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SOUTHERN ALBERTA HERBICIDE APPLICATION  
PROJECT REPORT  
1980

by  
S. E. Hoyles

**Alberta**

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by  
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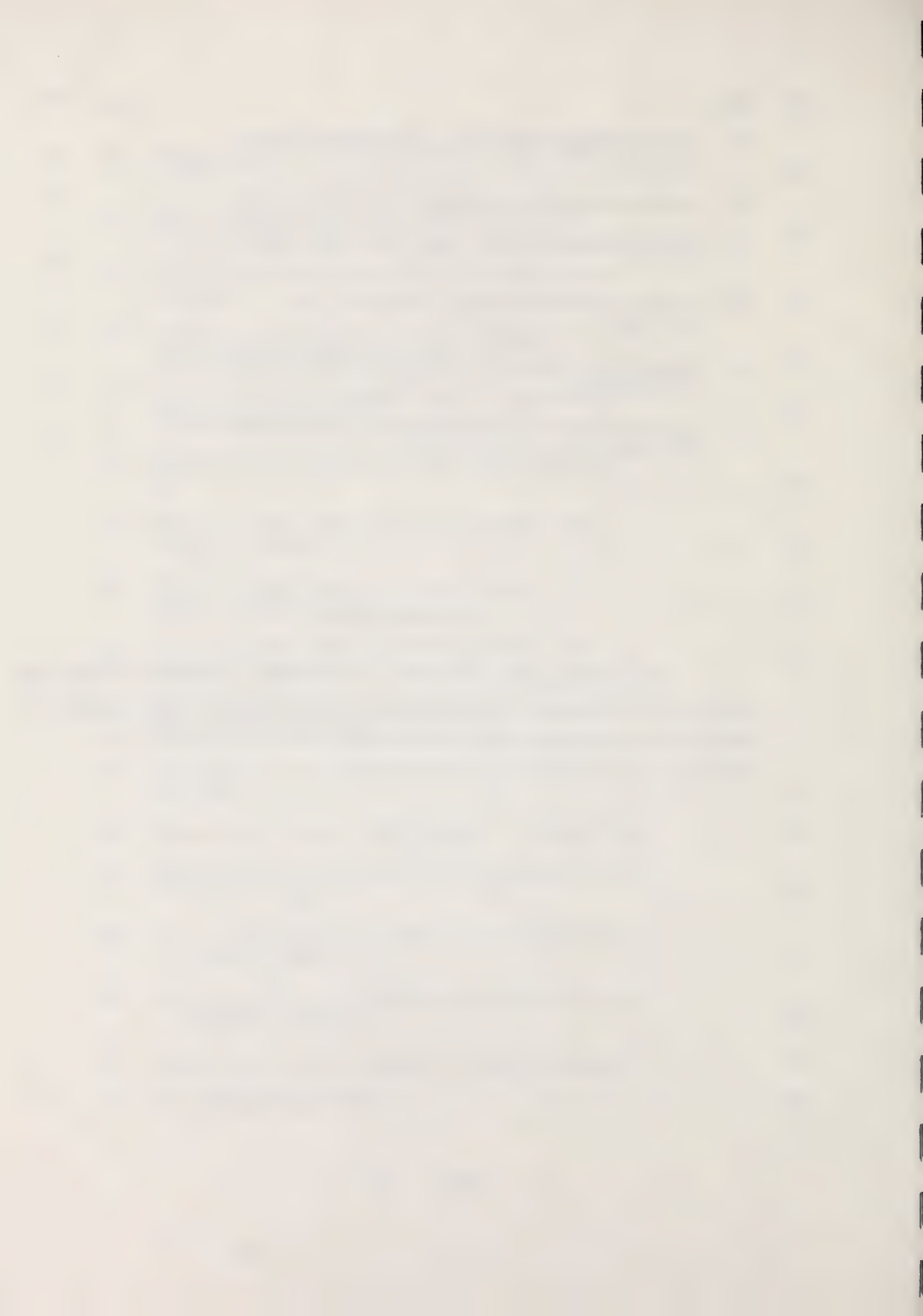
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## ABBREVIATIONS

<i>Fesc</i>	=	<i>Festuca scabrella</i>
<i>Feid</i>	=	<i>Festuca idahoensis</i>
<i>Dain</i>	=	<i>Danthonia intermedium</i>
<i>Agsu</i>	=	<i>Agropyron subsecundum</i>
<i>Phpr</i>	=	<i>Phleum pratense</i>
<i>Pofr</i>	=	<i>Potentilla fruticosa</i>
<i>Ant</i>	=	<i>Antennaria</i> spp.
<i>Gabo</i>	=	<i>Gallium boreale</i>
<i>Getr</i>	=	<i>Geum triflorum</i>
<i>Aggl</i>	=	<i>Agoseris glauca</i>
<i>Oama</i>	=	<i>Oxytropis macounii</i>
<i>Aemi</i>	=	<i>Achellia millifolium</i>
<i>Anmu</i>	=	<i>Anemone multifida</i>
<i>Heri</i>	=	<i>Heraculum richardsonii</i>
<i>Syoc</i>	=	<i>Symphoricarpus occidentalis</i>

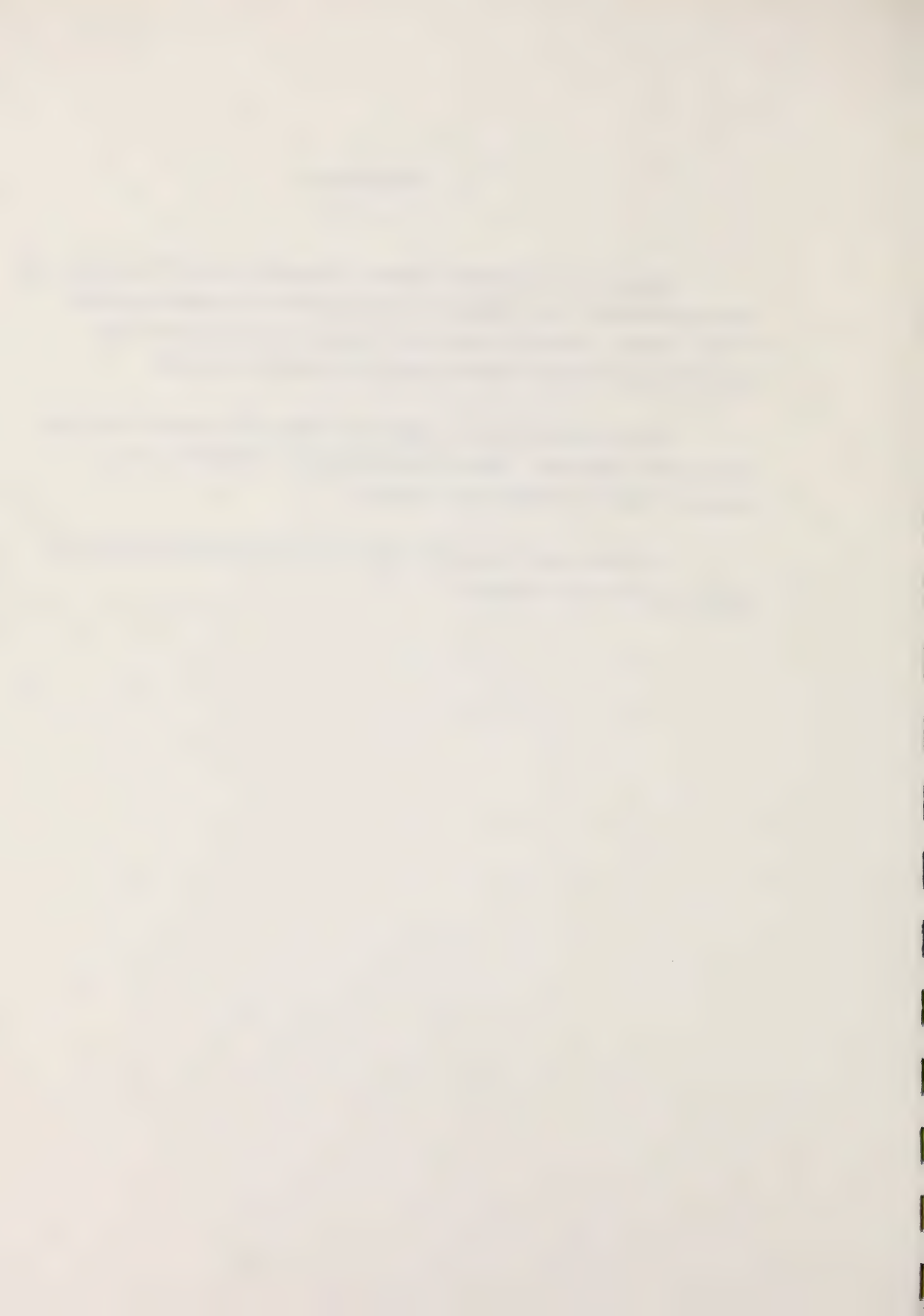


## 1. INTRODUCTION

Rangelands in Southern Alberta, along the foothills and into the fescue grasslands, are slowly being overtaken by encroaching brush. Willow, poplar, snowberry, and rose consume open grassland in the foothills at the rate of approximately one section per year.

Many methods of brush removal and range improvement are under investigation and use. These include chemical, biological, and mechanical means of removal and control.

In this report, various chemical applications for control of shrubby species are examined.





## 2. CARTWRIGHT RANCH -- 1980

This study was initiated as a result of a request from the Foothills Forage Co-operative Association to examine chemical means of brush control in the foothills region. John Cartwright offered a portion of his deeded land.

Spraying occurred July 16, 1976 on willow brush, maximum height of four feet. Three 10-acre plots were sprayed with the following:

1. Plot 6 -- Esteron 3-3E (24 oz. 2,4-D(10E) and 24 oz. 2,4,5-T(MBE)/a.).
2. Plot 7 -- Tordon 101 (5 oz. Picloram + 20 oz. 2,4-D (amine)/a.).
3. Plot 8 -- Tordon 101 + Nalcontrol (5 oz. Picloram + 20 oz. 2,4-D (amine), 1 oz. Nalcontrol added to 40 gal. solution).

Productivity clips are taken each year from the three treated plots and from untreated range. Clips for 1980 were taken on August 22. Forage was separated into four categories: forbs, shrubs, grass, and litter. Samples were then air-dried and weighed to determine pounds per acre of forage.

On July 21, 1980, the Cartwrights sprayed the rangeland where the plots were located with a mixture of 12 oz. 2,4,5-T and 20 oz. 2,4-D. The willow was starting to brown over at sampling time, but the forbs showed little effect. The last year forage productivity information was taken from these herbicide plots was 1980.

Data collected from 1980 and summary production data for 1977 to 1980 are listed in the table below.

Table 1  
 CARTWRIGHT RANCH  
 Production Data  
 1980

---



---

	Grass	Production - lbs/acre		
		Forbes	Shrubs	Litter
Plot 8 . . . . .	1 359	121	7.1	1 876
Plot 7 . . . . .	1 402	161	--	1 751
Plot 6 . . . . .	1 595	17	--	1 819
Outside . . . . .	1 213	253	29.0	839

---

Table 2  
 CARTWRIGHT RANCH  
 Summary Production  
 Data 1977-1980

	Production - lbs/acre			
	Grass	Forbs	Shrubs	Litter
Plot 8 (Tordon 101 + Nalcontrol) <sup>a</sup>				
1977	2 076	25	--	778
1978	2 558	171	--	895
1979	2 294	14	11	2 764
1980	1 359	121	7	1 876
Plot 7 (Tordon 101) <sup>a</sup>				
1977	1 759	32	--	935
1978	2 818	68	103	892
1979	1 648	27	7	2 675
1980	1 402	161	--	1 751
Plot 6 (Esteron 3-3E) <sup>a</sup>				
1977	1 584	25	--	1 149
1978	2 394	246	--	563
1979	2 129	25	4	2 137
1980	1 595	27	--	1 819
Control <sup>b</sup>				
1977	1 348	62	--	1 239
1978	1 327	490	--	739
1979	1 334	319	136	1 721
1980	1 312	253	29	839

<sup>a</sup>10 quarter-metre clips.

<sup>b</sup>15 quarter-metre clips.

## 2.1 Comments

Data collected in 1980 indicates grass production to be almost equal among all the plots. There is a 10 to 25 per cent increase in herbage on the treated, versus untreated, grassland. Forb production is still reduced by 47 to 53 per cent on Plots 8 and 7, and 90 per cent on Plot 6.

### 1. Tordon 101 + Nalcontrol

a) First year of data indicates a 35 per cent increase in grass productivity, 60 per cent decrease in forbs.

b) Preceding years show a 52 to 58 per cent increase in grass production. Four years after application, forbs are still reduced by 52 per cent.

### 2. Tordon 101

a) In the first year after herbicide application, grass production increased 33 per cent; forbs decreased 50 per cent.

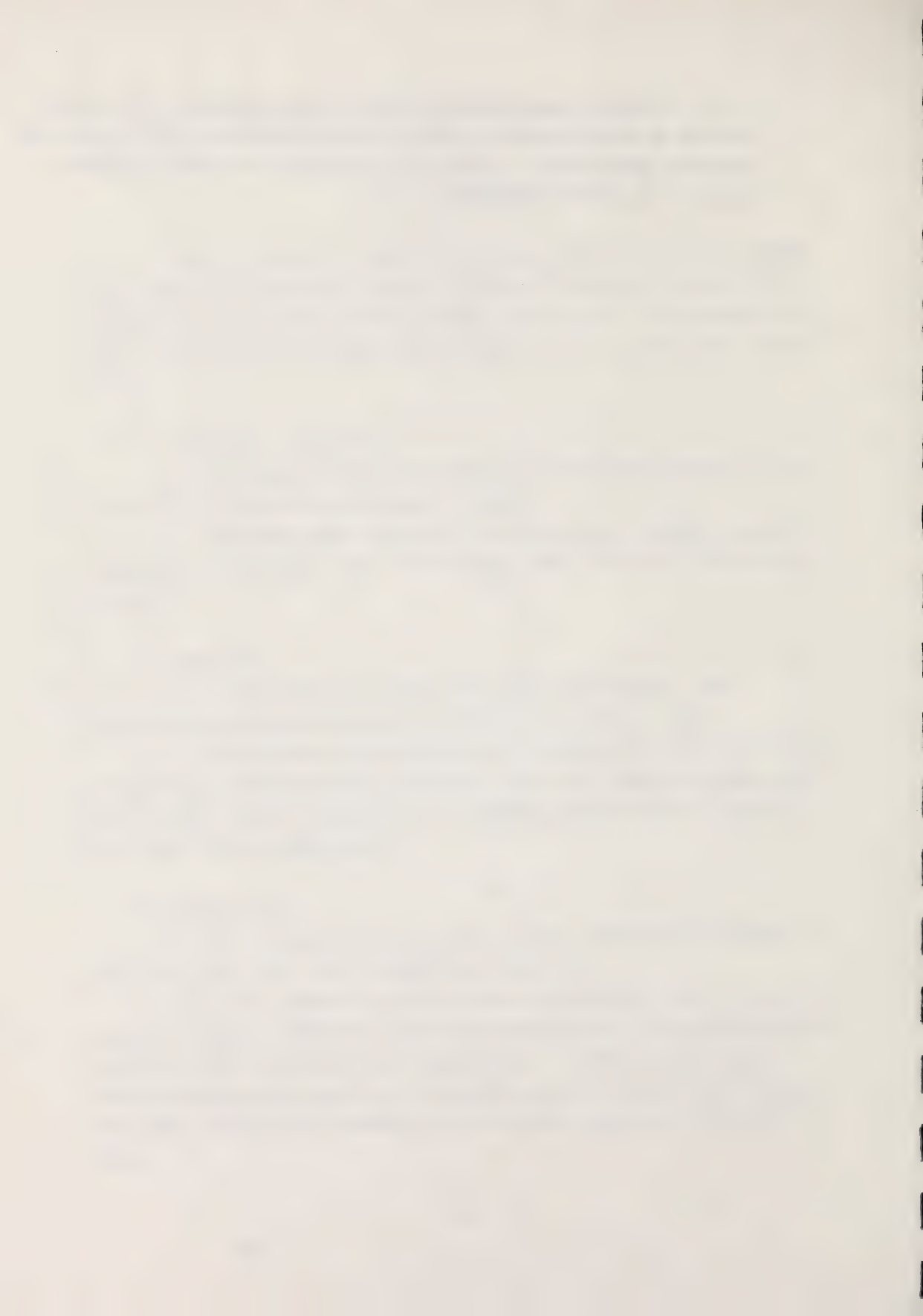
b) Second-year grass production increased by 63 per cent; grass production decreased sharply thereafter, but still remained greater than on untreated plots. Forb production decreased 85 per cent on treated plots over the following years.

### 3. Esteron 3-3E

a) An increase of 15 per cent in grass production was noted in the first year; forbs were reduced by 60 per cent.

b) In the second and third years, a 45 per cent and 37 per cent increase in grass production occurred, respectively. Forbs were reduced by 50 per cent and 90 per cent respectively. In 1980, though grass production was not as great as in previous years; a 24 per cent increase was noted. Forbs were reduced by 90 per cent compared to untreated range.

From the data presented above, it would seem that the greatest increase in grass production occurred in the second and third years after herbicide application. A definite levelling-off in grass production occurs in the fourth year.



3. CYPRESS HILLS (GOODE'S)  
 HERBICIDE TRIAL  
 INTERIM REPORT  
 1980

The Goode's herbicide trial plots are located on the southeast boundary of the Cypress Hills in SE 29-7-1-W4.

An enclosure, 20 rods by 80 rods, was fenced out in 1977. Eighteen plots 43' by 100' (1/10 acre) were marked out on the south side of the enclosure. Herbicide treatments were applied to various plots July 8, 1977, as follows:

Table 3  
 CYPRESS HILLS HERBICIDE PLOTS

Treatment	Plot No.
Tordon 10K pellets @ 15 lbs./a. . . . .	3, 8
Tordon 10K pellets @ 20 lbs./a. . . . .	1, 5
Tordon 10K pellets @ 32 lbs./a. . . . .	17, 18
Tordon 101 pellets @ 32 lbs./a. . . . .	2, 6
Brushkill @ 100 oz./a. . . . .	4, 7
Gyro mowing . . . . .	9, 10, 11, 12
Controlled burning . . . . .	13, 14, 15, 16

### 3.1 Procedure

On each of the 18 plots, various sampling methods were used to determine the effect of the brush control treatments. Two diagonal 100-foot line-point transects were run on each plot to determine native forage composition. Line-intercept readings of *Potentilla fruticosa* were taken from the same transect lines. Complete species lists within the plots were also compiled. Data collected is presented in Figure 1.

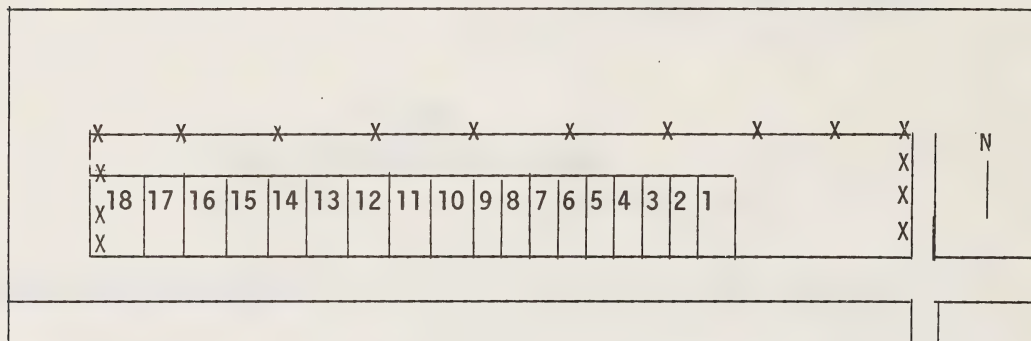


Fig. 1 CYPRESS HILLS HERBICIDE PLOT LAYOUT.



Table 4

## CYPRESS HILLS HERBICIDE PROJECT

Summary Data 1978-80

Treatment	<i>Pofr.</i> Line Intercept (In.)			% Composition					
	1978	1979	1980	Grass			Forbs		
	1978	1979	1980	1978	1979	1980	1978	1979	1980
Tordon 10K Pellets									
15 lbs/acre	11"	27"	38"	92	97	98	8	3	2
20 lbs/acre	79"	1"	5"	92	100	97	8	0	5
32 lbs/acre	127"	114"	103"	92	97	95	8	6	5
Tordon 101									
100 oz/acre	18"	75"	79"	94	92	94	6	8	6
Brushkill									
100 oz/acre	28"	58"	93"	77	93	93	23	7	7
Controlled									
Burning	88"	400"	240"	74	78	64	26	22	36
Gyro									
Mowing	82"	259"	112"	72	82	81	28	18	20

Abbreviations used: *Pofr.* - *Potentilla fruticosa*

Table 5  
 CYPRESS HILLS HERBICIDE PROJECT  
 Average % Composition

	Grass	Forbs	<i>P. Fruticosa</i> Intercept (In./200 ft.)	Plot Rating <sup>a</sup>
Tordon 10K 15 lbs/acre	98	2	38	8 7
Tordon 10K 20 lbs/acre	97	3	5	9 10
Tordon 10K 32 lbs/acre	95	5	103	7 5
Tordon 101 100 oz/acre	94	6	79	8 8
Brushkill 100 oz/acre	93	7	93	4 7
Gyro Mowing	81	20	112	6, 5 6, 5
Controlled Burning	64	36	240	3, 3 2, 3

NOTE: Data obtained July 30 and 31, 1980.

<sup>a</sup>Control of brush visually assessed on a scale from 1 to 10: 1 = plot extremely shrubby; 10 = few shrubs located.

Table 6

## CYPRESS HILLS HERBICIDE PROJECT

## Individual Species

## % Composition

Plant Species	Tordon 10K Pellet			Tordon 101	Brushkill	Control	Gyro
	15 lb/ac	20 lb/ac	32 lb/ac	100 oz/ac	100 oz/ac	Burn	Mowing
	(3,8) <sup>a</sup>	(1, 5)	(17, 18)	(2, 6)	(7, 4)	(13,14, 15,16)	(9,10, 11,12)
<i>Fesc</i>	82	71	55	77	68	46	58
<i>Feid</i>	11	18	35	8	14	5	9
<i>Dain</i>	2	--	--	--	--	--	2
<i>Carex</i>	4	5	--	4	5	1	7
<i>Agsu</i>	--	2	--	6	5	1	4
<i>Poa</i>	--	--	3	--	--	--	--
<i>Phpr</i>	--	--	3	--	--	--	--
<i>Aster</i>	2	4	3	6	--	24	13
<i>Pofr</i>	--	--	3	--	--	--	--
<i>Ant</i>	--	--	--	--	2	3	--
<i>Gabo</i>	--	--	--	--	4	1	--
<i>Getr</i>	--	--	--	--	2	3	2
<i>Aggl</i>	--	--	--	--	--	--	4
<i>Oaxna</i>	--	--	--	--	--	--	1
<i>Acni</i>	--	--	--	--	--	1	--
<i>Armu</i>	--	--	--	--	--	1	--
<i>Heri</i>	--	--	--	--	--	1	--
<i>Pofr</i> <sup>b</sup>	38	1	103	79	93	240	112

<sup>a</sup>Brackets indicate plot numbers.

<sup>b</sup>*Pofr* Line Intercept results in inches.

### 3.2 Observations

The following observations are based on data collected to date:

1. Tordon 10K pellets at 15 and 20 pounds per acre appear to have the greatest control on *Potentilla fruticosa*. In 1980, data indicates that these plots have the highest composition of grass.
2. Mechanical means of brush control seemed to stimulate growth of *Potentilla fruticosa*.
3. On burned plots, there is a definite increase in forb composition.
4. *Festuca scabrella* is the dominant grass in all plots.
5. *Festuca idahoensis* seemed to increase with the higher rates of Tordon application.

This is an interim report and, therefore, no definite conclusions can be formulated at this time. Sampling will continue and observations will be made in the future.

Table 7  
 CYPRESS HILLS HERBICIDE PLOTS  
 Species List

Plots 3 & 8							
Grasses	Tordon 10K 15 lbs/acre			Grasses	Tordon 10K 15 lbs/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron dasystachyum</i>	x			<i>Danthonia intermedia</i>	x	x	x
<i>intermedia</i>	x			<i>Festuca idahoensis</i>	x	x	x
<i>subsecundum</i>	x	x	x	<i>scabrella</i>	x	x	x
<i>Agrostis palustris</i>	x			<i>Juncus</i> spp.		x	
<i>scabra</i>	x	x	x	<i>Koeleria cristata</i>		x	
<i>Bromus inermis</i>			x	<i>Phleum pratense</i>			x
<i>Calamovilfa longifolia</i>	x			<i>Poa</i> spp.		x	
<i>Carex</i> spp.	x	x	x				
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x	x	x	<i>Hedysarum alpinum</i> var.	x		x
<i>Antennaria</i> spp.	x			<i>americanum</i>			
<i>Agoseris glauca</i>			x	<i>Heuchera richardsonii</i>	x		x
<i>Anemone multifida</i>			x	<i>Lupinus argenteum</i>	x	x	x
<i>Aster</i> spp.	x	x	x	<i>Penstemon albidus</i>	x		x
<i>Campanula rotundifolia</i>	x		x	<i>Potentilla nitidus</i>		x	
<i>Chenopodium album</i>			x	<i>gracilis</i>	x		
<i>Cirsium arvense</i>	x			<i>Solidago missouriensis</i>	x		
<i>Collomia linearis</i>			x	<i>Taraxacum officinale</i>	x		
<i>Erysimum cheiranthoides</i>			x	<i>Thermopsis rhombifolia</i>	x		
<i>Fragaria glauca</i>			x	<i>Thalictrum venulosum</i>			
<i>Galium boreale</i>	x		x	<i>Thlaspi arvense</i>			x
<i>Gaillardia aristata</i>	x		x	<i>Viola rugulosa</i>	x		
<i>Geum triflorum</i>	x	x	x	<i>Zizia aptera</i>	x	x	x
				<i>Zygadenus elegans</i>	x	x	x

Table 8

## CYPRESS HILLS HERBICIDE PLOTS

## Species List

Plots 1 & 5							
Grasses	Tordon 10K 20 lbs/acre			Grasses	Tordon 10K 20 lbs/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron subsecundum</i>	x	x	x	<i>Festuca idahoensis</i>	x	x	x
<i>Agrostis scabra</i>	x			<i>scabrella</i>	x	x	x
<i>Bromus inermis</i>		x	x	<i>Juncus</i> spp.		x	
<i>Carex</i> spp.	x	x	x	<i>Koeleria cristata</i>	x	x	
<i>Danthonia intermedia</i>	x	x	x	<i>Muhlenbergia cuspidata</i>	x		
				<i>Phleum pratense</i>			x
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>		x	x	<i>Heuchera richardsonii</i>	x		x
<i>Allium cernuum</i>	x		x	<i>Lupinus argenteus</i>	x	x	x
<i>Antennaria</i> spp.	x			<i>Penstemon nitidus</i>	x	x	
<i>Agoseris glauca</i>			x	<i>Potentilla gracilis</i>			x
<i>Anemone multifida</i>			x	<i>Sisyrinchium montanum</i>	x		
<i>Aster</i> spp.		x	x	<i>Solidago missouriensis</i>		x	
<i>Campanula rotundifolia</i>	x	x	x	<i>Taraxacum officinale</i>			x
<i>Collomia linearis</i>	x		x	<i>Thlaspi arvense</i>			x
<i>Cirsium arvense</i>	x			<i>Thallictrum venulosum</i>	x		
<i>Erysium cheiranthoides</i>			x	<i>Thermopsis rhombifolia</i>	x		x
<i>Galium boreale</i>	x		x	<i>Viola rugulosa</i>			x
<i>Gaillardia aristata</i>	x			<i>Zizia aptera</i>	x	x	x
<i>Geum triflorum</i>	x		x	<i>Zygadenus elegans</i>	x		
<i>Hedysarum alpinum</i> var. <i>americanum</i>	x	x	x				

Table 9

## CYPRESS HILLS HERBICIDE PLOTS

## Species List

Plots 17 & 18							
Grasses	Tordon 10K 32 lbs/acre			Grasses	Tordon 10K 32 lbs/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron subsecundem</i>		x		<i>Juncus</i> spp.	x	x	
<i>Agrostis scabra</i>	x	x	x	<i>Koeleria cristata</i>	x	x	
<i>Bromus inermis</i>		x	x	<i>Muhlenbergia cuspidata</i>	x		
<i>Carex</i> spp.	x	x		<i>Phleum pratense</i>			x
<i>Danthonia intermedia</i>	x	x	x	<i>Poa</i> spp.	x	x	x
<i>Festuca idahoensis</i>	x	x	x				
<i>scabrella</i>	x	x	x				
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>		x	x	<i>Helianthus petiolaris</i>		x	
<i>Agoseris glauca</i>		x		<i>Lupinus argenteum</i>	x	x	x
<i>Antennaria</i> spp.	x	x		<i>Oxytropis macounii</i>			x
<i>Aster</i> spp.		x	x	<i>Potentilla gracilis</i>	x		
<i>Campanula rotundifolia</i>	x	x	x	<i>Penstemon nitidus</i>	x	x	
<i>Cerastium arvense</i>		x		<i>Saponaria vaccaria</i>	x		
<i>Erigeron</i> spp.	x		x	<i>Solidago missouriensis</i>	x		
<i>Fragaria glauca</i>		x	x	<i>Taraxacum officinale</i>	x	x	x
<i>Galium boreale</i>	x	x	x	<i>Thallictrum venulosum</i>	x	x	x
<i>Gaillardia aristata</i>			x	<i>Thermopsis rhombifolia</i>	x		x
<i>Geum triflorum</i>	x	x	x	<i>Viola rugulosa</i>	x		x
<i>Hedysarum alpinum</i> var. <i>americanum</i>	x		x	<i>Zizia aptera</i>		x	x
				<i>Zygadenus elegans</i>		x	

Table 10

## CYPRESS HILLS HERBICIDE PLOTS

## Species List

Plots 2 & 6							
Grasses	Tordon 101 100 oz/acre			Grasses	Tordon 101 100 oz/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron subsecundum</i>	x	x	x	<i>Festuca idahoensis</i>	x	x	x
<i>Agrostis scabra</i>	x			<i>scabrella</i>	x	x	x
<i>Bromus inermis</i>			x	<i>Juncus spp.</i>		x	
<i>Carex spp.</i>		x	x	<i>Koeleria cristata</i>	x	x	
<i>Danthonia intermedia</i>		x	x	<i>Phleum pratense</i>	x	x	
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x	x	x	<i>Hedysarum alpinum var.</i>	x	x	x
<i>Agoseris glauca</i>		x		<i>americanum</i>			
<i>Anemone multifida</i>	x		x	<i>Heuchera richardsonii</i>	x		x
<i>Aster spp.</i>		x	x	<i>Lupinus argenteus</i>	x	x	x
<i>Antennaria spp.</i>		x	x	<i>Potentilla pensylvanica</i>			x
<i>Campanula rotundifolia</i>	x	x	x	<i>Penstemon nitidus</i>	x	x	
<i>Cirsium arvense</i>	x			<i>Taraxacum officinale</i>	x		x
<i>Collomia linearis</i>			x	<i>Thermopsis rhombifolia</i>	x		x
<i>Galium boreale</i>	x	x	x	<i>Viola rugulosa</i>	x		
<i>Gaillardia aristata</i>	x			<i>Zizia aptera</i>	x	x	x
<i>Geum triflorum</i>		x	x	<i>Zygadenus elegans</i>	x	x	



Table 11  
CYPRESS HILLS HERBICIDE PLOTS  
Species List

Plots 1 & 4							
Grasses	Brushkill 100 oz/acre			Grasses	Brushkill 100 oz/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron smithii</i>	x			<i>Koeleria cristata</i>	x	x	
<i>subsecundum</i>	x	x	x	<i>Phleum pratense</i>			x
<i>Agrostis scabra</i>	x		x	<i>Poa spp.</i>	x		
<i>Carex spp.</i>			x				
<i>Danthonia intermedia</i>		x	x				
<i>Festuca idahoensis</i>	x	x	x				
<i>scabrella</i>	x	x	x				
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x	x	x	<i>Geum triflorum</i>	x	x	x
<i>Antennaria spp.</i>	x	x	x	<i>Hedysarum alpinum var.</i>	x	x	x
<i>Agoseris glauca</i>	x	x	x	<i>americanum</i>			
<i>Anemone multifida</i>	x	x	x	<i>Heraclium lanatum</i>	x		x
<i>Aster spp.</i>	x	x	x	<i>Heuchera richardsonii</i>	x		x
<i>Campanula rotundifolia</i>	x	x	x	<i>Lupinus argenteus</i>	x	x	x
<i>Chenopodium album</i>			x	<i>Penstemon albidus</i>	x	x	x
<i>Collomia linearis</i>	x		x	<i>Potentilla gracilis</i>	x		
<i>Cerastium arvense</i>	x	x		<i>Plantago major</i>	x		
<i>Erigeron spp.</i>			x	<i>Solidago missouriensis</i>	x		
<i>Fragaria glauca</i>	x		x	<i>Taraxacum officinale</i>	x	x	x
<i>Galium boreale</i>	x	x	x	<i>Thalictrum venulosum</i>	x	x	x
<i>Gaillardia aristata</i>	x	x	x	<i>Zizia aptera</i>	x	x	x
<i>Geranium viscosissimum</i>	x	x	x	<i>Zygadenus elegans</i>	x	x	

Table 12

## CYPRESS HILLS HERBICIDE PLOTS

## Species List

Plots 9, 10, 11 & 12							
Grasses	Gyro Mowing			Grasses	Gyro Mowing		
	1978	1979	1980		1978	1979	1980
<i>Agropyron smithii</i>		x		<i>Elymus canadensis</i>			x
<i>subsecundum</i>	x	x	x	<i>Festuca idahoensis</i>	x	x	x
<i>Agrostis scabra</i>		x	x	<i>scabrella</i>	x		x
<i>Bromus inermis</i>			x	<i>Juncus</i> spp.	x		
<i>Bouteloua gracilis</i>	x			<i>Koeleria cristata</i>	x	x	
<i>Carex</i> spp.	x	x	x	<i>Muhlenbergia cuspidata</i>	x		
<i>Danthonia intermedia</i>	x	x	x	<i>Phleum pratense</i>			x
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x	x	x	<i>Heuchera richardsonii</i>	x		x
<i>Antennaria</i> spp.	x	x	x	<i>Lupinus argenteus</i>	x	x	x
<i>Agoseris glauca</i>	x	x	x	<i>Oxytropis macounii</i>			x
<i>Anemone multifida</i>		x	x	<i>splendens</i>	x		x
<i>Aster</i> spp.	x	x	x	<i>Potentilla gracilis</i>	x	x	x
<i>Astragalus</i> spp.			x	<i>pennsylvanica</i>			x
<i>Campanula rotundifolia</i>	x	x	x	<i>Penstemon albidus</i>			x
<i>Chenopodium album</i>			x	<i>Saponaria vaccaria</i>	x		
<i>Cirsium arvense</i>		x		<i>Sisyrinchium montanum</i>	x		
<i>Erigeron</i> spp.	x		x	<i>Solidago missouriensis</i>	x	x	
<i>Fragaria glauca</i>			x	<i>Taraxacum officinale</i>	x	x	x
<i>Galium boreale</i>	x	x	x	<i>Thlaspi arvense</i>		x	
<i>Gaillardia aristata</i>	x	x	x	<i>Thalicttrum venulosum</i>	x	x	
<i>Geum triflorum</i>	x	x	x	<i>Thermopsis rhombifolia</i>	x	x	x
<i>Hedysarum albinum</i> var. <i>americanum</i>	x	x	x	<i>Viola rugulosa</i>	x		
<i>Helianthus petiolaris</i>		x		<i>Zizia aptera</i>	x		x
				<i>Zygadenus elegans</i>	x		

Table 13

## CYPRESS HILLS HERBICIDE PLOTS

## Species List

Plots 13, 14, 15 & 16							
Grasses	Controlled Burning			Grasses	Controlled Burning		
	1978	1979	1980		1978	1979	1980
<i>Agropyron dasystachyum</i>			x	<i>Carex</i> spp.	x	x	x
<i>smithii</i>		x		<i>Danthonia intermedia</i>	x	x	x
<i>subsecundum</i>	x	x	x	<i>Festuca idahoensis</i>	x	x	x
<i>Agrostis scabra</i>	x	x		<i>scabrella</i>	x	x	x
<i>Bromus inermis</i>		x	x	<i>Koeleria cristata</i>	x	x	
<i>Bouteloua gracilis</i>	x			<i>Juncus</i> spp.	x	x	
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x	x	x	<i>Heuchera richardsonii</i>	x		
<i>Allium cernuum</i>			x	<i>Lupinus argenteus</i>	x	x	x
<i>Antennaria</i> spp.	x	x	x	<i>Oxytropis macounii</i>		x	x
<i>Agoseris glauca</i>	x		x	<i>Potentilla gracilis</i>	x	x	x
<i>Anemone multifida</i>		x	x	<i>pennsylvanica</i>			x
<i>Aster</i> spp.	x	x	x	<i>Sisyrinchium montanum</i>			x
<i>Campanula rotundifolia</i>	x	x	x	<i>Solidago missouriensis</i>	x	x	
<i>Cirastium arvense</i>		x		<i>Taraxacum officinale</i>	x	x	x
<i>Erigeron</i> spp.	x		x	<i>Thallictrum venulosum</i>		x	
<i>Fragaria glauca</i>	x	x	x	<i>Thermopsis rhombifolia</i>	x		x
<i>Galium boreale</i>	x	x	x	<i>Vicia americana</i>			x
<i>Gaillardia aristata</i>		x	x	<i>Zizia aptera</i>		x	x
<i>Geum triflorum</i>	x	x	x	<i>Zygadenus elegans</i>	x	x	
<i>Hedysarum albinum</i> var. <i>amercianum</i>	x	x	x				



4. McINTYRE RANCH HERBICIDE TRIALS  
INTERIM REPORT - 1980

The McIntyre herbicide plots are located west of the McIntyre Ranch Farm Headquarters and Highway 62 on the north side of the Milk River Ridge formation.

On July 4, 1977, six 0.1-acre plots were marked out (see Fig. 2) and were treated with herbicides as presented in Table 14.

Table 14  
McINTYRE RANCH HERBICIDE TRIALS  
Plot Treatment

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Treatment	Plot No.
Tordon 10K pellets @ 20 lbs./a.	3, 5
Tordon 101 @ 100 oz./a.	2, 4
Brushkill @ 100 oz./a.	1, 6

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In addition to the plots listed above, two patches of snowberry were treated with Tordon 10K pellets, the first (approximately 0.12 acres) at a rate of 16 lbs./a., and the second (approximately 0.10 acres) at a rate of 24 lbs./a.

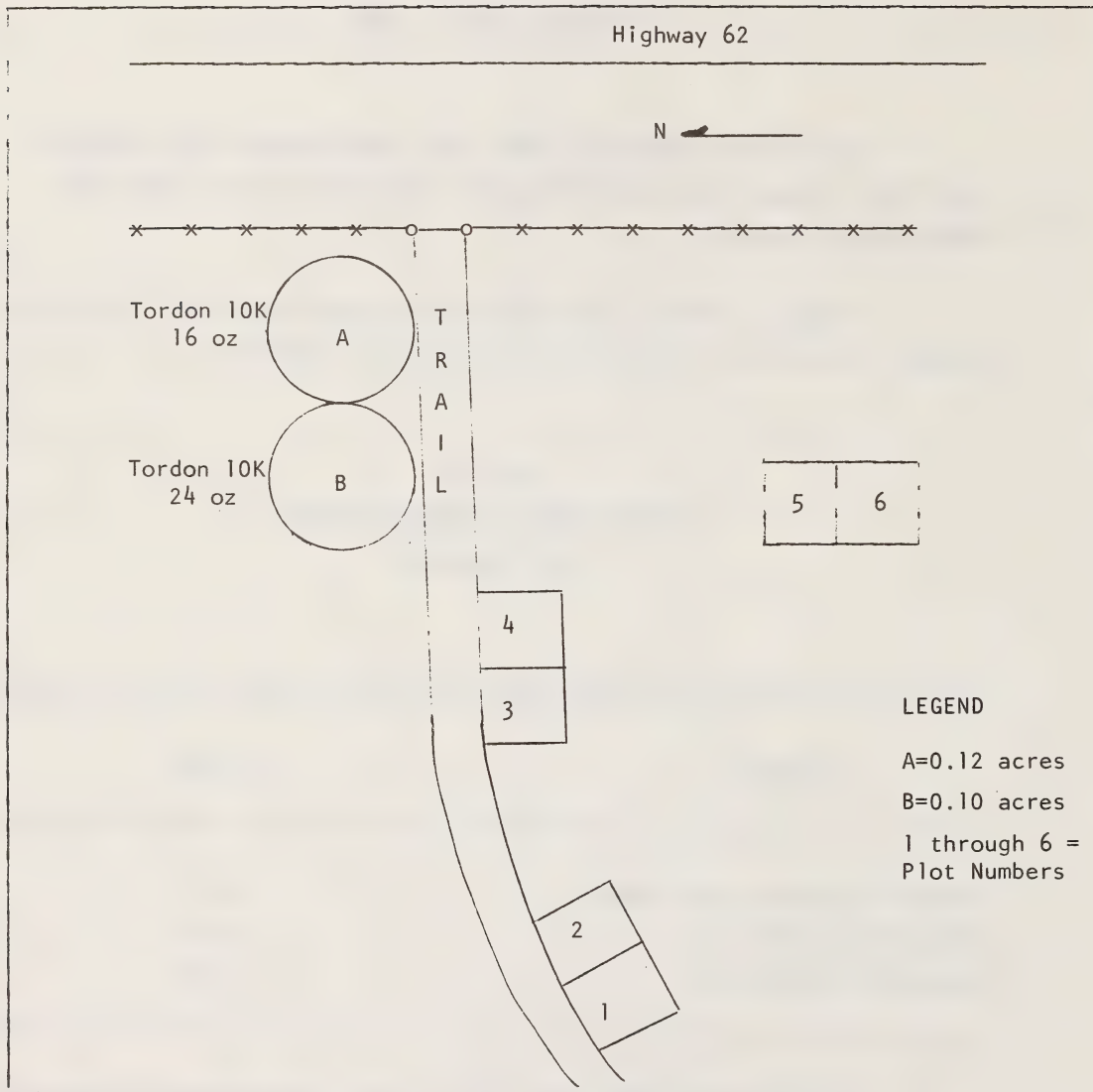


Fig. 2. McINTYRE RANCH HERBICIDE PLOT LOCATIONS

#### 4.1 Procedure

Beginning in 1977, data was collected from the McIntyre herbicide plots. Initially, stem counts were taken on each of the treatments to determine the effect of the herbicides on brush. Tallies were divided into four categories: (1) N = New growth, (2) U = Unaffected, (3) P = Partially affected, and (4) D = Dead.

Each of the six plots was marked with three one-square-metre sample sites. Over the years, many of these sites have disappeared by one means or another: all those on plot 4; two on plot 1; and, all on plot 3 in 1980. In 1979 and 1980, vegetative composition was determined by employing 100-foot line-point transects. In 1979, 20 quarter-metre clips were collected on all treated plots, and 40 on untreated range, to determine vegetative productivity. Cattle were allowed to graze where the treatments were located in 1980, so no clips were taken. Species lists were compiled every year.

Data compiled to date is presented in Table 15 along with comments.

Table 15

## McINTYRE RANCH HERBICIDE TRIALS

% Stem Counts - 1980

		N	U	P	D
Tordon 10K (5)                      20 lbs/acre					
Snowberry . . . . .		40	25	23	13
Rose . . . . .		56	44	--	--
Brushkill (1 & 6)                      100 oz/acre					
Snowberry . . . . .		5	39	34	21
Rose . . . . .		14	38	14	34
Tordon 101 (2)                      100 oz/acre					
Snowberry . . . . .		36	14	40	--
Rose . . . . .		50	20	25	5

NOTE: N = New growth; U = Unaffected; P = Partially affected; D = Dead.



Table 16

## MCINTYRE RANCH HERBICIDE PROJECT

## TOTAL STEM COUNT DATA 1978-1980

Plot No.	Shrub Species	N		U		P		D		Treatment		
		78	79	80	78	79	80	78	79		80	
1	<i>Syoc</i> <i>Rosa</i>	21	3	5	--	9	--	2	4	1	Brushkill 100 oz/ac.	
		12	5	1	--	3	--	9	2	--		
2	<i>Syoc</i> <i>Rosa</i>	7	8	5	--	6	--	7	4	--	Tordon 101 100 oz/ac.	
		2	6	10	--	1	--	5	--	1		
3	<i>Syoc</i> <i>Rosa</i>	10	--	--	1	--	--	--	4	--	Tordon 10K 20 lbs/ac.	
		2	--	--	2	--	--	21	--	--		
4	<i>Syoc</i> <i>Rosa</i>	NO DATA										
		NO DATA										
5	<i>Syoc</i> <i>Rosa</i>	32	106	5	60	27	8	2	16	16	--	Tordon 10K 20 lbs/ac.
		--	--	74	--	--	--	--	43	27	1	
6	<i>Syoc</i> <i>Rosa</i>	64	60	12	39	18	--	16	6	42	Brushkill 100 oz/ac.	
		20	9	6	20	26	--	36	15	19		

NOTE: N = New growth; U = Unaffected; P = Partially affected; D = Dead.

Table 17  
 McINTYRE RANCH HERBICIDE TRIALS  
 % Stem Counts 1978-1980

Plot No.	Shrub Species	N		U		P		D		Treatment	
		78	79	80	78	79	80	78	79		80
1	<i>Syoc</i> <i>Rosa</i>	80	50	6	--	30	--	56	20	13	Brushkill 100 oz/acre
		78	19	29	--	56	--	12	22	6	
2	<i>Syoc</i> <i>Rosa</i>	29	57	36	--	43	--	40	71	--	Tordon 101 100 oz/acre
		9	86	50	--	14	--	25	91	5	
3	<i>Syoc</i> <i>Rosa</i>	29	--	ND	3	--	6	--	62	100	Tordon 10K 20 lbs/acre
		4	--	ND	4	--	--	--	92	--	
4	<i>Syoc</i> <i>Rosa</i>										Tordon 101 100 oz/acre
5	<i>Syoc</i> <i>Rosa</i>	27	70	40	52	18	7	23	14	10	Tordon 10K 20 lbs/acre
		--	--	56	--	--	--	--	100	100	
6	<i>Syoc</i> <i>Rosa</i>	54	71	5	33	21	--	31	13	7	Brushkill 100 oz/acre
		19	17	11	19	48	--	15	62	35	

NOTE: N = New growth; U = Unaffected; P = Partially affected; D = Dead. Abbreviation used: ND = No Data.

Table 18

## McINTYRE RANCH HERBICIDE TRIALS

Average % Vegetative

Composition-1980

	Grasses	Forbs	% Cover
Tordon Pellets (3 & 5)	95	5	9
Tordon 101 (2 & 4)	88	11	13
Brushkill (1 & 6)	82	16	15
Control	56	39	9

Table 19

## McINTYRE RANCH HERBICIDE TRIALS

% Vegetative Composition

1979-1980

	Grass		Forbs		% Cover	
	1979	1980	1979	1980	1979	1980
Tordon Pellets	98	95	2	5	15	9
Tordon 101	91	88	9	11	23	13
Brushkill	66	82	34	16	12	15
Control	68	56	32	39	15	9

## 4.2 Observations

From data collected to date, the following observations were noted:

1. The clip data indicates a definite decrease in production of forbs on the Tordon 101 plots. A surprising increase in shrub production is also noted.

2. All herbicide treatments increased grass production ranging from 15 to 33 per cent.

3. Stem counts from 1978-1980 have revealed the following:

a) Tordon 101 plots indicate a surge of new growth for both *Symphoricarpus* and *Rosa*.

b) Tordon 10K plot shows a definite increase in new growth of *Rosa*.

c) On the brushkill plots, new growth seems to have declined.

d) Ocular evaluation of herbicide treatments are as follows:

1) Brushkill had a poor effect on shrubs, with less than 15 per cent kill.

2) Tordon 101 shows a 40 per cent kill; *Rosa* and *Symphoricarpus* are coming back quickly.

3) Tordon 10K appears to have a more effective kill -- 75 to 80 per cent; some *Symphoricarpus* and *Rosa* are returning.

Table 20  
 McINTYRE RANCH HERBICIDE PLOTS  
 1979 PRODUCTION DATA

	Average		lbs/acre Shrubs	Production	
	Grass	Forbs		Litter	Biomass
Control	883	443	355	525	2 207
Tordon 10K	1 321	111	181	1 314	2 927
Tordon 101 100 oz/acre	1 248	93	556	832	2 728
Brushkill 100 oz/acre	1 040	189	574	2 086	3 889

Table 21

## McINTYRE RANCH HERBICIDE PLOTS

## Species List

Plots 3 & 5							
Grasses	Tordon 10K 20 lbs/acre			Grasses	Tordon 10K 20 lbs/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron cristatum</i>			x	<i>Danthonia parryi</i>			x
<i>dasystachyum</i>			x	<i>Festuca idahoensis</i>			x x
<i>smithii</i>		x		<i>scabrella</i>			x x
<i>subsecundum</i>		x	x	<i>Hordeum jubatum</i>			x x
<i>Agrostis scabra</i>		x	x	<i>Juncus spp.</i>			x
<i>Bromus ciliatus</i>		x		<i>Phleum pratense</i>			x x
<i>inermis</i>		x		<i>Poa spp.</i>			x x
<i>tectorum</i>			x	<i>Stipa viridula</i>			x x
<i>Carex spp.</i>		x	x				
Shrubs	1978	1979	1980				
<i>Ribes spp.</i>			x				
<i>Rose spp.</i>		x	x				
<i>Symphoricarpos</i>		x	x				
<i>occidentalis</i>							
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>		x	x	<i>Hackelia floribunda</i>		x	
<i>Artemisia frigida</i>		x		<i>Lappula occidentalis</i>			x
<i>gnaphaloides</i>			x	<i>Lithosperunum ruderales</i>			x
<i>Antennaria spp.</i>		x	x	<i>Lupinus argenteus</i>		x	x
<i>Aster spp.</i>		x	x	<i>Oxytropis gracilis</i>		x	
<i>Chenopodium album</i>			x	<i>Monarda fistulosa</i>			x
<i>Cirsium arvense</i>		x	x	<i>Orthocarpus luteus</i>			x
<i>Discurainia sophia</i>			x	<i>Potentilla gracilis</i>		x	x
<i>Erysimum cheiranthoides</i>		x		<i>Penstemon confertus</i>		x	x
<i>Fragaria glauca</i>		x	x	<i>Plantago major</i>			x
<i>Galium boreale</i>			x	<i>Solidago missouriensis</i>			x
<i>Geranium viscosissimum</i>		x	x	<i>Thlaspi arvense</i>			x
<i>Geum triflorum</i>		x	x	<i>Tragapogan dubius</i>		x	x

Table 22

## McINTYRE RANCH HERBICIDE PLOTS

## Species List

Plots 2 & 4							
Grasses	Tordon 101 100 oz/acre			Grasses	Tordon 101 100 oz/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron dasystachyum</i>			x	<i>Danthonia parryi</i>			x
<i>smithii</i>		x		<i>Festuca idahoensis</i>			x
<i>subsecundum</i>		x	x	<i>scabrella</i>			x
<i>Agrostis scabra</i>		x	x	<i>Hordeum jubatum</i>			x
<i>Bromus ciliatus</i>		x	x	<i>Juncus</i> spp.			x
<i>inermis</i>		x	x	<i>Phleum pratense</i>			x
<i>tectorum</i>		x		<i>Poa</i> spp.			x
<i>Carex</i> spp.		x	x	<i>Stipa viridula</i>			x
Shrubs	1978	1979	1980				
<i>Rose</i> spp.			x				x
<i>Symphoricarpus occidentalis</i>			x				x
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>			x	<i>Geum triflorum</i>			x
<i>Antennaria</i> spp.			x	<i>Heuchera richardsonii</i>			x
<i>Anemone multifida</i>			x	<i>Lappula occidentalis</i>			x
<i>Artemisia frigida</i>			x	<i>Meliolotus officinalis</i>			x
<i>gnaphaloides</i>				<i>Penstemon confertus</i>			x
<i>Aster</i> spp.			x	<i>Monarda fistulosa</i>			x
<i>Castilleja septemtrionalis</i>			x	<i>Oenothera biennis</i>			x
<i>Cirsium arvense</i>			x	<i>Potentilla gracilis</i>			x
<i>Descurainia sophia</i>			x	<i>Ratibida columnifera</i>			x
<i>Erysimum cheiranthoides</i>			x	<i>Taraxacum officinale</i>			x
<i>Fragaria glauca</i>			x	<i>Thlaspi arvense</i>			x
<i>Galium boreale</i>			x	<i>Tragopogon dubius</i>			x
<i>Geranium viscosissimum</i>			x				

Table 23  
McINTYRE RANCH HERBICIDE PLOTS  
Species List

Plots 1 & 6							
Grasses	Brushkill 100 oz/acre			Grasses	Brushkill 100 oz/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron cristatum</i>		x		<i>Carex</i> spp.		x	x
<i>dasystachyum</i>			x	<i>Festuca idahoensis</i>			x
<i>smithii</i>		x		<i>scabrella</i>		x	
<i>subsecundum</i>			x	<i>Hordeum jubatum</i>		x	
<i>Agrostis scabra</i>		x	x	<i>Juncus</i> spp.			x
<i>Bromus ciliatus</i>			x	<i>Phleum pratense</i>		x	x
<i>inermis</i>			x	<i>Poa</i> spp.		x	x
<i>tectorum</i>		x		<i>Stipa viridula</i>			x
<i>Calamagrostis montanensis</i>		x					
Shrubs	1978	1979	1980				
<i>Crataegus chrysocarpa</i>		x		<i>Rubus strigosus</i>		x	
<i>Ribes</i> spp.			x	<i>Symphoricarpos occidentalis</i>		x	x
<i>Rose</i> spp.		x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>		x	x	<i>Geranium viscosissimum</i>		x	x
<i>Allium cernuum</i>			x	<i>Glycyrrhiza lepidata</i>			x
<i>Artemisia gnaphaloides</i>		x	x	<i>Hackelia floribunda</i>		x	
<i>Anemone multifida</i>			x	<i>Lappula occidentalis</i>			x
<i>Aster</i> spp.		x	x	<i>Lupinus argenteus</i>			x
<i>Androsace septentrionalis</i>		x		<i>Melilotus officinalis</i>		x	
<i>Castilleja septentrionalis</i>			x	<i>Monarda fistulosa</i>		x	x
<i>Cirsium arvense</i>		x		<i>Oxytropis macounii</i>			x
<i>Descurainia sophia</i>			x	<i>Potentilla gracilis</i>		x	x
<i>Epilobium angustifolium</i>			x	<i>Ratibada colummifera</i>			x
<i>Erysimum cheiranthoides</i>		x		<i>Solidago missouriensis</i>			x
<i>Fragaria glauca</i>		x	x	<i>Taraxacum officinale</i>			x
<i>Galium boreale</i>		x	x	<i>Tragopogan dubius</i>			x
<i>Gentiana affinis</i>		x		<i>Urtica gracilis</i>		x	x
<i>Geum triflorum</i>			x				



5. SPRUCE RANCH CO-OP  
HERBICIDE TRIALS  
INTERIM REPORT  
1980

The Spruce Ranch herbicide trial plots are located just north of Spruce Ranch Co-op Headquarters on SE1/4 13-16-3-W5.

Two 100- by 100-foot exclosures were erected in 1975. Four plots 100' by 22' were marked in each exclosure. Herbicide treatments were applied to the plots on June 25, 1977, as follows:

1. Tordon 10K pellets @ 20 lbs./a.
2. Tordon 101 @ 100 oz./a.
3. Brushkill @ 100 oz./a.
4. Control: untreated.

5.1 Procedure

Beginning in 1978, data was collected to determine the effect of the herbicides on the vegetative community. Two diagonal 100 foot linepoint transects were run to determine vegetative composition. Line intercept readings on *Potentilla fruticosa* were also recorded on these same transects. A complete species list was compiled for all treated and control plots.

Data collected to date appears as follows. It should be noted that these exclosures are excluded from grazing; therefore, the information should be viewed with that fact under consideration.

East Enclosure

West Enclosure

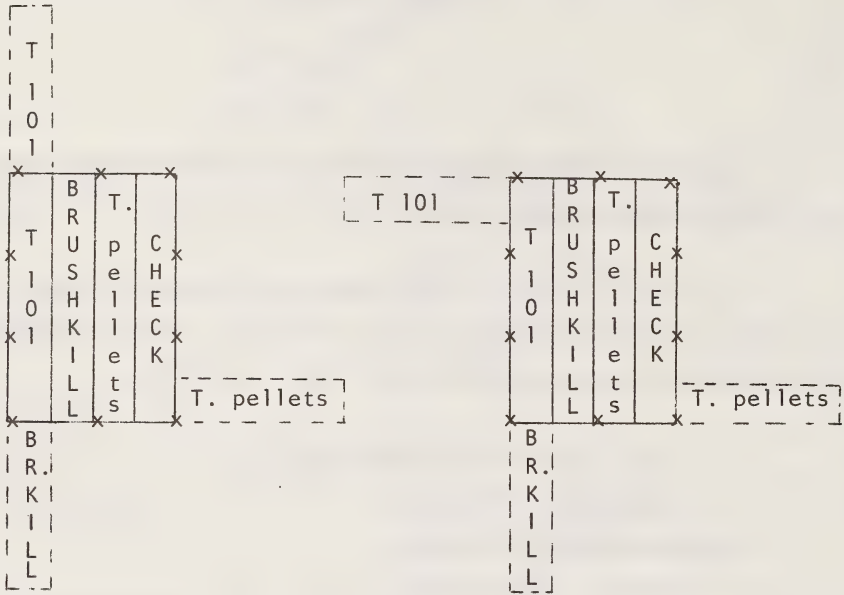


Fig. 3. SPRUCE RANCH CO-OP HERBICIDE PLOT LOCATIONS.

Table 24

## SPRUCE RANCH CO-OP - SUMMARY DATA

% Vegetative Composition

1978-1980

	Grass			Forbs			<i>Potentilla fruticosa</i> Intercept (in.)		
	1978	1979	1980	1978	1979	1980	1978	1979	1980
Control	68	68	71	32	32	29	75	60	148
Tordon 101	95	100	83	5	0	13	26	3	78
Tordon Pellets	100	90	97	0	10	3	4	42	21
Brushkill	85	88	89	15	12	11	7	7	29

Table 25

## SPRUCE RANCH CO-OP

Average Vegetative

Composition

1978-1980

	Grass	Forbs	<i>Potentilla fruticosa</i> Intercept (in.)
Control . . . . .	69	31	95
Tordon 101 . . . . .	93	6	36
Tordon Pellets . . . . .	96	4	23
Brushkill . . . . .	87	13	14

Table 26

SPRUCE RANCH CO-OP - 1980

Species % Composition

Species	Tordon 10K	Tordon 101	Brushkill	Control
Grasses				
<i>Agropyron smithii</i>	8	3	--	10
<i>subsecundum</i>	--	6	--	--
<i>Agrostis scabra</i>	4	--	--	--
<i>Bromus ciliatus</i>	8	--	12	--
<i>Carex</i> spp.	8	9	8	5
<i>Danthonia parryi</i>	8	21	15	--
<i>Festuca idahoensis</i>	8	--	--	5
<i>scabrella</i>	12	29	35	30
<i>Koeleria cristata</i>	--	3	12	--
<i>Phleum pratensis</i>	4	6	--	10
<i>Poa pratensis</i>	46	12	8	10
Forbs				
<i>Achillea millefolium</i>	--	--	4	5
<i>Agoseris glauca</i>	--	--	4	5
<i>Aster</i> spp.	--	3	--	--
<i>Gallium boreale</i>	--	3	--	--
<i>Geum triflorum</i>	4	--	--	--
<i>Poa</i> spp.	--	3	--	--
<i>Potentilla fruticosa</i>	--	--	--	10
<i>Taraxacum officinale</i>	--	--	4	5
<i>Thermopsis rhombifolia</i>	--	--	--	5
<i>Zygadenus elegans</i>	--	3	--	--

## 5.2 Observations

Presented here are observations based on data collected:

1. Transect data indicates per cent grass composition is greatest on Tordon 10K pellet-treated plots.
2. Of the treated plots, brushkill had the highest per cent composition of forbs.
3. Visual observations reveal that both Tordon treatments (10K and 101) have the greatest effect on brush.
4. *Rosa* spp. is very common on the brushkill plots.
5. *Festuca scabrella*, *Poa* spp., and *Danthonia parryi* are the dominant grasses on Tordon-treated plots.
6. On brushkill plots, *Poa* spp. and *Festuca scabrella* are the dominant grasses.
7. *Zygadenus elegans* and *Campanula rotundifolia* are the dominant forbs on Tordon-treated plots.

These observations form the basis of an interim report and, therefore, no conclusions have been presented.

Table 27

## SPRUCE RANCH CO-OP HERBICIDE PLOTS

## Species List

Plots East & West							
Grasses	Tordon Pellets			Grasses	Tordon Pellets		
	1978	1979	1980		1978	1979	1980
<i>Agropyron dasystachyum smithii</i>	x			<i>Danthonia parryi</i>	x	x	x
<i>subsecundum</i>	x	x	x	<i>Festuca idahoensis scabrella</i>	x	x	x
<i>Agrostis scabra</i>	x		x	<i>Koeleria cristata</i>	x		x
<i>Bromus ciliatus inermis</i>	x		x	<i>Juncus spp.</i>			x
<i>Calamagrostis canadensis montanensis</i>	x		x	<i>Phleum pratense</i>	x	x	x
<i>Carex spp.</i>	x	x		<i>Poa spp.</i>	x	x	x
				<i>Stipa viridula</i>	x	x	
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
<i>Rose spp.</i>			x				
<i>Salix spp.</i>	x		x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x		x	<i>Lupinus argenteus</i>			x
<i>Allium cernuum</i>	x		x	<i>Potentilla gracilis</i>	x	x	x
<i>Aster spp.</i>	x		x	<i>Sisyrinchium montanum</i>		x	
<i>Campanula rotundifolia</i>	x		x	<i>Taraxacum officinale</i>	x	x	x
<i>Erigeron glabellus</i>			x	<i>Thallictrum venulosum</i>	x	x	x
<i>Fragaria glauca</i>		x		<i>Vicia americana</i>			x
<i>Geum triflorum</i>	x	x	x	<i>Viola rugulosa</i>	x		
<i>Gaillardia aristata</i>	x		x	<i>Zizia aptera</i>	x	x	
<i>Hedysarum alpinum var. americanum</i>			x	<i>Zygadenus elegans</i>	x		x

Table 28

## SPRUCE RANCH CO-OP HERBICIDE PLOTS

## Species List

Plots East & West							
Grasses	Tordon 101 100 oz/acre			Grasses	Tordon 101 100 oz/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron smithii</i>	x	x		<i>Festuca idahoensis</i>	x	x	x
<i>subsecundum</i>	x	x	x	<i>scabrella</i>	x	x	x
<i>Agrostis scabra</i>	x			<i>Juncus</i> spp.			x
<i>Bromus ciliatus</i>			x	<i>Koeleria cristata</i>	x		x
<i>inermis</i>	x			<i>Phleum pratense</i>	x	x	x
<i>Calamagrostis canadensis</i>	x			<i>Poa</i> spp.	x	x	x
<i>montanensis</i>			x	<i>Stipa comata</i>			x
<i>Carex</i> spp.	x	x	x	<i>spartea</i>	x		
<i>Danthonia parryi</i>	x	x	x	<i>viridula</i>	x	x	
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
<i>Rose</i> spp.		x	x				
<i>Rubus strigosus</i>	x	x	x				
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x		x	<i>Helianthus lenticularis</i>		x	
<i>Allium cernuum</i>	x		x	<i>Heuchera richardsonii</i>	x		x
<i>Astragalus</i> spp.	x			<i>Monarda fistulosa</i>	x		x
<i>Artemesia gnaphaloides</i>	x	x	x	<i>Oxytropis</i> spp.	x		
<i>Aster</i> spp.	x	x	x	<i>Potentilla gracilis</i>	x	x	x
<i>Campanula rotundifolia</i>	x		x	<i>Sisyrinchium montanum</i>	x		x
<i>Crepis</i> spp.	x			<i>Senecio</i> spp.			x
<i>Fragaria glauca</i>	x	x	x	<i>Taraxacum officinale</i>	x	x	
<i>Gaillardia aristata</i>	x		x	<i>Thallictrum venulosum</i>	x	x	x
<i>Galium boreale</i>	x	x	x	<i>Vicia americana</i>			x
<i>Geum triflorum</i>		x	x	<i>Zizia aptera</i>	x	x	x
<i>Hedysarum alpinum</i> var <i>americanum</i>	x		x	<i>Zygadenus elegans</i>	x	x	x

Table 29

## SPRUCE RANCH CO-OP HERBICIDE PLOTS

## Species List

Plots East & West							
Grasses	Brushkill 100 oz/acre			Grasses	Brushkill 100 oz/acre		
	1978	1979	1980		1978	1979	1980
<i>Agropyron smithii</i>	x	x	x	<i>Danthonia parryi</i>	x	x	x
<i>subsecundum</i>	x	x	x	<i>Festuca idahoensis</i>	x	x	x
<i>Agrostis scabra</i>	x		x	<i>scabrella</i>	x	x	x
<i>Bromis inermis</i>	x			<i>Juncus spp.</i>	x		
<i>Calamagrostis canadensis</i>	x			<i>Koeleria cristata</i>	x		x
<i>montanensis</i>		x	x	<i>Phleum pratense</i>	x	x	x
<i>rubescens</i>		x	x	<i>Poa spp.</i>	x	x	x
<i>Carex spp.</i>	x	x	x	<i>Stipa viridula</i>	x	x	x
Shrubs	1978	1979	1980				
<i>Potentilla fruticosa</i>	x	x	x				
<i>Rose spp.</i>	x	x	x				
<i>Salix spp.</i>	x						
Forbs	1978	1979	1980	Forbs	1978	1979	1980
<i>Achillea millefolium</i>	x	x	x	<i>Lathyrus ochroleucus</i>	x		
<i>Astragalus spp.</i>	x			<i>Monarda fistulosa</i>	x		x
<i>Allium cernuum</i>	x		x	<i>Potentilla gracilis</i>	x		x
<i>Artemisia gnaphaloides</i>	x		x	<i>Sium suave</i>			x
<i>Agoseris glauca</i>	x		x	<i>Sisyrinchium montanum</i>			x
<i>Aster spp.</i>	x	x		<i>Solidago missouriensis</i>	x		
<i>Campanula rotundifolia</i>	x		x	<i>Taraxacum officinale</i>	x	x	x
<i>Erigeron glabellus</i>			x	<i>Thalictrum venulosum</i>	x	x	x
<i>Fragaria glauca</i>	x		x	<i>Thermopsis rhombifolia</i>	x	x	x
<i>Gaillardia aristata</i>	x		x	<i>Vicia americana</i>		x	x
<i>Galium boreale</i>	x	x	x	<i>Viola rugulosa</i>	x		
<i>Geranium viscosissimum</i>	x			<i>Zizia cordata</i>	x		
<i>Geum triflorum</i>		x		<i>Zygadenus elegans</i>	x	x	x
<i>Hedysarum alpinum var. americanum</i>			x				



Table 30

## SPRUCE RANCH CO-OP HERBICIDE PLOTS

## Species List

Check - East & West									
Grasses		1978	1979	1980	Grasses		1978	1979	1980
<i>Agropyron dasystachyum</i>		x			<i>Danthonia parryi</i>		x	x	x
<i>smithii</i>			x	x	<i>Festuca idahoensis</i>		x		x
<i>subsecundum</i>		x	x	x	<i>scabrella</i>		x	x	x
<i>Agrostis scabra</i>		x		x	<i>Koeleria cristata</i>		x		x
<i>Bromus ciliatus</i>				x	<i>Phleum pratense</i>		x	x	x
<i>marginatus</i>		x	x	x	<i>Poa spp.</i>		x	x	x
<i>tectorum</i>		x			<i>Stipa richardsonii</i>		x		
<i>Calamagrostis canadensis</i>		x			<i>viridula</i>		x	x	
<i>Carex spp.</i>		x	x	x					
Shrubs		1978	1979	1980	Shrubs		1978	1979	1980
<i>Juniperus horizontalis</i>		x	x		<i>Rose spp.</i>		x	x	x
<i>Potentilla fruticosa</i>		x		x	<i>Salix spp.</i>			x	x
Forbs		1978	1979	1980	Forbs		1978	1979	1980
<i>Achillea millefolium</i>		x	x	x	<i>Helianthus lenticularis</i>			x	
<i>Allium cernuum</i>		x		x	<i>Heuchera richardsonii</i>		x		x
<i>Artemisia gnaphaloides</i>				x	<i>Lathyrus ochroleucus</i>		x		
<i>Agoseris glauca</i>		x	x	x	<i>Linum lewisii</i>		x		
<i>Anemone canadensis</i>		x			<i>Lupinus argenteus</i>		x	x	x
<i>Aster spp.</i>		x		x	<i>Monarda fistulosa</i>		x	x	x
<i>Campanula rotundifolia</i>		x	x	x	<i>Oxytropis spp.</i>		x		
<i>Comandra pallida</i>		x			<i>Potentilla gracilis</i>		x	x	x
<i>Cirsium arvense</i>		x	x	x	<i>Sisyrinchium montanensis</i>		x	x	x
<i>Erigeron canadensis</i>		x		x	<i>Saponaria vaccaria</i>		x		
<i>Fragaria glauca</i>		x	x		<i>Penstemon nitidus</i>			x	
<i>Gaillardia aristata</i>		x	x	x	<i>Solidago missouriensis</i>		x		x
<i>Galium boreale</i>		x	x	x	<i>Taraxacum officinale</i>		x	x	x
<i>Geranium viscosissimum</i>		x	x	x	<i>Thalictrum venulosum</i>		x	x	x
<i>Geum triflorum</i>		x	x	x	<i>Thermopsis rhombifolia</i>		x		x
<i>Hedysarum alipun var. americanum</i>		x	x	x	<i>Vicia americana</i>		x		x
					<i>Zizia aptera</i>		x		x
					<i>Zygadenus elegans</i>		x	x	x



6. WALDRON GRAZING CO-OP  
HERBICIDE TRIAL  
INTERIM REPORT  
1980

The Waldron herbicide plots are located in the Waldron Grazing co-operative's lease along the north side of Section 13-12-2-W5.

Data was collected as in past years:

1. Stem counts were taken of all shrub species and separated into four categories: N (New), P (Partially affected), u (Unaffected), and D (Dead).

2. Completed species list was compiled from each treatment plot.

Data gathered to date is presented for the current sampling year (1980) and in the summary for all years collected.

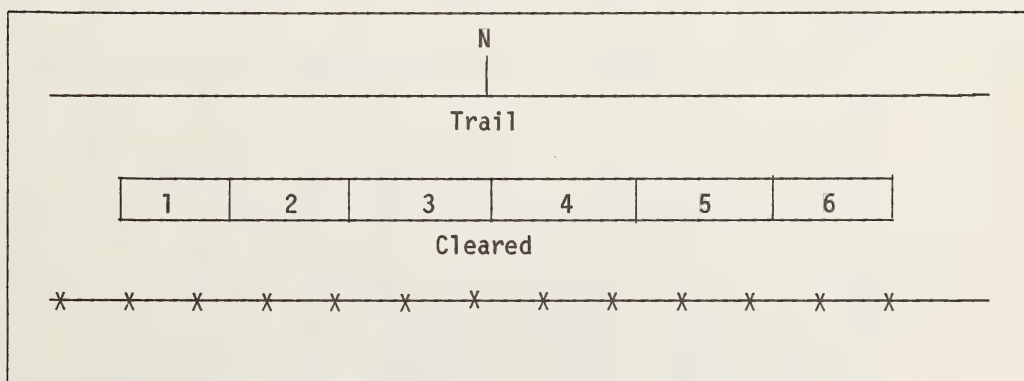


Fig. 4. PLOT LAYOUT OF WALDRON HERBICIDE TRIALS. (0.1 acre plots)

Table 31

## WALDRON HERBICIDE PLOTS

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Treatment	Plot No.
Tordon 10K pellets at 20 pounds per acre . . . . .	5
Tordon 10K pellets at 35 pounds per acre . . . . .	2
Tordon 101 at 100 ounces per acre . . . . .	3, 6
Brushkill at 100 ounces per acre . . . . .	1, 4

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Table 32  
 WALDRON HERBICIDE PLOTS - Stem Count Summary  
 1978-80

	Total		N		U		P	
	78	79	78	79	78	79	78	79
Tordon 101								
<i>Populus tremuloides</i>	166	50	164	7	1	4	1	39
<i>Rosa</i> spp.	166	12	164	2	--	10	2	--
<i>Symphoricarpus albus</i>	26	103	26	85	--	18	--	--
<i>Amelanchier alnifolia</i>	1	2	1	2	--	--	--	--
<i>Rubus</i> spp.	14	10	14	7	--	3	--	--
Brushkill								
<i>Populus tremuloides</i>	265	59	119	1	92	12	54	46
<i>Rosa</i> spp.	20	22	3	5	17	17	--	--
<i>Amelanchier alnifolia</i>	19	32	8	4	5	28	6	--
<i>Symphoricarpus albus</i>	28	47	3	39	21	3	4	5
<i>Rubus strigosus</i>	5	10	5	--	--	10	--	--
Tordon 10K-20 lbs/acre								
<i>Populus tremuloides</i>	15	19	2	--	13	17	--	2
<i>Rosa</i> spp.	4	--	4	--	--	--	--	--
<i>Amelanchier alnifolia</i>	1	--	--	--	1	--	--	--
<i>Symphoricarpus albus</i>	1	--	1	--	--	--	--	--
Tordon 10K-35 lbs/acre								
<i>Populus tremuloides</i>	38	48	2	--	31	34	5	14
<i>Rosa</i> spp.	11	26	3	15	8	11	--	--
<i>Amelanchier alnifolia</i>	8	5	--	4	8	1	--	--
<i>Symphoricarpus albus</i>	3	43	2	--	--	17	1	--
<i>Rubus parviflorus</i>	2	--	2	--	--	--	--	--
<i>Ernus</i> spp.	--	--	--	--	--	--	--	--
<i>Rubus strigosus</i>	--	--	--	--	--	--	--	--

NOTE: Abbreviations used: N = New, P = Partially affected, U = Unaffected.

Table 33  
WALDRON GRAZING CO-OP  
Stem Count Data-1980

Tordon 101 - 100 oz/acre		Plot 3				Plot 6			
Species	Total	N	U	P	Total	N	U	P	
<i>Populus tremuloides</i>	27	3	10	14	86	6	46	34	
<i>Rosa spp.</i>	18	4	13	1	403	69	328	6	
<i>Potentilla fruticosa</i>	--	--	--	--	2	--	2	--	
<i>Symphoricarpus albus</i>	220	24	196	--	3	--	2	1	
<i>Amelanchier alnifolia</i>	3	2	1	--	3	--	3	--	
<i>Rubus strigosus</i>	34	30	4	--	--	--	--	--	
Brushkill - 100 oz/acre		Plot 1				Plot 4			
Species	Total	N	U	P	Total	N	U	P	
<i>Populus tremuloides</i>	48	3	18	27	196	9	15	172	
<i>Rosa spp.</i>	27	6	16	5	53	29	24	--	
<i>Amelanchier alnifolia</i>	27	3	12	12	10	4	2	4	
<i>Symphoricarpus albus</i>	70	6	64	--	74	15	59	--	
<i>Rubus strigosus</i>	34	5	29	--	--	--	--	--	
Tordon 10K - 20 lbs/acre		Plot 5 <sup>a</sup>				Plot 2 <sup>b</sup>			
Species	Total	N	U	P	Total	N	U	P	
<i>Populus tremuloides</i>	10	--	5	5	43	--	28	15	
<i>Rosa spp.</i>	10	4	6	--	39	19	20	--	
<i>Amelanchier alnifolia</i>	4	2	2	--	7	2	4	1	
<i>Symphoricarpus albus</i>	15	15	--	--	83	39	34	10	
<i>Rubus parviflorus</i>	--	--	--	--	1	1	--	--	
<i>Prunus spp.</i>	--	--	--	--	2	--	2	--	
<i>Rubus strigosus</i>	--	--	--	--	8	5	3	--	

NOTE: Abbreviations used: N = New, U = Unaffected, P = Partially affected.

<sup>a</sup>Plot 5 - 20 lbs/acre.

<sup>b</sup>Plot 2 - 35 lbs/acre.

Table 34  
 WALDRON GRAZING CO-OP  
 Total Stem Count Data  
 1977-80

Species Brushkill 100 oz/acre	1977		1978		1979		1980	
	Plot 1	Plot 4	Plot 1	Plot 4	Plot 1	Plot 4	Plot 1	Plot 4
<i>Amelanchier alnifolia</i>	110	82	25	10	32	16	27	10
<i>Potentilla fruticosa</i>	0	0	0	0	0	0	0	0
<i>Populus tremuloides</i>	189	418	234	482	59	201	48	196
<i>Prunus spp.</i>	0	0	0	0	0	0	0	0
<i>Rosa spp.</i>	24	110	12	11	22	26	27	53
<i>Rubus strigosus</i>	19	0	8	0	10	0	34	0
<i>Symphoricarpus albus</i>	110	119	20	17	47	72	70	74
Species Tordon 101 100 oz/acre	1977		1978		1979		1980	
	Plot 3	Plot 6	Plot 3	Plot 6	Plot 3	Plot 6	Plot 3	Plot 6
<i>Amelanchier alnifolia</i>	3	43	1	0	2	0	3	3
<i>Potentilla fruticosa</i>	0	0	0	0	0	0	0	2
<i>Populus tremuloides</i>	288	346	317	322	50	78	27	86
<i>Prunus spp.</i>	0	0	0	0	0	0	0	0
<i>Rosa spp.</i>	50	308	19	238	12	187	18	403
<i>Rubus strigosus</i>	10	0	14	0	10	0	34	0
<i>Symphoricarpus albus</i>	217	0	29	10	103	1	220	3
Species Tordon 10K Pellets	1977		1978		1979		1980	
	Plot <sup>a</sup> 2	Plot <sup>b</sup> 5	Plot <sup>a</sup> 2	Plot <sup>b</sup> 5	Plot <sup>a</sup> 2	Plot <sup>b</sup> 5	Plot <sup>a</sup> 2	Plot <sup>b</sup> 5
<i>Amelanchier alnifolia</i>	16	89	12	1	5	0	4	7
<i>Potentilla fruticosa</i>	0	11	0	0	0	0	0	0
<i>Populus tremuloides</i>	178	218	241	294	48	19	10	43
<i>Prunus spp.</i>	0	0	4	0	0	0	0	2
<i>Rosa spp.</i>	83	216	18	41	26	0	10	39
<i>Rubus strigosus</i>	34	0	2	0	0	0	0	9
<i>Symphoricarpus albus</i>	59	2	3	19	43	2	15	83

<sup>a</sup>Plot 2 - 35 lbs/acre.

<sup>b</sup>Plot 5 - 20 lbs/acre.

## 6.1 Observations

Beginning in 1979, closer attention was again paid to the vegetative response to treatment, and in particular, more care was given to collecting the species list for 1980.

1. Tordon 101 -- The dominant grasses are *Calamagrostis rubescens*, *Bromus pumpehianus* and *Phleum pratense*. Forbs present are *Epilobium angustifolium*, *Geranium viscosissimum*, *Cirsium arvense*, *Aster* spp., *Fragaria glauca*, *Achillea millefolium*, *Lupinus argenteus* and *Galium boreale*. The ratio of grass to forbs was 4:1. In 1980, there was a marked increase in new growth for *Rubus* spp. and *Symphoricarpus*.

2. Brushkill -- There are quite a variety of grass species present. The most common ones are *Phleum pratense*, *Carex* spp. and *Calamagrostis rubescens*. Many forbs are also present. The dominant species are *Delphinium glaucum*, *Cirsium arvense*, *Aster* spp. and *Epilobium angustifolium*. There was an equal proportion of grass and forbs. Many *Populus tremuloides* were unaffected. *Symphoricarpus* appears to be increasing after treatment. The greatest increase in new growth was 1979. *Rubus* spp. also seems to be increasing.

3. Tordon 10K (20 lb./a.) -- Nearly 100 per cent grass is present on both plots. Dominant species are *Phleum pratense*, *Calamagrostis rubescens* and *Agrostis scabra*. The few forbs that are present are *Geranium viscosissimum*, *Allium textile* and *Epilobium angustifolium*. *Symphoricarpus* is starting to return.



4. Tordon 10K (35 lb./a.) -- The dominant grass is *Calamagrostis rubescens*. The dominant forbs are *Epilobium angustifolium* and *Lupinus argenteus*. The ratio of grass to forbs is 9:1. Those *Populus tremuloides* that were not affected by treatment were 14 feet high and approximately 1.5 " DBH. New growth is abundant for *Symphoricarpus spp.* and *Rosa spp.* in 1980. *Rubus spp.* are also beginning to come back in.

It appears that the Tordon formulations have the greatest effect as a brush control agent. Though forbs are drastically reduced, they are not totally eliminated.

*Symphoricarpus spp.* appears to be initially controlled by all treatments, but, in the following years, new growth is profuse. *Rosa spp.* are also coming back two to three years after treatment.

All information given forms an interim report based on data collected to 1980. These plots will continue to be monitored; therefore, no conclusions will be formulated at this time.

Table 35

## WALDRON HERBICIDE PLOTS - Species List 1977 - 1980

		Tordon 10K Pellets																	
Grasses	Plot:	1977		1978		1979		1980		Grasses	Plot:	1977		1978		1979		1980	
		5	2	5	2	5	2	5	2			5	2	5	2	5	2	5	2
<i>Agropyron subsecundum</i>				x						<i>rubescens</i>									x
<i>Agrostis scabra</i>				x	x	x	x	x	x	<i>Carex spp.</i>									x
<i>Bromus inermis</i>				x		x	x	x	x	<i>Festuca scabrella</i>		x	x	x					x
<i>marginatus</i>						x				<i>Phleum pratense</i>		x	x	x	x	x			x
<i>pumpellianus</i>							x	x	x	<i>Poa spp.</i>					x				x
<i>Catagmagrostis canadensis</i>								x	x	<i>Stipa spartea</i>									x
<i>montanensis</i>								x	x										x
		1977		1978		1979		1980				1977		1978		1979		1980	
Shrubs		5	2	5	2	5	2	5	2	Shrubs		5	2	5	2	5	2	5	2
<i>Amelanchier alnifolia</i>		x	x		x	x	x	x	x	<i>Rosa spp.</i>		x	x	x	x	x	x	x	x
<i>Potentilla fruticosa</i>		x								<i>Rubus strigosus</i>		x							x
<i>Populus tremuloides</i>		x	x	x	x	x	x	x	x	<i>Symphoricarpos occidentalis</i>		x	x	x	x	x	x	x	x
<i>Prunus virginiana</i>				x															
		1977		1978		1979		1980				1977		1978		1979		1980	
Forbs		5	2	5	2	5	2	5	2	Forbs		5	2	5	2	5	2	5	2
<i>Achillea millefolium</i>		x			x					<i>Lathyrus ochroleucus</i>		x							
<i>Allium cernuum</i>				x		x				<i>Lilium philadelphicum</i>			x						
<i>Agoseris glauca</i>										<i>Lomatium simplex</i>			x						
<i>Androsace septentrionalis</i>										<i>Lupinus argenteus</i>			x	x	x	x	x	x	x
<i>Artemisia gnaphalodes</i>										<i>Lysimachia ciliata</i>				x					
<i>Arabis drummondii</i>										<i>Monarda fistulosa</i>		x							x
<i>Aster spp.</i>				x	x	x	x	x	x	<i>Penstemon procerus</i>					x				x
<i>Castilleja miniata</i>										<i>Potentilla gracilis</i>		x	x						x
<i>Delphinium glauca</i>				x	x	x	x	x	x	<i>Smilacina stellata</i>				x					x
<i>Epilobium angustifolium</i>		x	x	x	x	x	x	x	x	<i>Taraxacum officinale</i>									x
<i>Fragaria glauca</i>		x	x	x	x	x	x	x	x	<i>Thalictrum venulosum</i>									x
<i>Galium boreale</i>		x	x	x	x	x	x	x	x	<i>Trollius albiflorus</i>									x
<i>Geranium viscosissimum</i>		x	x	x	x	x	x	x	x	<i>Vicia americana</i>		x							x
<i>richardsonii</i>										<i>Zygadenus elegans</i>									x
<i>Heracleum lanatum</i>																			

NOTE: Plot 5 = 20 lbs/acre; Plot 2 = 35 lbs/acre.

Table 36

## WALDRON HERBICIDE PLOTS

## Species List

Plots 3 & 6									
Grasses	Tordon 101 100 oz/acre				Grasses	Tordon 101 101 oz/acre			
	77	78	79	80		77	78	79	80
<i>Agropyron intermedia</i>				x	<i>Carex</i> spp.				x
<i>subsecundum</i>		x	x	x	<i>Elymus canadensis</i>		x		x
<i>Agrostis scabra</i>		x		x	<i>Festuca scabrella</i>			x	x
<i>Bromus ciliatus</i>				x	<i>Phleum pratense</i>	x	x	x	x
<i>inermis</i>		x	x		<i>Poa</i> spp.		x	x	x
<i>pumpillianus</i>				x	<i>Stipa spartea</i>		x		x
<i>Calamagrostis montanensis</i>		x	x	x	<i>viridula</i>				x
<i>rubescens</i>				x					
Shrubs	77	78	79	80	Shrubs	77	78	79	80
<i>Amelanchier alnifolia</i>	x			x	<i>Rosa</i> spp.	x	x	x	x
<i>Arctostaphylos uva-ursi</i>				x	<i>Rubus pubescens</i>				x
<i>Potentilla fruticosa</i>				x	<i>strigosus</i>	x	x		x
<i>Populus tremuloides</i>	x	x	x	x	<i>Symphoricarpos occidentalis</i>	x	x	x	x
Forbs	77	78	79	80	Forbs	77	78	79	80
<i>Anemone multifida</i>				x	<i>Heracleum lanatum</i>				x
<i>Achillea millefolium</i>		x	x	x	<i>Lappula echinata</i>				x
<i>Antennaria anaphaloides</i>				x	<i>Lathyrus ochroleucus</i>	x	x		x
<i>Agoseris glauca</i>			x	x	<i>Lupinus argenteus</i>		x	x	x
<i>Arabis drummondii</i>				x	<i>Monarda fistulosa</i>		x		x
<i>Artemisia gnaphalodes</i>			x	x	<i>Oxytropis macounii</i>				x
<i>Aster</i> spp.	x	x	x	x	<i>Oxytropis gracilis</i>			x	
<i>Campanula rotundifolia</i>				x	<i>Potentilla gracilis</i>				x
<i>Castilleja miniata</i>		x	x		<i>Penstemon albidus</i>				x
<i>Cirsium arvense</i>		x		x	<i>Smilacina stellata</i>	x	x		x
<i>Delphinium glauca</i>				x	<i>Solidago missourienses</i>				x
<i>Epilobium angustifolium</i>	x	x		x	<i>Taraxacum officinale</i>		x		x
<i>Fragaria glauca</i>	x	x		x	<i>Thalictrum venulosum</i>	x	x		x
<i>Gallium boreale</i>	x	x	x	x	<i>Tragopogan dubius</i>				x
<i>Geranium richardsonii</i>				x	<i>Vicia americana</i>	x	x		x
<i>Geranium viscosissimum</i>	x	x	x	x	<i>Zygadenus elegans</i>		x	x	x
<i>Hedysarum alpinum</i> var. <i>americanum</i>		x	x	x					

Table 37

## WALDRON HERBICIDE PLOTS

## Species List

Plots 1 & 4									
Grasses	Brushkill 100 oz/acre				Grasses	Brushkill 100 oz/acre			
	77	78	79	80		77	78	79	80
<i>Agropyron dasystachyum</i>				x	<i>Calamagrostis canadensis</i>	x		x	
<i>smithii</i>			x	x	<i>rubescens</i>		x	x	x
<i>subsecundum</i>	x	x			<i>montanensis</i>				x
<i>Agrostis scabra</i>		x	x	x	<i>Carex</i> spp.				x
<i>Bromus ciliatus</i>				x	<i>Elymus canadensis</i>		x		x
<i>inermis</i>		x	x		<i>Festuca scabrella</i>				x
<i>marginatus</i>			x		<i>Phleum pratense</i>	x	x	x	x
<i>pumpellianus</i>				x	<i>Poa</i> spp.				x
<i>tectorum</i>				x	<i>Stipa spartea</i>				x
					<i>viridula</i>				x
Shrubs	77	78	79	80	Shrubs	77	78	79	80
<i>Amelanchier alnifolia</i>	x	x	x	x	<i>Rubus strigosus</i>	x			x
<i>Populus tremuloides</i>	x	x	x	x	<i>Symphoricarpos occiden-</i>	x	x	x	x
<i>Rosa</i> spp.	x	x	x	x	<i>talis</i>				
Forbs	77	78	79	80	Forbs	77	78	79	80
<i>Achillea millefolium</i>			x	x	<i>Lathyrus ochroleucus</i>	x			x
<i>Allium cernuum</i>				x	<i>Lomatium macrocarpum</i>	x			
<i>Agoseris glauca</i>				x	<i>Lupinus argenteus</i>				x
<i>Antennaria anaphalooides</i>				x	<i>Monarda fistulosa</i>		x	x	
<i>Aster</i> spp.	x		x	x	<i>Perideridia gardneri</i>				x
<i>Cirsium arvense</i>		x	x	x	<i>Potentilla gracilis</i>		x		x
<i>Delphinium glauca</i>		x	x	x	<i>Sium suave</i>			x	
<i>Epilobium augustifolium</i>	x	x	x	x	<i>Smilacina stellata</i>	x	x	x	x
<i>Erysimum cheiranthoides</i>				x	<i>Taraxacum officinale</i>		x		x
<i>Fragaria glauca</i>			x	x	<i>Thlispi arvense</i>				x
<i>Galium boreale</i>	x	x	x	x	<i>Thallictrum venulosum</i>	x	x	x	x
<i>Geranium richardsonii</i>				x	<i>Tragopogan dubius</i>				x
<i>Geranium viscosissimum</i>	x	x	x	x	<i>Trollius albiflorus</i>		x		
<i>Hedysarum alpinum</i> var.	x				<i>Vicia americana</i>	x			
<i>americanum</i>					<i>Viola rugulosa</i>	x			
<i>Heracleum lanatum</i>	x	x	x	x	<i>Zygadenus elegans</i>				x



Table 51  
 VARIOUS WEEDICIDE PLOTS  
 Species list

Species	1977				Species	1978			
	77-1	77-2	77-3	77-4		78-1	78-2	78-3	78-4
<i>Abutilon theophrasti</i>					<i>Abutilon theophrasti</i>				
<i>Chenopodium album</i>					<i>Chenopodium album</i>				
<i>Amaranthus retrofractus</i>					<i>Amaranthus retrofractus</i>				
<i>Cyperus sp.</i>					<i>Cyperus sp.</i>				
<i>Conyza bonariensis</i>					<i>Conyza bonariensis</i>				
<i>Parthenocissus vitacea</i>					<i>Parthenocissus vitacea</i>				
<i>Cyperus sp.</i>					<i>Cyperus sp.</i>				
<i>Conyza bonariensis</i>					<i>Conyza bonariensis</i>				
<i>Parthenocissus vitacea</i>					<i>Parthenocissus vitacea</i>				
<i>Cyperus sp.</i>					<i>Cyperus sp.</i>				
<i>Conyza bonariensis</i>					<i>Conyza bonariensis</i>				
<i>Parthenocissus vitacea</i>					<i>Parthenocissus vitacea</i>				
<i>Cyperus sp.</i>					<i>Cyperus sp.</i>				
<i>Conyza bonariensis</i>					<i>Conyza bonariensis</i>				
<i>Parthenocissus vitacea</i>					<i>Parthenocissus vitacea</i>				
<i>Cyperus sp.</i>					<i>Cyperus sp.</i>				
<i>Conyza bonariensis</i>					<i>Conyza bonariensis</i>				
<i>Parthenocissus vitacea</i>					<i>Parthenocissus vitacea</i>				
<i>Cyperus sp.</i>					<i>Cyperus sp.</i>				



N.L.C. - B.N.C.



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