately, the alfalfa plant bug is not often a pest in the Peace River region so there is usually no need to burn alfalfa seed fields.

Biological

The damsel bug is the most important natural enemy of the lygus bug and alfalfa plant bug in the Peace River region. The adult damsel bug is a greyish brown colour and is 8 to 9 mm long and 1.5 to 2 mm wide. It has enlarged front legs that are used for grasping its prey and piercing-sucking mouthparts. A ratio of two damsel bugs to one lygus bug (based on 90° sweep counts) during the green seed stage is sufficient to control the lygus bugs in the northwestern United States.

The big-eyed bug is another predator of the plant bugs found in this region. It is not as numerous as the damsel bug.

PEA APHID

The pea aphid has the potential to build up at any time during the growing season. It is a small (up to 3 mm in length) green coloured, slow moving insect with two cornicles on its hind end that look like tail pipes. There are winged and non-winged forms.

Damage

Pea aphids are found primarily in the growing tips of plants. The adults and nymphs feed on the juices from leaves, petioles, stems and flower buds. Their feeding can cause the plants to become stunted and reduces the seed yield. At damaging population levels the alfalfa plants are stunted, wilted and the top leaves turn light green and the lower ones yellow. The damaged area appears brownish from a distance. When populations are heavy a black sooty mould grows on the sticky honeydew that the aphids produce.

Life History

The pea aphid overwinters as an egg on alfalfa and clover stems and leaves. Aphids hatch in the spring, grow to become adults and reproduce asexually giving birth to many females. During the growing season the second and third generations are winged and migrate to other suitable hosts such as clover species and peas. Pea aphids are able to build up to

high levels in a very short period of time since the time required for development from birth to maturity can be as short as five days.

Control

The economic threshold for pea aphids is 200 to 300 per 90° sweep.

Natural enemies such as ladybird beetles, damsel bugs, big-eyed bugs, green lacewings, hover flies, and parasitic wasps help keep the numbers below the damaging levels most of the time. Ladybird beetle adults and larvae are voracious aphid predators, each beetle can eat a couple of hundred aphids in its lifetime. Damsel bug and big-eyed bug nymphs and adults, green lacewing larvae and hover fly larvae are also aphid feeders. The parasitic wasp larvae develop inside the aphids and kill them.

Monitoring Program

A sweep net sampling program is used to check seed fields to determine whether the pest insects need to be controlled. Each alfalfa seed field is divided into sampling regions. There are a minimum of three regions per field and the number of regions is dependant upon the size of the field. When the field is sampled five 90° sweeps are taken in each region with a 37.5 cm diameter sweep net. The number of pest insects of one type is divided by the total number of sweeps taken in the field to give the average number per sweep. For example, a 30 acre field sampled at five sampling sites for a total of 25 sweeps with a total of 50 lygus bugs and alfalfa plant bugs would have a field average of 2 per sweep (50 divided by 25). Because the economic threshold is 5 per sweep the field would be below treatment level.

WEED CONTROL IN FORAGE CROPS

D. Cole and A.L. Darwent*

Weeds can be a major problem in forage crop production in Alberta. In stands used for seed production losses caused by weeds are quite obvious. Canada thistle, at a density of 20 plants per square metre, has been shown to reduce the seed yield of alfalfa by 50 per cent. Similarly, heavy infestations of wild oats and stinkweed in the year of seeding of creeping red fescue have caused up to a 75 per cent reduction in seed yields the following year.

In forages grown for purposes of feeding to livestock losses caused by weeds are less obvious than in forages grown for seed. Some weeds have feed value and this must be considered. In a study near Lethbridge, alfalfa grown under irrigation and heavily infested with weeds in the year of seeding did not have large losses due to weeds. Over a four-year-period weedy plots produced only 1.6 tonnes per acre less forage than under weed-free conditions. Losses occurred only in the first year. However, factors other than yield must be considered, e.g. the spread of perennial weeds and the build-up of weed seeds.

Decisions on how to manage weed populations in forages must take into consideration factors such as the age of the stand, the types of weeds present, and the way in which the forage crop is used.

Cultural Control

The key to controlling weeds in a forage crop lies in the establishment and maintenance of a vigorous, highly competitive crop stand. Some suggestions for obtaining and maintaining such a stand are as follows:

- Seed into a clean field. Heavy weed infestations should be controlled prior to the seeding of the forage crop through either cultural or chemical means. Perennial weeds, such as Canada thistle, perennial sow-thistle and quack grass, are extremely difficult and costly to eradicate in a forage stand and should be eliminated before the stand is established. The herbicide Roundup is useful for this purpose.

- Seed into fields free of any herbicide residues. Residues of herbicides such as Glean and Tordon 202C can remain in the soil for one or more years and seriously reduce the emergence and growth of seedling grasses and/or legumes. (See section on cropping restrictions - Table 1).

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- Use seed that is either weed-free or free of problem weed seeds. When purchasing certified seed check the seed testing certificate. This certificate provides information on the type and quantity of weed seeds present. Make sure that the list does not contain too many weed seeds or seeds of weeds not present where the forage crop is to be seeded. It is particularly important to avoid seed stock containing seeds of any noxious or restricted weeds such as nodding thistle, diffuse knapweed, spotted knapweed, scentless chamomile, toadflax, quack grass, perennial sow-thistle, Canada thistle, leafy spurge, and field bindweed.

- Use forage crops and varieties recommended for your area and the field to be planted.

- Seed into a firm, well prepared seedbed at the recommended rate and depth.

- Seed at a time to coincide with favorable moisture conditions. In the north, seed of forage in the spring is most successful while in southern areas the appropriate time can be in the early spring or in the fall.

- Use fertilizer according to soil test results and inoculate legumes properly with the appropriate inoculum.

- Evaluate the option of seeding without a companion crop. Since soil type, weather and economic conditions and type of farming operation are all important factors, the choice is an individual one. In general, where soil crusting or erosion is not a problem and maximum forage production is a primary objective, seeding without a companion crop is advisable. While companion crops suppress weeds and enhance herbicide efficacy, they also suppress forage seedling development and yield in subsequent years. Less competitive companion crops such as flax should be considered. If a cereal companion crop is to be used, harvesting of the companion crop early as greenfeed or silage can sometimes aid in the establishment of the forage crop.

- Mow at a height just above the forage crop as this is an effective method of preventing annual weeds from smothering seedling forages. Seed set of the weeds is also reduced. A flail-type mower, or one that distributes the plant material evenly over the field, is preferable to a swather.

- Harvest the established forage crop at the appropriate time. Harvesting at the wrong time can cause crop injury. For example, alfalfa in northern and central Alberta should not be harvested in August while in southern Alberta, where a three-cut system is used, it should not be harvested in September. Harvesting during these periods can predispose alfalfa to potential winterkill and reduce its competitiveness. Such weakened stands allow weeds to become established.

- Cut hay or silage crops early before weeds go to seed.

- Do not overgraze pastures. Fertilize older forage stands.

- Pull by hand or spot spray problem weeds such as Canada thistle. Failure to control small patches of problem weeds will lead to problems in the future.

- Clean up the weeds in the adjoining fence-lines, roadways and rights-of-way.

- Break up old, depleted or winter-killed stands where there is no longer a vigorous forage stand to compete with weeds.

Chemical Control

Herbicides should be used only when needed and to supplement, not replace, good cultural management of weeds in forage crops. The selection of herbicides for use on forages is limited when compared with that for cereal crops.

Herbicide selection depends upon:

- The problem weeds present and the effectiveness of the herbicide on these weeds. Chart 1 gives a summary of herbicides for the control of the main problem weeds in forage crops in Alberta. For other weeds check with the local district agriculturist or agricultural fieldman.

- The forage crop(s) grown and the tolerance to the herbicides registered for this use. When mixed stands of grasses and legumes are grown, herbicide choice is especially limited. For grass-legume mixes, use of herbicides for broadleaf weed control will be most limited by the legume, for grassy weed control herbicide choice will be most restricted by the presence of forage grasses. Consult the selector Charts (1 & 2) to determine herbicides that can be used in mixed grass-legume stands. The herbicide must be registered on all crops present in the stand.

- The companion crop, if used, and its tolerance.

- The stage of growth of both crop and weeds. See the herbicide label for the recommended stage of application.

- The age of the stand i.e. seedling (within approximately 3 months of the time of seeding) or established (3 months or more after seeding).

- The purpose or use for which the stand is being grown, i.e. pasture, hay or seed production.

- The cost of the herbicide. Is the herbicide application economical in the short term and/or in the long term?

When the herbicide is selected for use in a forage crop, several points should be kept in mind:

- Follow all label directions closely, particularly as they relate to stage of crop and weed development, water volume, and grazing or feeding restrictions.

- Spray at the appropriate stage. In the year of seeding, spray post-emergent herbicides as early as label direction will permit. Young weeds, i.e. in the 2-4 leaf stage, are easier to kill than those in the more advanced stages. Early removal of weeds will enhance forage seedling vigor as forage seedlings do not compete effectively with faster growing weeds. Seedling legumes are most resistant to herbicides for broadleaved weed control from the first to the third trifoliate leaf stage. They should not be sprayed after reaching 10 cm in height.

- Check label instructions closely when applying herbicides for grassy weed control to seedling forage grasses. Tolerance is specific for each herbicide i.e. Hoe-Grass can be used on brome grass but will completely kill timothy.

- Use extra precautions when applying herbicides to stands that are being grown for seed. Research has shown that applications of 2,4-D in the fall of the year of seeding can drastically reduce seed yields of creeping red fescue and timothy the following year. Spring application should be made prior to the shot blade stage. Do not exceed 0.45 L/ac of 2,4-D (500 g/L formulation) on grass stands grown for seed.

- Consider other options than 2,4-D or MCPA on forage legume crops. The use of 2,4-D and MCPA, while registered for use on certain seedling legumes, is not recommended as serious damage to the legume may result.

- Calibrate the sprayer for uniform application of the correct amount of herbicide.

- Avoid drift onto sensitive crops growing in nearby areas.

- Spray according to environmental conditions. If conditions are very dry, consider delaying spraying until a few days after a substantial rain. The performance of most herbicides is frequently reduced under dry conditions.

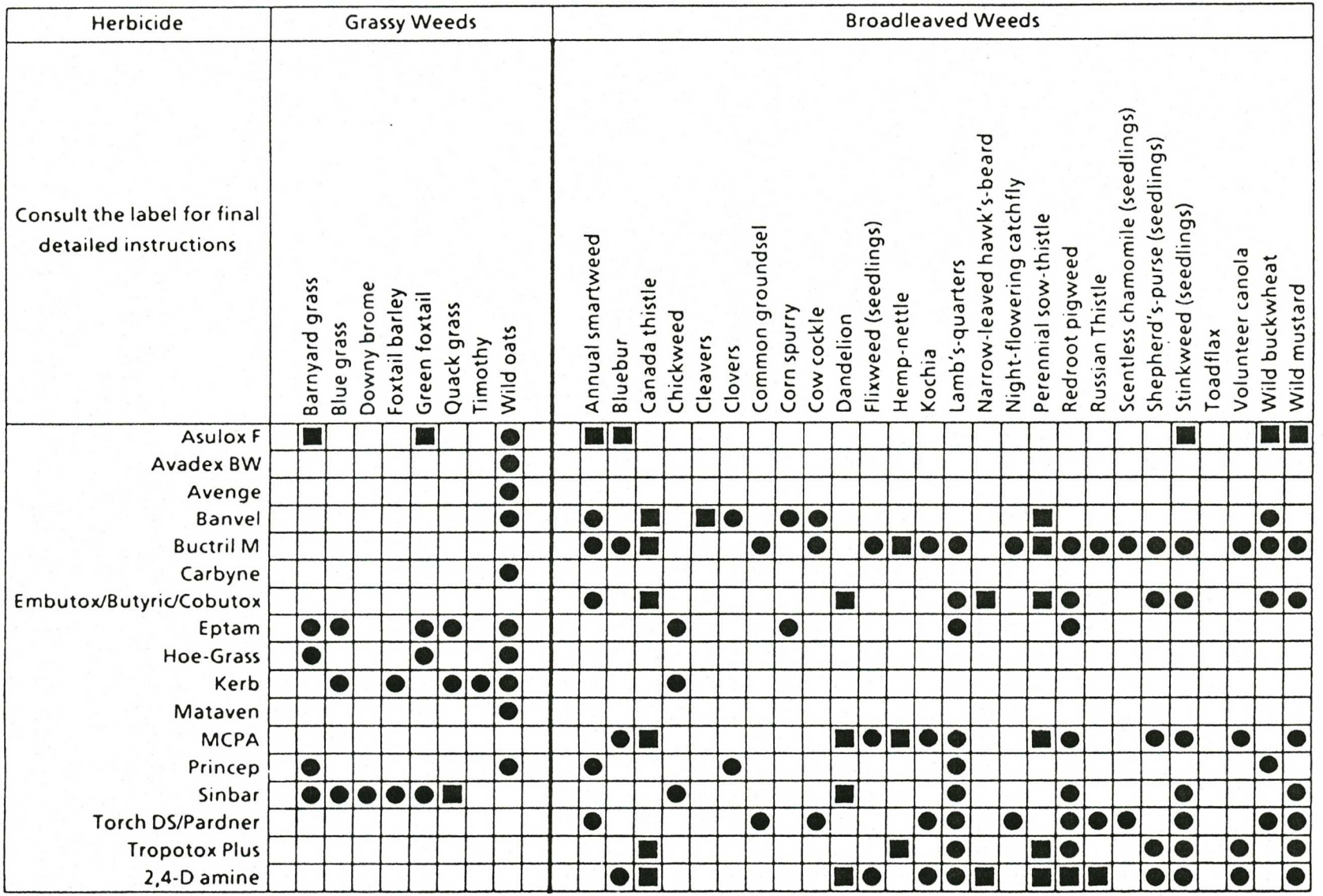
- Do not use herbicides with long lasting residues on forage crops that may be worked under in 1 or 2 years. Injury will occur to crops seeded in soil containing these residues.

- Consult the Guide to Crop Protection in Alberta. Part 1 - Chemical. Alberta Agriculture. Agdex 606-1 or the label on the herbicide container for further information on each herbicide listed in the selector charts.

There are a number of options for dealing with weed problems in forage crops. It may pay to spray and it always pays to use good agronomic practices.

CHART 1.

HERBICIDES FOR USE IN FORAGE CROPS AND THE WEEDS CONTROLLED - ALBERTA, 1987



● Controlled by rates recommended for crops. ■ Top growth control or suppression only.

CHART 2.

HERBICIDES FOR USE IN GRASSES AND LEGUMES FOR SEED AND FORAGE - ALBERTA, 1987

	Herbicide	Grasses													Legumes								Cover Crop				
	Consult the label for final detailed instructions.	Brome grass	Creeping red fescue	Crested wheat grass	Inter. wheat grass	Kentucky blue grass	Meadow fescue	Meadow foxtail	Orchard grass	Reed canary grass	Russian wild rye grass	Slender wheat grass	Tall wheat grass	Timothy	Alfalfa	Alsike clover	Bird's-foot trefoil	Cicer milkvetch	Red clover	Sainfoin	Sweet clover	White clover	Barley	Canola	Flax	Oats	Wheat
SEEDLING* STAND FOR SEED	Asulox F																										
	Avadex BW														1	1	1		1		1	1					
	Avenge	1	1	1		1	1		1	1	1			1	1		1		1		1						2
	Banvel		3																								
	Buctril M																										
	Carbyne																										
	Embutox/Butyric/Cobutox																										
	Eptam																										
	Hoe-Grass																										
	Mataven																										2
	MCPA	4	4	4	4	4	4	4	4	4	4	4	4	4													
	Torch DS/Pardner																										
	Tropotox Plus																										
	2,4-D amine	4	4	4	4	4	4	4	4	4	4	4	4	4													
SEEDLING* STAND FOR FORAGE	Avadex BW														1	1	1		1		1	1					
	Avenge	1	1	1		1	1		1	1	1			1	1		1		1		1						2
	Carbyne																										
	Embutox/Butyric/Cobutox																										
	Eptam																										
	Hoe-Grass																										
	MCPA																										
	Tropotox Plus																										
	2,4-D amine																										
ESTABLISHED* STAND FOR SEED	Asulox F																										
	Banvel																										
	Carbyne																										
	Kerb														5		5										
	MCPA	6	6	6	6	6	6	6	6	6	6	6	6	6													
	Princep														7												
	Sinbar														7												
	2,4-D amine	6	6	6	6	6	6	6	6	6	6	6	6	6													
ESTABLISHED* STAND FOR FORAGE	Banvel																										
	Carbyne																										
	Embutox/Butyric/Cobutox														8	8	8					8					
	Kerb	9	9	9	9	9	9	9	9	9	9	9	9	9	9		9										
	MCPA																										
	Princep														7												
	Sinbar														7												
	Tropotox Plus															8			8			8					
	2,4-D amine																										

☐ - Herbicide is recommended for the crop.

* Seedling - within approximately 3 months of the time of seeding. Established - 3 months or more after the time of seeding.

1. Use only if forage crop is underseeded with a companion crop for which herbicide is registered.
2. Check label for varietal restrictions.
3. Apply when crop is 5 cm tall. If mixed with 2,4-D, do not apply in the fall of the year of seeding if forage grass is seeded without a companion crop.
4. DO NOT apply to timothy or fescue (beyond 4 leaf stage of crop) in the fall of the year of seeding when a seed crop is expected the following year. 2,4-D or MCPA may be applied to fescue in the fall of the year of seeding if a companion crop is used since a seed crop is not normally expected the following year. The effect of applying 2,4-D or MCPA in the fall of the year of seeding on other grasses is not known at this time, although in preliminary tests, brome grass appears to have some tolerance. DO NOT exceed 0.45 L/ac of 2,4-D or MCPA (500g/L formulation) except for narrow-leaved hawk's-beard, on creeping red fescue only (0.90 L/ac). Rates above 0.45 L/ac may cause seed yield losses.
5. Fall application only on trefoil, fall or spring application on alfalfa.
6. May be applied prior to shot-blade in the seed production year or in the fall after a seed crop has been removed. Applications made during flower development and during pollination will reduce seed yield. Apply 2,4 - D in the fall for narrow-leaved hawk's-beard. Limited information is available on the effect of MCPA on seed production. Although most crops usually are more tolerant of MCPA than 2,4-D, it would be prudent to follow the guidelines outlined for 2,4-D until more data are available.
7. Established at least one year.
8. In established legume pasture spray after grazing or cutting when regrowth is not above 7 cm. Damage to the crop is related to amount of foliage present when sprayed.
9. For foxtail barley control in established pastures (grass, grass/legumes, alfalfa, trefoil). Creeping red fescue, Kentucky blue grass and timothy are less tolerant than other grasses and may experience some yield reduction (10-15%). Brome grass, orchard grass and wheat grass are the most tolerant grasses.

TABLE 1.

GRAZING AND FEEDING RESTRICTIONS FOR HERBICIDES USED IN FORAGE CROPS

Herbicide	Restriction
Asulox F	Do not graze or feed treated crop.
Avadex BW	Do not harvest legumes as forage in year of treatment.
Avenge	Do not graze or harvest forage crops for feed in year of treatment.
Banvel	**Dairy Cattle** - do not graze or cut for hay for 7 to 60 days after treatment, depending on rate of Banvel applied. See product label for additional detail. **Beef Cattle and other meat animals** - do not graze or feed slaughter animals for 30 days after treatment.
Buctril M	No restrictions specified.
Carbyne	Do not graze or feed crop for 5 weeks after treatment.
Embutox/Butyric/Cobutox	No restrictions specified.
Eptam	No restrictions specified.
Hoe-Grass	Do not use for forage in year of treatment.
Kerb	Do not harvest or graze for 90 days after application of the 1.3 kg/ac rate or for 60 days after application of rates below this level.
Mataven	Do not graze or harvest forage crops for feed in year of treatment.
MCPA	Do not graze dairy cattle for 7 days after treatment.
Princep	Do not graze for 30 days after application. Do not cut for hay for 60 days after application.
Sinbar	No restrictions specified.
Torch DS/Pardner	Do not graze or harvest forage grasses for feed in the year of treatment with Torch DS.
Tropotox Plus	No restrictions specified.
2,4-D amine	Do not graze for 24 hours after treatment.

CROPPING RESTRICTIONS

Herbicide	Forage Crops Which May Be Affected The Year Following Use of the Herbicide
Atrazine (including all products containing atrazine)	Seedling legumes and grasses may be affected for 1 or more years after Atrazine application.
Banvel	Legumes and seedling grasses if high rates of Banvel were used for perennial weed control the year before.
Glean	Seedling legumes and grasses may be affected for 2 or more years after Glean application. A test strip should be seeded the year before seeding a forage crop. The time interval between application of the herbicide and seeding of the forage crop is increased when the pH of the soil is greater than 7.0, the organic matter content is less than 5% and/or there is less than 250 mm of rainfall in a season.
Lontrel	Small seeded legumes may be affected 2 or more years after application. Only wheat, oats, barley, rye, flax, or canola should be seeded the following season. Residual carryover 2 years after application has not been fully evaluated.
Princep	All crops except established forage legumes. Soil residues may persist for 2 or more years.
Rival/Treflan/Triflurex Heritage, Fortress	Small seeded grasses should not be seeded for 21 months after application. Drought conditions in the year of treatment or the use of a granular formulation may result in higher levels of carryover into the next year.
Sinbar	All crops except established alfalfa as recommended. DO NOT plant treated area to any crop within 2 years after last treatment.
Tordon 202C	Do not plant alfalfa until at least the third growing season after the year of treatment. Seed only wheat, barley, oats, flax or canola for 2 years following treatment.