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## **1982 Summary of research: Low volume herbicide application methods for leafy spurge control**

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Evaluation of the effectiveness of picloram applied using the roller, wick and controlled droplet applicator (CDA) for leafy spurge control continued in 1982. The CDA has been used successfully for leafy spurge control in wooded areas. Picloram at 1:3 (picloram:water, v:v) and picloram plus 2,4-D in water at 1:1:10 (v:v:v) CDA applied in August and September 1981 at two locations resulted in 65 and 100% control of leafy spurge one year after application without visible damage to established trees. Glyphosate applied at 1:1 (v:v) with the CDA also gave excellent control of leafy spurge, but required two treatments of 2,4-D at 1:4 (v:v) during the 1982 growing season to control seedlings. The U.S. Forest Service used the CDA to treat 16 ha of wooded area on the Sheyenne National Grasslands and generally were pleased with the results.

In general, picloram applied using the roller and wick applicator provided similar leafy spurge control to picloram at 1.12 kg/ha broadcast. Fall-applied herbicide treatments with the roller or wick applicators resulted in better leafy spurge control than spring-applied treatments. The most efficient solution concentration was 1:7 to 1:4 (v:v) for the roller and 1:3 to 1:1 (v:v) for the wick applicator; the highest herbicide concentrations are required for dense leafy spurge stands.

Three designs of a pipe-wick applicator were evaluated. The best design consisted of two parallel 1.8 m long bars 0.3 m apart with three interconnecting diagonal bars so each leafy spurge stem was treated by the front, diagonal, and rear bars. Two passes of the diagonal-bar wick with picloram at 1:3 (v:v) resulted in 99% leafy spurge control one year after application. A carpet-wiper applicator, modeled after the design developed by Dr. Jim Dale at the USDA Southern Weed Science Laboratory in Stoneville, MS, was used for the first time in 1982. Initial observations indicate that the carpet-wiper applicator applied the herbicide uniformly, but a clear measure of the leafy spurge control will not be obtained until field evaluations are taken in June 1983.

Picloram residues of 0.27, 0.21 and 0.19 ppm were detected with a soil bioassay from plots treated nine months earlier with picloram using the roller applicator at 1:7, 1:5 and 1:3 (v:v), respectively. The residues were similar to the residues from plots which had received picloram at 2.24 kg/ha broadcast. Preliminary studies using the

<sup>14</sup>C-picloram indicated that up to 70% of the <sup>14</sup>C-picloram translocated from a treated leafy spurge leaf was excreted by the roots into the media. Further, very little <sup>14</sup>C-picloram translocated lower than 45 cm in leafy spurge roots, using plants grown in root boxes, and the <sup>14</sup>C-picloram translocation increased as the application rate (kg/ha) decreased.

Evaluations of the long term management alternatives for leafy spurge control continued at four sites originally established in 1980. The original treatments (Year 1) included 2,4-D, picloram liquid (2S) and granules (2%G) and picloram applied with the roller and wick applicators. In 1981 (Year 2), each plot was divided into six subplots and received retreatments of 2,4-D, picloram 2S, dicamba, or no retreatment. The retreatments were applied again in 1982 (Year 3) and forage yields were obtained from each plot in 1981 and 1982. Economic return was estimated by converting forage production to hay sold at \$53/MT minus the herbicide and application costs.

Forage yield increased for 42 of the 59 leafy spurge control treatments with an average forage increase of 2336 kg/ha for the four best treatments compared to the control. Picloram roller applied at 1:7 (v:v) resulted in the highest forage production of the original treatments at 5194 kg/ha when averaged across all retreatments. The best leafy spurge control was 91% with picloram 2S at 1.12 kg/ha (Year 1) plus dicamba at 2.24 kg/ha (Years 2 and 3) but forage yield was intermediate at 4647 kg/ha for this treatment. Seven of the 59 treatments resulted in positive economic return. The most economical long term treatment was picloram 2S at 0.28 kg/ha (Years 2 and 3) without an original treatment (Year 1) which resulted in 63% leafy spurge control and a net return of \$57/ha after two years.

An experiment to evaluate leafy spurge control from annual applications of picloram at 0.28 to 0.56 kg/ha alone or in combination with 2,4-D at 1.12 to 2.24 kg/ha was established at three sites around North Dakota. Evaluations 12 months after application revealed a trend towards increased leafy spurge control when 2,4-D at 1.12 to 2.24 kg/ha was applied with picloram at 0.28 kg/ha but not for higher picloram rates. Picloram at 0.28, 0.42 and 0.56 kg/ha provided 49, 66 and 74% control, respectively, after two treatments; this control represents an average increase of 23% control compared to evaluations after one treatment.

Several plant growth regulators and herbicides were screened in 1982 for activity on leafy spurge, including acifluorfen, bentazon, chlorflurenol plus dicamba, cytokinin, dikegulac sodium, DPX-T6376, HOE-00661, 2,4-D lithate and SC-0224. Only dikegulac sodium and SC-0224 indicated potential for leafy spurge control. Dikegulac sodium at 0.28 kg/ha or less applied before flowering of leafy spurge stopped stem elongation and caused profuse branching along the main stem. Greenhouse studies indicated that tank-mixing dikegulac sodium with 2,4-D or picloram caused greater injury to leafy spurge than either 2,4-D or picloram alone. Dikegulac sodium activity decreased as the leafy spurge plant matured. Field trials with dikegulac sodium plus 2,4-D or picloram and with SC-0224 were established in 1982, so more reliable evaluations of leafy spurge control will be obtained in 1983. If any of the new broadcast treatments are effective in 1983, then they will be considered for application using low volume application equipment.