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*Published by: Department of Agronomy, North Dakota State University, Fargo, ND.*

# Long term management of leafy spurge in pasture and rangeland – year two[1]

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Seven experiments were established around North Dakota in 1980 to evaluate long term leafy spurge management alternatives on pasture and rangeland. All experiments were established in late June and early July 1980 except the fall Valley City experiment which was established in September 1980. The herbicides in the study included 2,4-D, dicamba, picloram liquid (2S) and granular (2%G), and picloram applied using the roller and wick applicators. The conventional broadcast treatments were applied using a tractor mounted sprayer delivering 8 gpa water at 35 psi. A granular applicator was used to apply the picloram 2%G treatments. The roller and wick were adjusted to treat the top one-half of the taller leafy spurge stems. The wick was made of two 0.75 inch PVC pipes, with small holes covered with poly-foam and a 50% cotton:50% polyester canvas material. The additive in the roller and wick treatments was a 5% (v:v) oil concentrate (83% paraffin based petroleum oil plus 15% emulsifier). The plots at each site were 15 by 150 feet and replicated twice in a randomized complete block. Visual evaluations were based on percent stand reduction as compared to the control and were taken in the spring and fall of 1981. In 1981 (Year 2) each plot was divided into six 7.5 by 50 feet subplots for retreatments of 2,4-D, picloram 2S, dicamba or no retreatment. A second experiment was begun at Dickinson in August 1981, since the first experiment was established under atypical application conditions of extreme drought in 1980 and early 1981. Data from Dickinson are reported separately.

Treatment with 2,4-D at 2.0 lb/A did not provide long term leafy spurge control regardless of the 1981 retreatment applied (Table 1). Control in spring 1982 ranged from 45% at the spring Valley City site following a picloram + 2,4-D at 0.25 + 1.0 lb/A retreatment to 0% at Tolna and Minot with no retreatment.

Picloram 2%G at 2.0 lb/A provided 50% or more leafy spurge control at Sheldon and the spring Valley City site when evaluated after 24 months (Table 1). Picloram 2%G at 1.0 lb/A did not provide much long term leafy spurge control except at Sheyenne. Leafy spurge control generally increased 10 to 30% when the picloram 2%G at 1.0 and 2.0 lb/A treatments were retreated the second year with picloram at 0.25 lb/A or picloram + 2,4-D at 0.25 + 1.0 lb/A.

[1] Cooperative investigation of Agronomy and ARS, U.S. Department of Agriculture. Published with the approval of the Agriculture Experiment Station, North Dakota State University, Fargo, ND.

Picloram 2S at 2.0 lb/A without a Year 2 treatment provided 99, 97 and 94% leafy spurge control at Tolna, Sheyenne and Valley City (fall applied), respectively, but only 68 and 41% control at Sheldon and the spring Valley City site, respectively (Table 1). Retreatments of picloram at 0.25 lb/A and dicamba at 2.0 lb/A in 1981 increased the leafy spurge control by 20 to 50% over no retreatment at the Sheldon and spring Valley City sites. Picloram 2S at 1.0 lb/A provided leafy spurge control ranging from 88% at the fall Valley City site to 0% at Tolna and Minot after 24 months. However, fair to good leafy spurge control was maintained at all sites except Sheldon and Valley City (spring applied) with retreatments of dicamba at 2.0 lb/A, picloram at 0.25 lb/A and picloram + 2,4-D at 0.25 1.0 lb/A in 1981. Leafy spurge control with picloram at 1 and 2 lb/A usually was higher when applied as a postemergence liquid spray (picloram 2S) than as a granular treatment (picloram 2%G). These data suggest that foliar uptake and translocation of picloram are important for maximizing leafy spurge control with a given rate of picloram.

The roller application of picloram at 1:7 (v:v) with or without an oil concentrate generally provided poor leafy spurge control after 24 months except at the fall Valley City site (Table 1). No retreatment consistently resulted in improved leafy spurge control compared to the original roller treatment alone. Wick application of picloram at 1:3 (v:v) alone or with an oil concentrate additive did not provide long term leafy spurge control at any site. Retreatments of picloram at 0.25 lb/A in 1981 increased leafy spurge control to 70 and 80% at Tolna and the fall Valley City site, respectively, following an original wick treatment with picloram plus oil concentrate. Leafy spurge control was not increased similarly at the other sites with any follow-up treatment.

Dicamba at 4.0 and 8.0 lb/A was applied at the Tolna and Minot sites with varying results. Dicamba at 4.0 lb/A alone provided fair leafy spurge control at Tolna, if a retreatment was applied (Table 1). Leafy spurge control with dicamba at 8.0 lb/A alone ranged from 75% at Tolna to 0% at Minot and no retreatment provided increased control.

The retreatments applied alone in 1981 (control treatment in 1980) gave varying results. The retreatments of picloram at 0.25 lb/A and picloram + 2,4-D at 0.25 + 1.0 lb/A provided leafy spurge control of 35 and 44%, respectively, on the sandy soil of the Sheyenne National Grasslands, but did not provide good control at any other site. Dicamba at 2.0 lb/A provided 50% control after 12 months at Minot in north central North Dakota, but did not control leafy spurge at any of the eastern sites.

Leafy spurge control at Dickinson for the 1980 experiment was less for most treatments compared to any other site in North Dakota (Table 2). The total precipitation at this site in 1980 was 11.15 inches, a departure from normal of -6.4 inches. Thus the leafy spurge was under poor growing conditions which probably accounts for the reduced control by all treatments except picloram at 1.0 and 2.0 lb/A in 1981. Also, the leafy spurge was too short for adequate treatment when the roller and wick applications were used. A second experiment at Dickinson was started on 24 August 1981. The total precipitation for 1981 was 17.78 inches, a departure from normal of +0.23 inches. The leafy spurge was 16 to 18 inches tall with abundant fall growth during treatment. The dicamba treatment at 4.0 lb/A was increased to 6.0 lb/A, and the roller and wick applications of picloram with an oil concentrate were replaced with a treatment of picloram at 1:5 (v:v) for both applicators.

All treatments for the 1981 experiment at Dickinson gave good to excellent leafy spurge control except 2,4-D at 2.0 lb/A when evaluated in June 1982 (Table 2). The leafy spurge had excellent growing conditions with a cool moist spring and an average rainfall of 1.8 inches above normal. However leafy spurge control at 12 months after treatment decreased rapidly with all treatments except the wick application of picloram at 1:3 (v:v). Picloram 2S at 2.0 lb/A generally provides 90 to 100% leafy spurge control after 12 months but provided 0% control at the Dickinson site. The poor control observed after 12 months could not be attributed to poor moisture conditions in the year of treatment as in the previous experiment. Picloram at 1 and 2 lb/A generally provides good leafy spurge control in that area of the state and the reason for the poor control in this experiment is unknown.

In summary, 2,4-D did not control leafy spurge either as a first year treatment at 2.0 lb/A or as a retreatment at 1.0 lb/A. Picloram 2%G at 2.0 lb/A did not provide good leafy spurge control after 24 months unless a picloram retreatment was applied after one year. Picloram 2S at 2.0 lb/A provided excellent leafy spurge control at most sites after 24 months especially when a retreatment was applied after 12 months. The roller and wick application of picloram provided poorer control than broadcast application. The poor results from these applicators may be due to the generally poor growing conditions of 1980 when many leafy spurge stems were too short for adequate treatment by the wiping applicators. Dicamba at 8.0 lb/A gave fair to poor leafy spurge control and control was not improved by any retreatments evaluated. As retreatments, dicamba at 2.0 lb/A and picloram at 0.25 lb/A with and without 2,4-D provided the best leafy spurge control. Retreatments with dicamba tended to be better in western North Dakota and with picloram tended to be better in eastern North Dakota. The reason for the poor leafy spurge control with all treatments at Dickinson probably can be attributed to poor growing conditions for the 1980 experiment but the cause is not known for the experiment established in 1981.

**Table 1. Leafy spurge control in a long term management study – 2 years after the initial treatment. (Messersmith and Lym).**

| Year one | | | Year two | | Location | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Herbicide | Rate (1lb/A) | Soln[a] conc | Herbicide | Rate (lb/A) | Shey-enne | Shel-don | Valley City spring | Valley City fall | Tolna | Minot | Avg |
| | | | | | (Percent control) | | | | | | |
| 2,4-D(LVE) (broadcast) | 2.0 | 1:15 | 2,4-D(LVE) | 1.0 | 14 | 6 | 16 | 4 | 20 | 0 | 10 |
| | | | Dicamba | 1.0 | 15 | 9 | 5 | 5 | 20 | 0 | 9 |
| | | | Dicamba | 2.0 | 6 | 6 | 15 | 8 | 30 | 0 | 11 |
| | | | Picloram | 0.25 | 40 | 14 | 34 | 16 | 40 | 25 | 28 |
| | | | Picloram 2,4-D | 0.25+1.0 | 31 | 20 | 45 | 17 | 40 | 25 | 30 |
| | | | -------- | ---- | 3 | 1 | 1 | 3 | 0 | 0 | 1 |
| Picloram 2%G (granules) | 1.0 | ---- | 2,4-D(LVE) | 1.0 | 25 | 2 | 13 | 30 | ---- | ---- | 18 |
| | | | Dicamba | 1.0 | 48 | 3 | 11 | 5 | ---- | ---- | 17 |
| | | | Dicamba | 2.0 | 56 | 10 | 39 | 10 | ---- | ---- | 29 |
| | | | Picloram | 0.25 | 53 | 10 | 16 | 45 | ---- | ---- | 31 |
| | | | Picloram 2,4-D | 0.25+1.0 | 45 | 8 | 38 | 51 | ---- | ---- | 36 |
| | | | -------- | ---- | 28 | 4 | 4 | 8 | ---- | ---- | 11 |
| Picloram 2%G (granules) | 2.0 | ---- | 2,4-D(LVE) | 1.0 | 50 | 50 | 88 | 27 | ---- | ---- | 54 |
| | | | Dicamba | 1.0 | 46 | 78 | 85 | 34 | ---- | ---- | 61 |
| | | | Dicamba | 2.0 | 47 | 50 | 88 | 42 | ---- | ---- | 57 |
| | | | Picloram | 0.25 | 71 | 56 | 95 | 52 | ---- | ---- | 69 |
| | | | Picloram 2,4-D | 0.25+1.0 | 82 | 73 | 91 | 24 | ---- | ---- | 68 |
| | | | -------- | ---- | 56 | 70 | 85 | 19 | ---- | ---- | 57 |
| Picloram 2S (broadcast) | 1.0 | 1:15 | 2,4-D(LVE) | 1.0 | 26 | 10 | 23 | 100 | 20 | 0 | 30 |
| | | | Dicamba | 1.0 | 37 | 10 | 26 | 86 | 50 | 70 | 47 |
| | | | Dicamba | 2.0 | 59 | 14 | 39 | 98 | 60 | 90 | 60 |
| | | | Picloram | 0.25 | 69 | 13 | 39 | 82 | 50 | 80 | 56 |
| | | | Picloram 2,4-D | 0.25+1.0 | 45 | 18 | 51 | 94 | 60 | 95 | 61 |
| | | | -------- | ---- | -- | 12 | 45 | 88 | 0 | 0 | 31 |
| Picloram 2S (broadcast) | 2.0 | 1:7 | 2,4-D(LVE) | 1.0 | 95 | 65 | 85 | 93 | 99 | 98 | 89 |
| | | | Dicamba | 1.0 | 92 | 66 | 49 | 98 | 90 | 93 | 81 |
| | | | Dicamba | 2.0 | 96 | 88 | 85 | 96 | 99 | 99 | 94 |
| | | | Picloram | 0.25 | 97 | 86 | 93 | 97 | 90 | 95 | 93 |
| | | | Picloram 2,4-D | 0.25+1.0 | 96 | 62 | 72 | 92 | 99 | 97 | 86 |
| | | | -------- | ---- | 97 | 68 | 41 | 94 | 99 | 85 | 81 |
| Picloram (Roller applied) | ---- | 1:7 | 2,4-D(LVE) | 1.0 | 56 | 10 | 9 | 4 | 10 | 5 | 14 |
| | | | Dicamba | 1.0 | 58 | 11 | 3 | 35 | 10 | 0 | 20 |
| | | | Dicamba | 2.0 | 59 | 17 | 7 | 13 | 0 | 0 | 16 |
| | | | Picloram | 0.25 | 45 | 24 | 24 | 30 | 10 | 35 | 28 |
| | | | Picloram 2,4-D | 0.25+1.0 | 68 | 19 | 14 | 79 | 10 | 5 | 33 |
| | | | -------- | ---- | 41 | 10 | 2 | 56 | 0 | 0 | 18 |

(continued)

**Table 1. Continued (Messersmith and Lym).**

| Year one | | | Year two | | Location | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rate | Soln[a] | | Rate | Shey- | Shel- | Valley City | | | | |
| Herbicide | (lb/A) | conc | Herbicide | (lb/A) | enne | don | spring | fall | Tolna | Minot | Avg |
| | | | | | (Percent control) | | | | | | |
| Picloram oil conc (Roller applied) | --- | 1:7 | 2,4-D(LVE) | 1.0 | 13 | 9 | 8 | 68 | 0 | 0 | 16 |
| | | | Dicamba | 1.0 | 25 | 4 | 7 | 58 | 0 | 0 | 16 |
| | | | Dicamba | 2.0 | 21 | 17 | 9 | 64 | 0 | 25 | 19 |
| | | | Picloram | 0.25 | 43 | 14 | 9 | 80 | 10 | 5 | 27 |
| | | | Picloram 2,4-D | 0.25+1.0 | 44 | 20 | 14 | 88 | 10 | 5 | 30 |
| | | | --- | --- | 11 | 9 | 0 | 83 | 10 | 0 | 119 |
| Picloram (Wick applied) | --- | 1:3 | 2,4-D(LVE) | 1.0 | 9 | 11 | 21 | 2 | 0 | 5 | 8 |
| | | | Dicamba | 1.0 | 9 | 11 | 10 | 8 | 10 | 5 | 9 |
| | | | Dicamba | 2.0 | 2 | 9 | 16 | 10 | 10 | 15 | 10 |
| | | | Picloram | 0.25 | 20 | 34 | 29 | 10 | 0 | 15 | 18 |
| | | | Picloram 2,4-D | 0.25+1.0 | 28 | 15 | 15 | 25 | 10 | 5 | 16 |
| | | | --- | --- | 13 | 10 | 13 | 7 | 0 | 5 | 8 |
| Picloram oil conc (Wick applied) | --- | 1:3 | 2,4-D(LVE) | 1.0 | 7 | 9 | 14 | 16 | 20 | 5 | 12 |
| | | | Dicamba | 1.0 | 5 | 7 | 42 | 43 | 0 | 0 | 16 |
| | | | Dicamba | 2.0 | 18 | 14 | 45 | 34 | 0 | 5 | 19 |
| | | | Picloram | 0.25 | 44 | 20 | 39 | 80 | 70 | 0 | 42 |
| | | | Picloram 2,4-D | 0.25+1.0 | 39 | 27 | 23 | 47 | 40 | 5 | 30 |
| | | | --- | --- | 2 | 5 | 36 | 8 | 20 | 0 | 12 |
| Dicamba 4S (Broadcast) | 4.0 | 1:7 | 2,4-D(LVE) | 1.0 | ---- | ---- | ---- | ---- | 20 | 0 | 10 |
| | | | Dicamba | 1.0 | ---- | ---- | ---- | ---- | 50 | 0 | 25 |
| | | | Dicamba | 2.0 | ---- | ---- | ---- | ---- | 80 | 0 | 40 |
| | | | Picloram | 0.25 | ---- | ---- | ---- | ---- | 40 | 0 | 20 |
| | | | Picloram 2,4-D | 0.25+1.0 | ---- | ---- | ---- | ---- | 60 | 15 | 38 |
| | | | --- | --- | | | | | 20 | 0 | 10 |
| Dicamba 4S (Broadcast) | 8.0 | 1:3 | 2,4-D(LVE) | 1.0 | ---- | ---- | ---- | ---- | 60 | 10 | 35 |
| | | | Dicamba | 1.0 | ---- | ---- | ---- | ---- | 30 | 15 | 23 |
| | | | Dicamba | 2.0 | ---- | ---- | ---- | ---- | 75 | 10 | 43 |
| | | | Picloram | 0.25 | ---- | ---- | ---- | ---- | 80 | 10 | 45 |
| | | | Picloram 2,4-D | 0.25+1.0 | ---- | ---- | ---- | ---- | 50 | 5 | 28 |
| | | | --- | --- | ---- | ---- | ---- | ---- | 75 | 0 | 38 |
| Control | --- | ---- | 2,4-D(LVE) | 1.0 | 2 | 5 | 5 | 1 | 0 | 10 | 12 |
| | | | Dicamba | 1.0 | 0 | 2 | 2 | 7 | 0 | 10 | 14 |
| | | | Dicamba | 2.0 | 2 | 8 | 8 | 5 | 0 | 50 | 12 |
| | | | Picloram | 0.25 | 35 | 7 | 7 | 5 | 10 | 15 | 13 |
| | | | Picloram 2,4-D | 0.25+1.0 | 44 | 10 | 12 | 13 | 20 | 10 | 18 |
| | | | --- | --- | 0 | 0 | 0 | 0 | 0 | 0 | |
| LSD (0.05) | | | | | 26 | 20 | 22 | 29 | 24 | 27 | |

[a] Herbicide:water (v:v).

**Table 2. Leafy spurge control with various treatments at Dickinson, ND with experiments established on 10 July 1980 and 24 August 1981. (Messersmith and Lym).**

| | | | Experiment | | | |
|---|---|---|---|---|---|---|
| | | Soln[a] | 1980 | | 1981 | |
| Treatment | Rate | conc | 25 Aug. 81 | 16 June 82 | 16 June 82 | 9 Sept. 82 |
| | | | (Percent control) | | | |
| 2,4-D(LVE) | 2.0 | 1:15 | 0 | 0 | 13 | 0 |
| Picloram 2S | 1.0 | 1:15 | 87 | 25 | 89 | 5 |
| Picloram 2S | 2.0 | 1:7 | 96 | 72 | 88 | 0 |
| Picloram (Roller) | | 1:7 | 0 | 0 | 78 | 40 |
| Picloram+oil conc (Roller) | | 1:7 | 28 | 0 | -- | -- |
| Picloram (Roller) | | 1:5 | -- | -- | 93 | 60 |
| Picloram (Wick) | | 1:5 | -- | -- | 87 | 50 |
| Picloram (Wick) | | 1:3 | 0 | 0 | 99 | 88 |
| Picloram+oil conc (Wick) | | 1:3 | 30 | 0 | -- | -- |
| Dicamba 4S | 4.0 | 1:7 | 51 | 0 | -- | |
| Dicamba 4S | 6.0 | 1:5 | -- | -- | 70 | 8 |
| Dicamba 4S | 8.0 | 1:3 | 35 | 0 | 80 | 5 |
| LSD (0.05) | | | 38 | 47 | 23 | 43 |

[a] Herbicide:water (v:v).