

## LEAFY SPURGE CONTROL WITH TEBUTHIURON – 1983

### Dickinson Experiment Station

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A study that tests the effects of Tebuthiuron (Graslan) on leafy spurge (*Euphorbia esula*) was started in 1983 at the Dickinson Experiment Station. Leafy spurge is a major problem weed in uncultivated rangelands in North Dakota. It greatly reduces herbage production and beef production, which causes substantial economic losses. The leafy spurge plant is extremely difficult to control and has numerous mechanisms to survive control attempts.

Tebuthiuron is an herbicide that is primarily intended for use on shrubs in rangeland. The chemical is absorbed by the roots and translocated to the leaves. Photosynthesis is restricted. The leaves senesce prematurely and fall off and a new set of leaves develop. This process continues until the plant depletes its stored carbohydrates. The process may take one to four years before the plant dies completely, depending on the species and the environmental conditions. In theory, this appears to be a desirable method to control leafy spurge.

The test plots for this study were established on 0.1 acres located on the NE $\frac{1}{4}$ , NE $\frac{1}{4}$ , SW $\frac{1}{4}$  Sec. 22, T. 141 N., R. 104 W. on the property of Dale Maus, five miles north of Camels Hump Butte. The 10 X 53 foot plots were arranged in a randomized block design with two replications. The size of the leafy spurge patch was not sufficient for additional treatments or replications. The soil is vebar fine sandy loam. The range site is sandy. The site has a slight slope of about 3% with an east aspect and the south half of the plots has a slight slope of about 5% with a north aspect. The vegetation on the site was predominately leafy spurge with an understory of Kentucky bluegrass (*Poa pratensis*) and a few scattered plants of smooth brome grass (*Bromus inermis*). The herbicide, Tebuthiuron, was furnished by the Elanco Products Company. The chemical is incorporated into solid clay pellets in two concentrations, 40% and 20% active ingredients. Three rates of the 20% concentration were used in this trial. The three rates were: 1, 2 and 3 pounds of active ingredient per acre. A control of no chemical treatment was included in each replication. The herbicide was Broadcast, applied with a whirlybird hand spreader on 12 July 1983. The recommended optimum period to apply herbicides to leafy spurge is from mid-June until seed dispersal during hot, dry weather in July (Lym and Messersmith, 1983).

The data that were collected from these plots were: monthly above ground herbage production, monthly leafy spurge stem densities and monthly mean weight per leafy spurge stem. The monthly above ground herbage production was sampled by clipping the vegetation to ground level in two  $\frac{1}{4}$  m<sup>2</sup> quadrats for each plot on 12 July, 22 August and 28 of September. These clipping dates were: 0, 41 and 78 days after treatment respectively. The herbage was separated into two categories: leafy spurge and grass. The samples were oven dried at 80°C. The average herbage production for each category and the total production for each plot were determined. The monthly leafy spurge stem densities were conducted by counting all of the current years leafy spurge stems that were rooted within two  $\frac{1}{4}$  m<sup>2</sup> quadrats per plot. These stem density counts were conducted on 12 July, 22 August and 28 September. These data were converted to stems per foot square. The mean dry weight per leafy spurge stem data was collected by counting the number of stems clipped during collection of the above ground herbage samples per  $\frac{1}{4}$  m<sup>2</sup> and calculating the mean weight per stem from the leafy spurge herbage production data.

The herbage production data, the leafy spurge stem density data and the mean dry weight per leafy spurge stem data will be collected from these plots for the next few years in order to follow the effects of Tebuthiuron on leafy spurge. The data to be collected in the spring and summer of 1984 will be very important in evaluating the use of Tebuthiuron for leafy spurge control.

No definitive conclusions can be made from this first year's data because it reflects only the effects on the top growth. Several encouraging trends do show up in the data however. Tebuthiuron does affect the top growth of leafy spurge at the two and three pounds of active ingredient per acre rates during the first year of treatment. The reduction in herbage weight of leafy spurge at 78 days after treatment was 71% and 79% for the 2 and 3 lbs ai/acre rates respectively. The control treatment had a reduction of 58% in herbage weight of leafy spurge during the same time period. The density of leafy spurge stems was reduced by 36% and 70% for the 2 and 3 lbs ai/acre rates respectively, while the control stem densities were reduced by 11% in 78 days. The mean weight per stem was reduced by 59% for both the 2 and 3 lbs ai/acre rates in 78 days, while the control weight per stem was reduced by 48%. The grass component of the 2 and 3 lbs ai/acre rate plots appears to have been affected by the Tebuthiuron also. Very little grass growth occurred on these plots after treatment. A higher rate of grass leaf senescence was visually observed on the 2 and 3 lbs ai/acre rate plots than on the control plots. The quantitative data from the 1 lb ai/acre rate plots shows very little effect on the leafy spurge or grass component except for the first clip period on the leafy spurge herbage production and the stem density data. The 1 lb ai/acre plots could easily be separated from the control plots by visual observation 41 and 78 days after treatment because of a difference in the rate of leaf senescence.

#### **Literature Cited**

Lym, Rodney G. and Calvin G. Messersmith. 1983. Control of Leafy Spurge with Herbicides. North Dakota Farm Research Bimonthly Bulletin Vol. 40(5): 16-19.

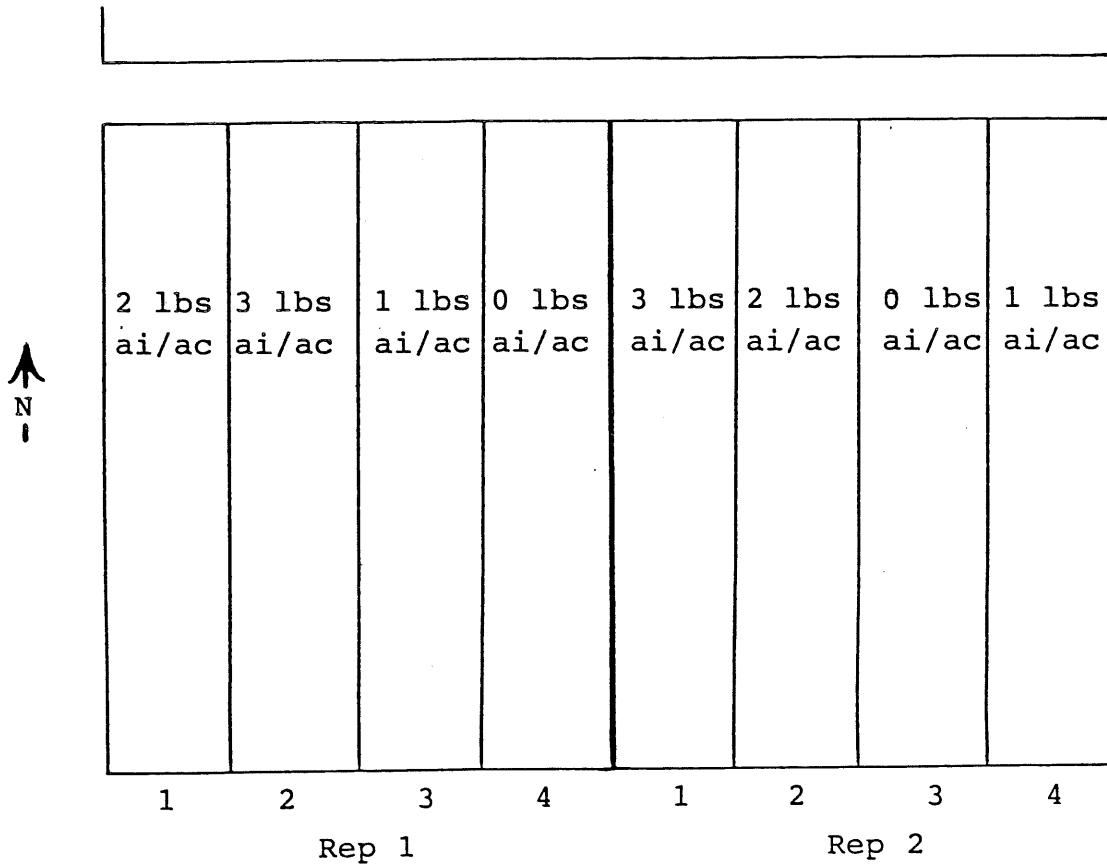


Figure 1. Control of Leafy Spurge with Tebuthiuron randomized block plot design with two replications. Rates are 0,1,2 and 3 pounds of active ingredient per acre using 20 percent concentration pellets. Located at NE $\frac{1}{4}$  NE $\frac{1}{4}$  SW $\frac{1}{4}$  sec. 22, T.141 N., R.104 W. Plots are 10 feet by 53 feet.

**Table 1. Monthly Above Ground Herbage Production in Lbs/Acre for the Leafy Spurge Control Trial  
at the Dickinson Experiment Station – 1983**

Herbicide Rate In Lbs Ai/Acre	12 July			22 August			28 September		
	Spurge	Grass	Total	Spurge	Grass	Total	Spurge	Grass	Total
<b>0 Lbs:</b>									
Rep 1	1493.2	852.8	2346.0	1161.4	1002.6	2164.0	633.3	809.9	1443.3
Rep 2	1218.5	1154.3	2372.7	745.7	1759.0	2504.7	504.9	1118.6	1623.4
Mean	1355.8	1003.7	2359.5	953.7	1380.8	2334.6	569.1	964.3	1533.4
<b>1 Lbs:</b>									
Rep 1	1175.7	966.9	2142.6	644.0	1384.4	2028.4	619.1	1095.4	1714.4
Rep 2	829.6	1400.4	2230.0	628.0	1646.6	2274.6	488.8	1154.3	1643.1
Mean	1001.9	1183.9	2185.8	636.2	1515.7	2151.9	553.9	1124.8	1678.8
<b>2 Lbs:</b>									
Rep 1	1400.4	645.8	2046.3	652.9	788.5	1441.5	574.5	811.7	1386.2
Rep 2	1978.5	1186.4	3164.8	875.9	872.4	1748.3	422.8	713.6	1136.4
Mean	1689.5	916.3	2605.7	764.6	830.6	1595.3	498.6	762.7	1261.3
<b>3 Lbs:</b>									
Rep 1	1015.1	1059.7	2074.8	611.9	1147.1	1759.0	212.3	868.8	1081.1
Rep 2	1550.3	1115.0	2665.3	1015.1	1181.0	2196.1	339.0	1329.1	1668.0
Mean	1282.7	1087.5	2370.2	813.5	1164.2	1977.7	275.6	1099.0	1374.6

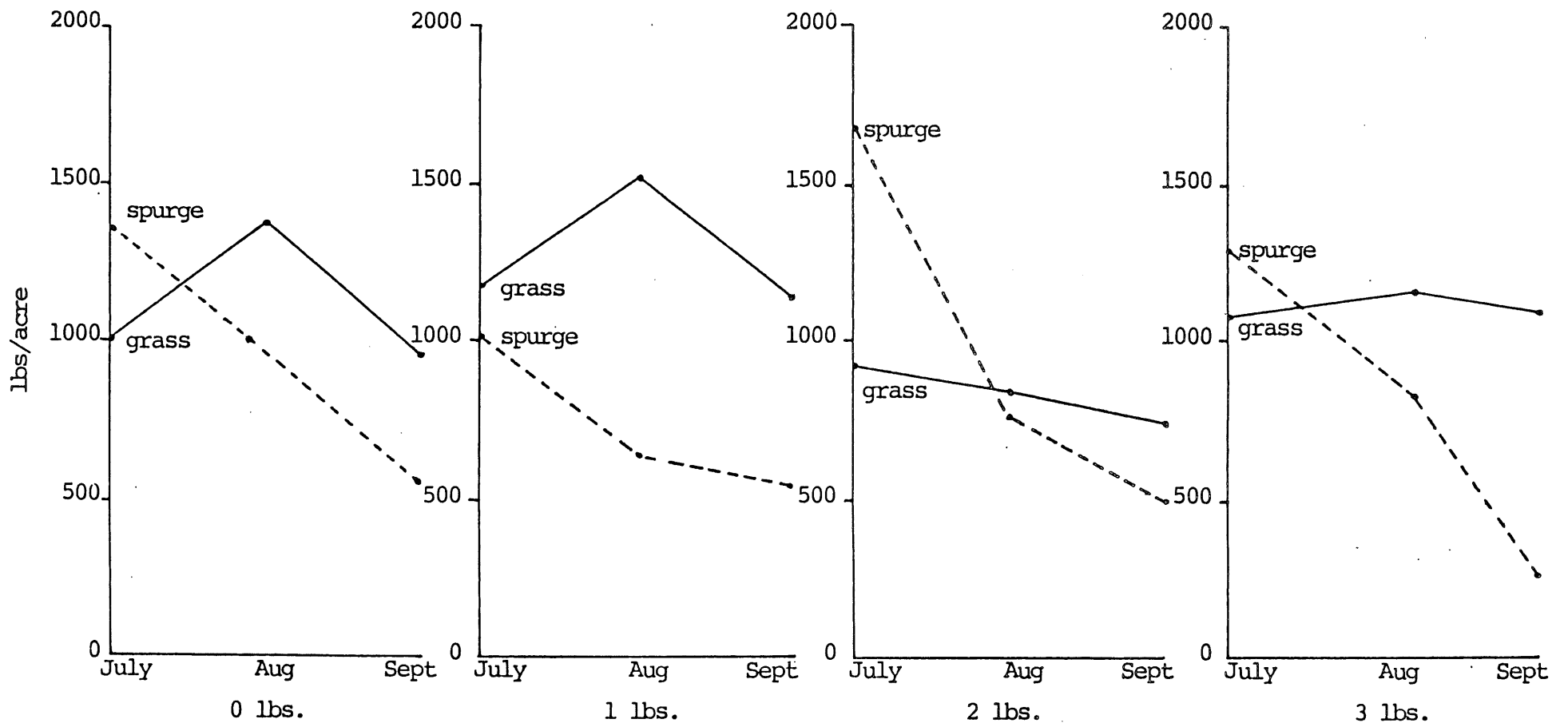


Figure 2. Monthly herbage production in pounds per acre for the Leafy spurge control trial at the Dickinson Experiment Station 1983.

**Table 2. Monthly Leafy Spurge Densities in Stems per Foot Square for the Leafy Spurge Control Trial  
at the Dickinson Experiment Station – 1983**

Herbicide Rate In Lbs Ai/Acre	12 July			22 August			28 September		
	Mature	Regrowth	Total	Mature	Regrowth	Total	Mature	Regrowth	Total
<b>0 Lbs:</b>									
Rep 1	15.05	0.0	15.05	20.25	0.0	20.25	15.61	0.0	15.61
Rep 2	11.15	0.0	11.15	10.96	0.0	10.96	7.62	0.0	7.62
Mean	13.10	0.0	13.10	15.61	0.0	15.61	11.61	0.0	11.61
<b>1 Lbs:</b>									
Rep 1	14.12	0.0	14.12	10.03	0.0	10.03	10.78	0.0	10.78
Rep 2	7.80	0.0	7.80	9.29	0.0	9.29	8.18	0.0	8.18
Mean	10.96	0.0	10.96	9.66	0.0	9.66	9.48	0.0	9.48
<b>2 Lbs:</b>									
Rep 1	21.18	0.0	21.18	16.54	0.0	16.54	15.24	0.56	15.80
Rep 2	16.16	0.0	16.16	14.86	0.0	14.86	8.55	2.23	10.78
Mean	18.67	0.0	18.67	15.70	0.0	15.70	11.90	1.40	13.29
<b>3 Lbs:</b>									
Rep 1	27.50	0.0	27.50	12.26	0.0	12.26	6.32	2.23	9.55
Rep 2	17.28	0.0	17.28	13.75	0.0	13.75	7.06	0.93	7.99
Mean	22.39	0.0	22.39	13.01	0.0	13.01	6.69	1.58	8.77

**Table 3. Monthly Mean Dry Weight per Stem of Leafy Spurge in Grams for the Leafy Spurge Control Trial at the Dickinson Experiment Station – 1983**

<b>Herbicide Rate In Lbs Ai/Acre</b>	<b>12 July G/Stem</b>	<b>22 August G/Stem</b>	<b>28 September G/Stem</b>
<b>0 Lbs:</b>			
Rep 1	1.01	0.60	0.42
Rep 2	1.14	0.72	0.69
Mean	1.08	0.66	0.56
<b>1 Lbs:</b>			
Rep 1	0.84	0.71	0.60
Rep 2	1.13	0.74	0.62
Mean	0.99	0.73	0.61
<b>2 Lbs:</b>			
Rep 1	0.68	0.41	0.38
Rep 2	1.26	0.62	0.41
Mean	0.97	0.52	0.40
<b>3 Lbs:</b>			
Rep 1	0.78	0.52	0.26
Rep 2	0.92	0.78	0.44
Mean	0.85	0.65	0.35

**Table 4. Percentage of Difference in Herbage Production for the Three Clipping Dates for the Leafy Spurge Control Trial at the Dickinson Experiment Station – 1983**

Herbicide Rate In Lbs Ai/Acre	12 Jul – 22 Aug 41 Days		22 Aug – 28 Sep 37 Days		12 Jul – 28 Sep 78 Days	
	Spurge	Grass	Spurge	Grass	Spurge	Grass
<b>0 Lbs:</b>						
Rep 1	-22.22	+17.57	-45.47	-19.22	-57.59	- 5.03
Rep 2	-38.80	+52.40	-32.30	-36.41	-58.57	- 3.10
Mean	-29.66	+37.58	-40.33	-30.17	-58.02	- 3.93
<b>1 Lbs:</b>						
Rep 1	-45.22	+43.17	- 3.87	-20.88	-47.34	+13.29
Rep 2	-24.30	+17.58	-22.17	-29.90	-41.08	-17.57
Mean	-36.50	+28.03	-12.94	-25.79	-44.72	- 4.99
<b>2 Lbs:</b>						
Rep 1	-53.38	+22.10	-12.01	+ 2.94	-58.98	+25.69
Rep 2	-55.73	- 26.47	-51.73	-18.20	-78.63	-39.85
Mean	-54.74	- 9.35	-34.79	- 8.17	-70.49	-16.76
<b>3 Lbs:</b>						
Rep 1	-39.72	+ 8.25	-65.30	-24.26	-79.09	-18.01
Rep 2	-34.52	+ 5.92	-66.60	+12.54	-78.13	+19.20
Mean	-36.58	+ 7.05	-66.12	- 5.60	-78.51	+ 1.06



**Table 5. Percentage of Difference in Leafy Spurge Stem Density for the Three Sample Dates for the Leafy Spurge Control Trial at the Dickinson Experiment Station – 1983**

<b>Herbicide Rate In Lbs Ai/Acre</b>	<b>12 Jul – 22 Aug 41 Days %</b>	<b>22 Aug – 28 Sep 37 Days %</b>	<b>12 Jul – 28 Sep 78 Days %</b>
<b>0 Lbs:</b>			
Rep 1	+34.55	- 22.91	+ 3.72
Rep 2	- 1.70	-30.47	- 31.66
Mean	+19.16	-25.56	- 11.30
<b>1 Lbs:</b>			
Rep 1	-28.97	+ 7.48	- 23.65
Rep 2	+19.10	- 11.95	+ 4.87
Mean	-11.86	- 1.86	- 13.50
<b>2 Lbs:</b>			
Rep 1	-21.91	- 7.86	-28.05
Rep 2	- 8.04	-42.46	-47.09
Mean	-15.91	-24.20	-36.26
<b>3 Lbs:</b>			
Rep 1	-55.42	-48.45	-77.02
Rep 2	-20.43	-48.65	-59.14
Mean	-41.89	-48.58	-70.12

**Table 6. Percentage of Difference in Mean Dry Weight per Stem of Leafy Spurge for the Three Sample Dates for the Leafy Spurge Control Trial at the Dickinson Experiment Station - 1983**

<b>Herbicide Rate In Lbs Ai/Acre</b>	<b>12 Jul – 22 Aug 41 Days %</b>	<b>22 Aug – 28 Sep 37 Days %</b>	<b>12 Jul – 28 Sep 78 Days %</b>
<b>0 Lbs:</b>			
Rep 1	-40.59	-30.00	-58.42
Rep 2	-36.84	- 4.17	-39.47
Mean	-38.89	-15.15	-48.15
<b>1 Lbs:</b>			
Rep 1	-15.48	-15.49	-28.57
Rep 2	-34.51	-16.22	-45.13
Mean	-26.26	-16.44	-38.38
<b>2 Lbs:</b>			
Rep 1	-39.71	- 7.32	-44.12
Rep 2	-50.79	-33.87	-67.46
Mean	-46.39	-23.08	-58.76
<b>3 Lbs:</b>			
Rep 1	-33.33	-50.00	-66.67
Rep 2	-15.22	-43.59	-52.17
Mean	-23.53	-46.15	-58.82

**Table 7. Mean Percentage of Difference in Herbage Production, Leafy Spurge Stem Density and Weight per Stem of Leafy Spurge for 41 Days and 78 Days after Treatment for the Leafy Spurge Control Trial at Dickinson Experiment Station - 1983**

<b>Herbicide Rate In Lbs Ai/Acres</b>	<b>12 Jul – 22 Aug 41 Days</b>	<b>12 Jul – 28 Sep 78 Days</b>
<b>0 Lbs:</b>		
Herbage Production		
Leafy Spurge	-29.66	-58.02
Grass	+37.58	- 3.93
Stem Density	+19.16	-11.30
Mean Stem Weight	-38.89	-48.15
<b>1 Lbs:</b>		
Herbage Production		
Leafy Spurge	-36.50	-44.72
Grass	+28.03	- 4.99
Stem Density	-11.86	-13.50
Mean Stem Weight	-26.26	-38.38
<b>2 Lbs:</b>		
Herbage Production		
Leafy Spurge	-54.74	-70.49
Grass	- 9.35	-16.76
Stem Density	-15.91	-36.26
Mean Stem Weight	-46.39	-58.76
<b>3 Lbs:</b>		
Herbage Production		
Leafy Spurge	-36.58	-78.51
Grass	+ 7.05	+ 1.06
Stem Density	-41.89	-70.12
Mean Stem Weight	-23.53	-58.82