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Exudation of picloram by leafy spurge

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Observations of picloram injury symptoms on untreated plants following picloram application to nearby leafy spurge suggested that the herbicide may be released into the soil from the roots of treated plants. In an initial laboratory experiment, up to 70% of the picloram translocated from the treated leaf was exuded into the media.

Laboratory experiments: Experiments were established to more thoroughly examine the process of herbicide exudation. ^{14}C-picloram was used to establish a time course of exudation. Leafy spurge plants were rooted and established from stem cutting of accession 79-MN-008. The cuttings were grown in a peat moss and perlite mixture for 6 weeks. The plants were transferred into a dilute nutrient solution and equilibrated 3 days before treatment. Treatment consisted of an application of approximately 90,000 dpm ^{14}C-picloram to each plant. A 0.1% surfactant solution was applied to the treated leaves before and after the labeled herbicide was applied. Plants were grown for 120 hours before harvest. The nutrient solution was completely changed At 12, 24, 48, 72, and 96 hours. The ^{14}C-picloram in the nutrient solutions was extracted and quantified by liquid scintillation spectroscopy.

An average of 41% of applied ^{14}C-picloram was absorbed by the treated plants. Twenty-four percent of the absorbed ^{14}C-picloram was exuded to the nutrient solution by 120 hours after application. The exudation process began very soon after herbicide application with 3.5% of absorbed picloram detected in the nutrient solution 12 hours after application. Picloram exudation continued throughout the 120-hour experiment, but the maximum rate of exudation occurred between 24 and 48 hours after application.

Field experiments. Experiments were established to determine the effects of plant growth stage, herbicide application rate, and time after treatment on picloram exudation. The field experiments were established at Sheldon and Hunter, ND in the spring of 1984 and were repeated in 1985.

Field experiments were arranged in a randomized, complete block design. The picloram was applied with a pipe-wick applicator to minimize herbicide contact on the soil. Picloram concentrations of 1:1, 1:3, and 1:7 (Tordon 22K:H20, v/v) were used. Applications were made to leafy spurge in the vegetative, flowering, and seed maturation stages of growth. Soil samples were collected at 1, 2, and 3 weeks after application from three depths within the profile (0 to 5, 5 to 10, and 10 to 15 inches). Concentrations of picloram in the soil were determined by sunflower bioassay.

Picloram residues were similar among soil samples taken at 1, 2, and 3 weeks following application. This indicates that picloram exudation in the field was essentially completed within 1 week after application.

The residue levels of picloram detected by bioassay tended to be less for the 10 to 15 inch depth than for the 5 to 10 inch depth (Table 1). The reduced picloram concentration at the lowest depth probably was due to fewer and smaller leafy spurge roots in the lower profile. The amount of exudation was not affected consistently by the plant growth stage at application. However, the rate of herbicide application did affect the total amount of exudation. Usually, the residue levels increased directly with the application rate. The 1:1 rate had the highest residue levels in all depths among all experimental conditions.

Table 1. Picloram concentrations in soil at 5 to 10 and 10 to 15 inch depths after foliar treatment with a pipe-wick applicator, averaged over samples taken 1, 2, and 3 weeks after treatment.

		1984				1985			
		Hunter		Sheldon		Hunter		Sheldon	
Growth stage	Herbicide rate[a]	5-10 inch	10-15 inch	5-10 inch	10-15 inch	5-10 inch	10-15 inch	5-10 inch	10-15 inch
		ppmw picloram							
Veg	1:1	294	344	469	180	332	154	256	284
Veg	1:3	74	116	238	52	280	115	202	129
Veg	1:7	166	202	200	55	230	93	160	151
Flower	1:1	299	231	262	144	365	105	181	232
Flower	1:3	137	139	172	172	443	56	165	189
Flower	1:7	71	84	44	62	318	45	86	111
Seed	1:1	64	282	197	356	438	434	386	148
Seed	1:3	48	236	75	274	395	196	426	156
Seed	1:7	36	235	41	111	257	83	323	154
LSD		95	80	101	107	96	102	120	131

[a] Ratio Tordon 22K:H20, v/v