

Leafy Spurge Control with Chemical and Mechanical Treatments – 1984

Dickinson Experiment Station

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A study to test the effects of chemical and mechanical treatments on leafy spurge (Euphorbia esula) was started in 1984 at the Dickinson Experiment Station. The chemical Picloram (Tordon) at 2 lbs ai / acre (1 gallon of 22K liquid or 100 pounds of 2K granules) has been shown by many scientists to reduce leafy spurge and it is one technique that is accepted and recommended as a good treatment for leafy spurge control. It is not an inexpensive treatment. The mechanical treatment of mowing leafy spurge has been observed to reduce the density of leafy spurge at times. Observations also have been made that spraying picloram on leafy spurge regrowth two weeks after mowing increases the effects of the chemical. These observations of the effects of mowing of leafy spurge need to be tested to determine if mowing has a beneficial detrimental effect on leafy spurge. If this study shows that mowing of leafy spurge can be beneficial or additive to chemical treatments, a follow-up study will be needed to test if the rate of chemical applied can be reduced.

The test plots were established on 0.25 acres located on the NE¹/₄, SE¹/₄, NE¹/₄ Sec. 4, T. 140 N., R. 103 W. on the property of Cecil Adams. The 30 x 22 foot plots were arranged in a randomized block design with two replications. The soil was Havrelon silt loam. The range site was overflow. The vegetation on the site was predominantly leafy spurge with a few scattered plants of silver sage (Artemisia cana) and wolfberry (Symphoricarpos occidentalis) and a thin understory of Kentucky bluegrass (Poa pratensis), prairie sandreed (Calamovilfa longifolia) and needleandthread Stipa comata).

The treatments were: in early June, mowing, mowing plus Tordon, and Tordon; in early July, mowing, mowing plus Tordon and Tordon; and in mid August, Tordon. A control of no treatment was included in each replication. The early June, early July and mid August periods of treatment coincided with pre-flower, post flower (seed development) and early regrowth phenological stages of development for the leafy spurge plants respectively. The mowing treatment was conducted with a sickle bar mower and the herbage was raked off the plots. The chemical treatment was applied at a rate of 2 lbs ai / acre of picloram in the form of 2K granules with a hand held whirlybird spreader.

The data that were collected from these plots were: above ground herbage production, leafy spurge stem densities, and mean weight per leafy spurge stem. The sample dates were: 5 and 19 June, 6 July, 8 August, 6 September and 8 October 1984. Three plants from each plot were dug up on 8 November to determine general condition of the roots.

Data will be collected from these plots with no retreatment for one or two additional years in order to follow the effects of chemical and mechanical treatments on leafy spurge.

No definitive conclusions can be made from these data without knowing the relative survival rate of the leafy spurge plants on each treatment one year after treatment. Several encouraging trends do show up in the data however.

Mowing leafy spurge appeared to have a little effect on the top growth. We do not know yet if this effect is significant. The total herbage production of leafy spurge and the mean weight per stem was reduced considerably. The density of live stems greatly increased for a month after the June mow treatment and then it decreased. All of the stems were dead 125 days after the June mow. The control plots had 17% of the stems still alive on the same sample date which amounted to an 87% reduction in live stems. The July mow treatment had a 98% reduction in live stems 93 days after treatment. A few of the plants on the July mow plots had mature seeds at time of treatment. The mowing treatment should be applied prior to the seed development phenophase. The July mow appeared to stimulate a small amount of additional regrowth over the control. The roots in both mowing treatments were alive but no buds were present on the first 6 inches of root except for a few buds on the roots on one plot of the July mow treatment. The roots on the control plots had numerous healthy buds on the same amount of root. If mowing has detrimental effects on leafy spurge it would probably be more effective to use two annual mowing periods rather than a single application. The first mowing should be in June before the plants start seed development and the second mowing should be of the regrowth in July just prior to peak herbage production to eliminate any possibility of flowering and seed development.

Tordon at 2 lbs ai / acre was effective in killing the top growth of the leafy spurge for the June, July and August application dates. The June treatment had 100% of the stems dead 62 days after treatment. The July treatment had 99.7% stem kill after 93 days and the August treatment had 99.1% kill of the top growth after 62 days. The roots were dead or near dead with decaying on the June and July treatments in early November. The roots on the August Tordon treatment were still alive in early November but no healthy buds were present in the first six inches.

The combination of mowing plus Tordon treatment appeared to have a little more effect on the top growth than the Tordon alone treatment. Both the June and July combination treatments had 100% of the top growth dead 62 days after treatment and no fall regrowth occurred. The roots on these plots were dead and decaying in early November in the first six inches.

Mowing of leafy spurge did have some detrimental effects. It may or may not be significant. Mowing alone may be a better alternative to no treatment in areas of leafy spurge that can be reached with a mower and cost was a factor. Tordon at 2 lbs ai / acre was effective in top growth kill. At this rate, the chemical treatment was not inexpensive and may be a major deterrent of its use. The combination of mowing plus tordon appears to be additive to some degree. Mowing may not have a cost / benefit ratio that would warrant this added expense at the 2 lbs ai / acre rate of chemical. If the rate of chemical could be reduced and still have effective kill with the addition of mowing, the total cost may be reduced.

Leafy Spurge Control by Chemical and Mechanical Treatment in 1984

Location:	NE ¹ / ₄ , SE ¹ / ₄ , NE ¹ / ₄ Sec. 4, T. 140 N., R. 103 W. Property of Cecil Adams
Replications:	Two Randomized Block Design
Study Size:	62' x 178' 0.25 acres
Plot Size:	22' x 30' 0.02 acres
Perimeter Border:	2'
Soil:	Havrelon silt loam
Range Site:	Overflow
Application Rate:	2 lbs ai / acre of Tordon 2K pellets
Application Dates:	Early June – 4 Jun 1984 Early July – 6 Jul 1984 Mid August – 8 Aug 1984
Treatments:	Control Early June Mow Early June Mow + Tordon 2K Early June Tordon 2K Early July Mow Early July Mow + Tordon 2K Early July Tordon 2K Mid August Tordon 2K

Figure 1. Plot Diagram for the Leafy Spurge Control by Chemical and Mechanical Treatment



	1	2	3	4	5	6	7	8
Rep 1	Early July Mow + Tordon 2K	Early July Tordon 2K	Early July Mow	Early June Mow + Tordon 2K	Early June Tordon 2K	Early June Mow	Control	Mid August Tordon 2K
Rep 2	Early June Mow + Tordon 2K	Control	Early June Tordon 2K	Early July Mow + Tordon 2K	Mid August Tordon 2K	Early July Mow	Early June Mow	Early July Tordon 2K

Figure 1. Plot diagram for the leafy spurge control by chemical and mechanical treatment at the Dickinson Experiment Station, 1984.

Table 1. Mean Above Ground Herbage Production in Lbs / Acre for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatments	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
Control:						
Spurge	2234.5	3524.3	3957.8	3635.8	2709.0	2604.6
Grass	12.5	11.6	41.9	0.0	0.0	271.2
Forbs	13.4	0.0	0.0	0.0	0.0	0.0
Shrubs	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2260.3	3535.9	3999.7	3635.8	2709.0	2875.8
Jun Mow:						
Spurge	2459.3	575.3	1475.4	1993.6	564.6	502.2
Grass	36.6	3.6	0.0	29.4	16.1	23.2
Forbs	7.1	0.0	0.0	0.0	0.0	0.0
Shrubs	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2503.0	578.9	1475.4	2023.1	580.7	525.4
Jun Mow + Tordon:						
Spurge	1719.8	431.7	154.3	138.3	161.5	30.3
Grass	17.8	67.8	72.3	88.3	422.8	25.9
Forbs	6.3	0.0	24.1	3.6	0.0	0.0
Shrubs	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	1743.9	499.5	250.7	230.1	584.3	56.2
Jun Tordon:						
Spurge	1949.0	2462.8	885.8	925.0	580.7	796.6
Grass	63.3	10.7	69.6	30.3	0.0	0.9
Forbs	0.0	0.0	0.0	0.0	0.0	0.0
Shrubs	9.8	2.7	26.8	0.0	0.0	0.0
TOTAL	2022.2	2476.2	982.1	955.3	580.7	797.5

Table 1. (Cont.) Mean Above Ground Herbage Production in Lbs / Acre for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatments	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
Jul Mow:						
Spurge	2044.5	2705.4	3282.6	220.3	125.8	82.1
Grass	58.0	11.6	61.6	15.2	27.7	53.5
Forbs	0.0	0.0	0.0	0.0	0.0	0.0
Shrubs	34.8	0.0	92.8	0.0	0.0	0.0
TOTAL	2137.2	2717.0	3436.9	235.5	130.2	135.6
Jul Mow + Tordon:						
Spurge	1621.7	2380.8	2337.0	161.5	24.0	24.1
Grass	100.8	138.3	173.9	32.1	144.5	192.7
Forbs	0.0	0.0	0.0	0.0	0.0	0.0
Shrubs	201.6	15.2	50.0	0.0	0.0	0.0
TOTAL	1924.1	2534.2	2560.9	193.6	167.7	216.8
Jul Tordon:						
Spurge	2326.3	3271.0	2769.7	1670.7	1261.3	1133.7
Grass	6.3	17.0	0.0	2.7	0.0	2.7
Forbs	0.0	0.0	0.0	0.0	0.0	0.0
Shrubs	185.5	0.0	0.0	0.0	0.0	0.0
TOTAL	2518.1	3287.9	2769.7	1673.4	1261.3	1136.4
Aug Tordon:						
Spurge	2154.2	2458.4	3172.0	2058.7	909.0	1179.2
Grass	77.6	75.8	80.3	23.2	37.5	53.5
Forbs	0.9	0.0	0.0	0.0	0.0	0.0
Shrubs	162.4	0.0	5.4	0.0	0.0	0.0
TOTAL	2395.0	2534.2	3257.6	2081.9	946.4	1232.8

Table 2. Mean Leafy Spurge Densities in Stems per Foot Square for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatments	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
Control:						
Seedling	67.5	36.8	0.7	0.2	0.0	0.0
Mature	33.6	33.4	28.5	32.1	21.8	4.5
Regrowth	0.0	0.0	0.0	0.0	0.0	0.1
Dead	0.0	0.0	0.1	1.5	3.8	21.7
Jun Mow:						
Seedling	32.5	23.9	2.7	1.2	0.0	0.0
Mature	38.7	43.5	67.1	46.3	21.6	0.0
Regrowth	0.0	0.0	0.0	0.0	0.0	0.0
Dead	0.0	0.0	0.0	0.0	6.0	32.4
Jun Mow + Tordon:						
Seedling	32.5	43.0	0.1	0.0	0.0	0.0
Mature	25.6	29.0	5.1	0.0	0.0	0.0
Regrowth	0.0	0.0	0.0	0.0	0.0	0.0
Dead	0.0	0.0	5.2	6.6	11.0	1.7
Jun Tordon:						
Seedling	52.0	18.7	0.0	0.0	0.0	0.0
Mature	28.7	40.0	20.7	0.0	0.0	0.0
Regrowth	0.0	0.0	0.0	0.0	0.0	0.0
Dead	0.0	0.0	0.7	20.4	12.1	7.4
Jul Mow:						
Seedling	60.4	39.0	8.1	0.0	0.0	0.0
Mature	31.1	34.6	30.0	17.4	2.3	0.7
Regrowth	0.0	0.0	0.0	0.0	0.0	0.7
Dead	0.0	0.0	0.0	3.8	13.8	8.9
Jul Mow + Tordon:						
Seedling	34.1	81.8	6.6	0.0	0.0	0.0
Mature	25.5	37.9	26.9	13.3	0.0	0.0
Regrowth	0.0	0.0	0.0	0.0	0.0	0.0
Dead	0.0	0.0	0.0	3.5	1.8	2.0
Jul Tordon:						
Seedling	26.5	22.0	0.0	0.0	0.0	0.0
Mature	38.8	38.0	31.3	25.4	2.6	0.1
Regrowth	0.0	0.0	0.0	0.0	0.0	0.0
Dead	0.0	0.0	0.0	3.3	15.3	16.7
Aug Tordon:						
Seedling	24.6	25.3	1.3	0.0	0.0	0.0
Mature	40.8	35.0	31.3	32.5	11.0	0.3
Regrowth	0.0	0.0	0.0	0.0	0.0	0.0
Dead	0.0	0.0	0.0	3.6	11.0	25.6

Table 3. Mean Dry Weight per Stem of Leafy Spurge in Grams for the Leafy Spurge Control by Chemical and Mechanical Treatment at the Dickinson Experiment Station, 1984

Treatment	Grams / Stem					
	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
Control	0.69	1.10	1.44	1.13	1.10	1.07
Jun Mow	0.66	0.14	0.23	0.45	0.22	0.16
Jun Mow + Tordon	0.70	0.16	0.16	0.22	0.15	0.23
Jun Tordon	0.71	0.64	0.43	0.47	0.50	1.11
Jul Mow	0.68	0.80	1.14	0.11	0.08	0.09
Jul Mow + Tordon	0.66	0.75	0.91	0.11	0.14	0.13
Jul Tordon	0.62	0.90	0.92	0.61	0.73	0.72
Aug Tordon	0.55	0.73	1.06	0.59	0.43	0.54

Table 4. Mean Percentage of Difference in Herbage Production from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatment	Days After Treatment					
	0	14	31	62	93	125
Control:						
Spurge		+57.72	+77.13	+62.71	+21.24	+16.57
Grass		- 7.13	+235.71	-100.00	-100.00	+2071.10
Jun Mow:						
Spurge		-76.61	-40.01	-18.93	-77.04	-79.58
Grass		-90.24	- 100.00	-19.50	-56.08	-36.59
Jun Mow + Tordon:						
Spurge		-74.90	-91.03	-91.96	-90.61	-98.24
Grass		+279.99	+304.99	+395.01	+2270.01	+45.01
June Tordon:						
Spurge		+26.36	-54.55	-52.54	-70.21	-59.13
Grass		-83.10	+ 9.87	-52.11	-100.00	-98.59
Jul Mow:						
Spurge			-93.29	-96.17	-97.50	
Grass			-75.37	-55.06	-13.05	
Jul Mow + Tordon:						
Spurge			-93.09	-98.97	-98.97	
Grass			-81.54	-16.92	+10.77	
Jul Tordon:						
Spurge			-39.68	-54.46	-59.07	
Grass			+100.00	0.00	+100.00	
Aug Tordon:						
Spurge			-55.85	-42.72		
Grass			+61.58	+130.79		

Table 5. Mean Percentage of Difference in Mature Leafy Spurge Stem Density from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatment	Days After Treatment					
	0	14	31	62	93	125
Control		- 0.83	-15.19	- 4.42	- 35.08	-86.74
Jun Mow		+12.23	+73.14	+ 19.42	- 44.36	-100.00
Jun Mow + Tordon		+13.45	-80.00	-100.00	-100.00	-100.00
Jun Tordon		+39.16	-27.83	-100.00	-100.00	-100.00
Jul Mow			-42.11	- 92.26	- 97.83	
Jul Mow + Tordon			-50.52	-100.00	-100.00	
Jul Tordon			-18.99	- 91.69	- 99.70	
Aug Tordon			-66.29	- 99.14		

Table 6. Mean Percentage of Difference in Mean Dry Weight per Stem from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatment	Days After Treatment					
	0	14	31	62	93	125
Control		+59.42	+108.70	+63.77	+59.42	+55.07
Jun Mow		-78.79	-65.15	-31.82	-66.67	-75.76
Jun Mow + Tordon		-77.14	-77.14	-68.57	-78.57	-67.14
Jun Tordon		- 9.86	-39.44	-33.80	-29.58	+56.34
Jul Mow			-90.35	-92.98	-92.11	
Jul Mow + Tordon			-87.91	-84.62	-85.71	
Jul Tordon			-33.70	-20.65	-21.74	
Aug Tordon			-27.12	- 8.47		

Table 7. Mean Percentage of Difference in Herbage Production, Leafy Spurge Stem Density and Weight per Stem of Leafy Spurge from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatment	Days After Treatment					
	0	14	31	62	93	125
Control:						
Herbage Production:						
Leafy Spurge		+57.72	+77.13	+62.71	+21.24	+16.57
Grass		- 7.13	+235.71	-100.00	-100.00	+2071.10
Stem Density		- 0.83	-15.19	- 4.42	-35.08	-86.74
Stem Weight		+59.42	+108.70	+63.77	+59.42	+55.07
Jun Mow:						
Herbage Production:						
Leafy Spurge		-76.61	-40.01	-18.93	-77.04	-79.58
Grass		-90.24	-100.00	-19.50	-56.08	-36.59
Stem Density		+12.23	+73.14	+19.42	-44.36	-100.00
Stem Weight		-78.79	-65.15	-31.82	-66.67	-75.76
Jun Mow + Tordon:						
Herbage Production:						
Leafy Spurge		-74.90	-91.03	-91.96	-90.61	-98.24
Grass		+279.99	+304.99	+395.01	+2270.01	+45.01
Stem Density		+13.45	-80.00	-100.00	- 100.00	-100.00
Stem Weight		-77.14	-77.14	-68.57	-78.57	-67.14
Jun Tordon:						
Herbage Production:						
Leafy Spurge		+26.36	-54.55	-52.54	-70.21	-59.13
Grass		-83.10	+9.87	-52.11	-100.00	-98.59
Stem Density		+39.16	-27.83	-100.00	-100.00	-100.00
Stem Weight		- 9.86	-39.44	-33.80	-29.58	+56.34

Table 7. (Cont.) Mean Percentage of Difference in Herbage Production, Leafy Spurge Stem Density and Weight per Stem of Leafy Spurge from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984

Treatment	Days After Treatment					
	0	14	31	62	93	125
Jul Mow:						
Herbage Production:						
Leafy Spurge			-93.29	-96.17	-97.50	
Grass			-75.37	-55.06	-13.05	
Stem Density			-42.11	-92.26	-97.83	
Stem Weight			-90.35	-92.98	-92.11	
Jul Mow + Tordon:						
Herbage Production:						
Leafy Spurge			-93.09	-98.97	-98.97	
Grass			-81.54	-16.92	+10.77	
Stem Density			-50.52	-100.00	-100.00	
Stem Weight			-87.91	-84.62	-85.71	
Jul Tordon:						
Herbage Production:						
Leafy Spurge			-39.68	-54.46	-59.07	
Grass			+100.00	0.00	+100.00	
Stem Density			-18.99	-91.69	-99.70	
Stem Weight			-33.70	-20.65	-21.74	
Aug Tordon:						
Herbage Production:						
Leafy Spurge			-55.85	-42.72		
Grass			+61.58	+130.79		
Stem Density			-66.29	-99.14		
Stem Weight			-27.12	- 8.47		

Table 8. General Condition of Roots for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 8 November 1984

Treatment	Rep 1	Rep 2
Control	Alive, very tough, buds	Alive, tough, buds
June:		
Mow	Alive, tough	Alive, tough
Mow + Tordon	Dead, very decayed	Dead, decaying
Tordon	Dead, very decayed	Near dead, some decay
July:		
Mow	Alive, tough, few buds	Alive, tough
Mow + Tordon	Dead, decaying	Dead, decaying
Tordon	Near dead, some decay	Dead, decaying
August:		
Tordon	Alive	Alive, tough