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The Absence of Glyphosate Residues in Wet Soil and the Adjacent Watercourse after a Forestry Application in New Brunswick

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ABSTRACT

A successful ground application of glyphosate for competition control was made on an 11 ha site planted with white spruce. During the application, monitoring was conducted of the buffer-protected stream before treatment and intensively after treatment. No herbicide was found in the adjacent waters. In addition, samples were taken of water-saturated soil at several locations on the site, frozen, and analyzed for glyphosate. Under the application and weather conditions that prevailed, no glyphosate was detected 24 hours after treatment with a trace amount detected in one replicate sample after 1 year. Warm temperatures at the time of and in the season before the application are thought to explain the fast degradation rate in the water-saturated soil samples.

Keywords: ground application, glyphosate, water and soil monitoring

The application of glyphosate for competition control in conifer plantations 1-3 years after establishment is a common practice in the northeast. Gylphosate is a widely used herbicide that is approved for such use in the North America and elsewhere because of its low toxicity to nontarget species and rapid degradation (Giesy et al. 2000, Williams et al. 2000, Takacs et al. 2002). There are few studies where measurements have been made of potential residues in adjacent watercourses and sources of surface water/soil after an application using industrial methods. We report such a study designed to assess the risk of groundwater contamination under operational conditions. We reasoned that if glyphosate was found in adjacent watercourses and/or persisted in surface waters, additional investigations of this question would be indicated.

Methods

The general approach used was adapted from a protocol from the Oregon Department of Forestry. They tested various procedures to ensure the reliability of sampling, transport, and storage of samples (Dent and Robben 2000). The site was located approximately 50 km from Fredericton, New Brunswick (45.696 N, 65.9257W) and comprised 11.2 ha. It was harvested 5 years before the trial and planted with white spruce in the following year. The topography of this site was rolling with a southwestern grade. It was treated 2 years later than normal and there was dense coverage of competing species. These included trembling aspen *(Populus tremuloides),* white birch *(Betula papyrifera),* pin cherry *(Prunus pensylvanica),* speckled alder *(Alnus rugosa),* and raspberry *(Rubus strigosus).* The buffer was composed of a suppressed understory of balsam fir *(Abies balsamea)* intermixed with a mature/overmature overstory of black spruce *(Picea mariana),* balsam fir *(A. balsamea),* cedar *(Thuja occidentalis),* red maple *(Acer rubrum),* and some white pine *(Pinus strobus).*

The necessary permits were secured from the New Brunswick Department of Environment after review in accordance with the herbicide application policies of JD Irving Limited. After more than 24 hours without rainfall, the site was treated with Vision concentrate (PCP 19899; Monsanto Canada, Winnepeg, MB, Canada) on Sept. 9, 2002. This was done with a model 640B John Deere skidder (Burlington, ON, Canada) that was fitted with a Radiarc nozzle spray attachment (Waldrum Specialities, Inc., Doylestown, PA) and a 1,300-1 water tank mounted over the back wheels. The application rate was 4.7 l/ha of Vision concentrate or 1.67 kg/ha glyphosate; the application took 2.5 hours.

Water collections were taken at three locations along a stream 65 m from the perimeter of the treatment area spaced out along the perimeter of the treatment area. The stream widths at the three sites (A, B, and C) were 2.20, 2.28, and 1.15 m wide, respectively. Mean water depths during the 96-hour sampling after treatment of 11.9 $\pm$ 0.19, 9.6 $\pm$ 0.63, and 12.1 $\pm$ 0.38 cm, respectively; water flows were 0.05, 0.12 $\pm$ 0.06, and 0.16 $\pm$ 0.03 m/second. Water flows were measured with a Global Flow Probe (model FP101; Global Instrumentation, Gold River, CA).

All sample bottles were labeled with a unique code that did not provide information on the identity of the sample. These were triple rinsed at the sample site, with rinse water emptied downstream. While facing upstream, the container was slowly sunk into the main flow of the water column until the lip was just below the surface and filled the container. Samples (100 ml) were immediately put into

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