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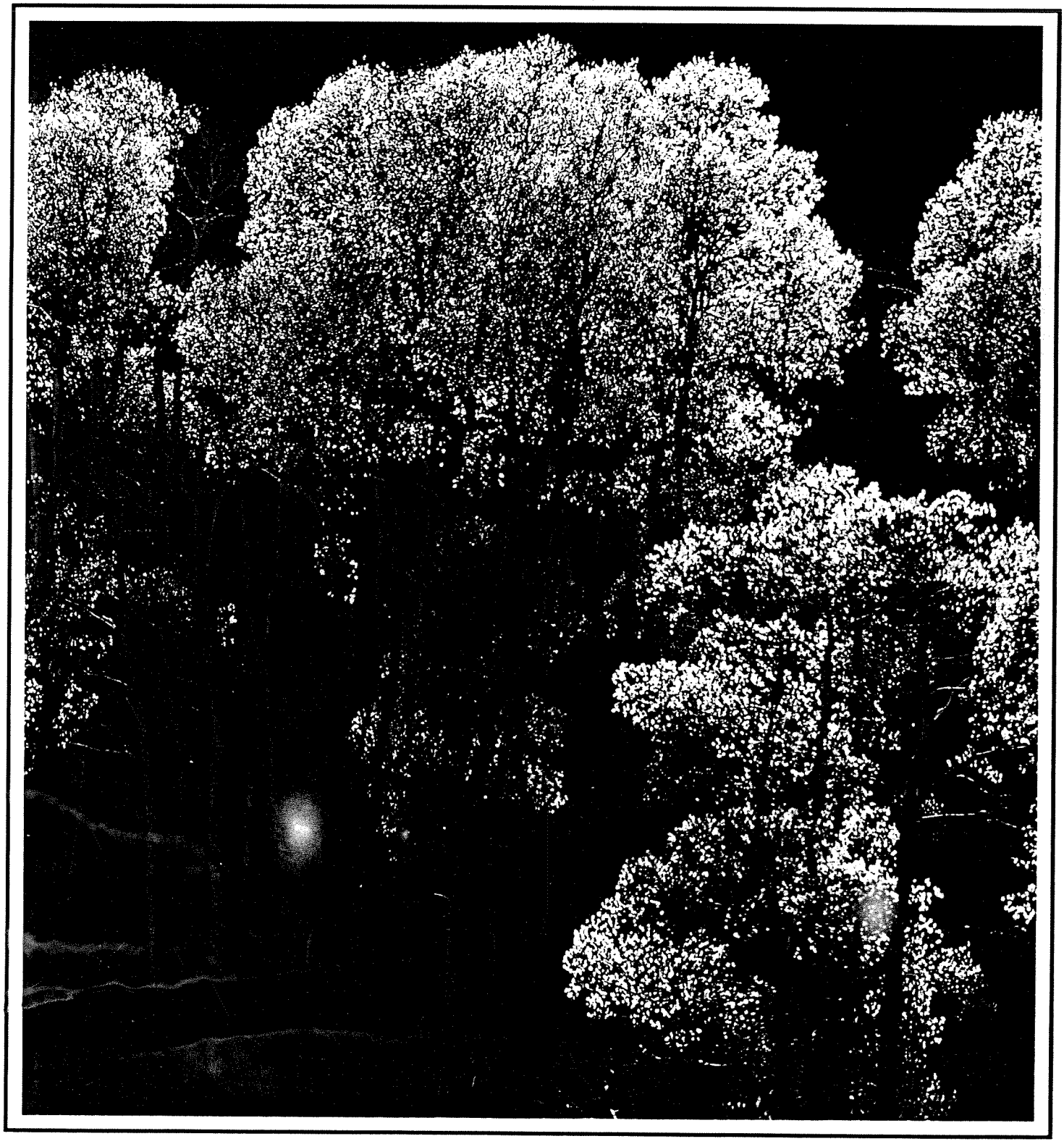

Comparing a Spray Boom to a Roller-Wiper System for a Single-Passenger Four-Wheeler

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The ability of spray booms and carpet-covered roller-wipers mounted on four-wheelers to apply herbicides on pine planting sites was tested with the following treatments: spray boom application of 0.31 kg (0.69 lb) acid equivalent glyphosate with 0.08 kg (0.18 lb) active ingredient sulfometuron in 215 liters of water/ha (23 gallons/acre) and roller-wiping the vegetation with a solution of 1% glyphosate and 0.1% sulfometuron in water. Both application methods controlled herbaceous plants, but the spray boom was more effective than the roller-wiper: weed control averaged 94% on sprayed plots and 63% on wiped plots compared to untreated controls. Apparently, unless modified, the roller assembly is not a practical alternative to the spray boom unless drift must be kept minimal. Tree Planters' Notes 43(2):36–38; 1992.

Single-passenger four-wheelers can be used to apply herbicides on forest sites. The driver can spot-treat with a spray gun or granular applicator to avoid broadcasting the herbicide. However, broadcast or banded applications of herbicides over or between rows of planted seedlings may be a better option than spot treatments.

Sponge bar, roller-wiper, or spray boom systems can be used to broadcast or band herbicides. Wiping places the herbicide more selectively than spraying and reduces drift because small droplets are not formed. Almost no off-site movement of the herbicide should occur with wiping if the herbicide is nonvolatile and adsorbed readily in the soil. One widely used herbicide that meets these criteria is glyphosate—N-(phosphonomethyl)glycine.

A small-scale herbicide application system designed to be mounted on a single-passenger four-wheeler might include either a spray boom or a roller-wiper. Because of the important need to find herbicide applications that minimize drift, we compared the field performance of a 6-foot spray boom mounted with five fan nozzles to that of a carpet-covered roller-wiper for controlling established herbaceous vegetation prior to planting pine seedlings.

Methods

Study site and equipment calibration. The study was done in Rapides Parish, Louisiana, on a site where herbaceous weed control was needed before outplanting. The vegetation was primarily bluestem (*Andropogon* spp. and *Schizachyrium* spp.) and panicum (*Panicum* spp. and *Dichanthelium* spp.) grasses, pinehill beakrush (*Rhynchospora globularis* (Chapm.) Small), eupatoriums (*Eupatorium* spp.), sunflowers (*Helianthus* spp.), catclaw sensitive brier (*Schrankia uncinata* Willd), asters (*Aster* spp.), blackberry (*Rubus* spp.), and Japanese honeysuckle (*Lonicera japonica* Thunb.).

Before treatment, the spray boom was calibrated to determine the actual spray swath and flow rate through the fan nozzles. Boom height was adjusted to ensure proper overlapping coverage between nozzles, and the five nozzles were evenly spaced 0.45 m (1.5 feet) apart along the boom. Total spray swath was 2.3 m (7.6 feet), and the flow rate through the five fan nozzles was 2.3 liters (0.6 gallons) per min. For the roller-wiper treatment, actual dosage depended on the degree of contact with the vegetation. The roller-wiper was 1.2 m (4 feet) wide (figure 1).

Treatments. Five blocks of three 20-m-long (66-foot) and 2.4-m-wide (8-foot) plots were established in a randomized complete block design (5 blocks × 3 treatments). Blocking was based on drainage and changes in species composition of the vegetation. There was a 2.4-m (8-foot) buffer between plots within and between blocks.

We tested the following treatments:

1. Untreated controls
2. Spray boom application of 0.31 kg (0.69 lb) acid equivalent glyphosate with 0.08 kg (0.18 lb) active ingredient sulfometuron—2-[[[(4,6-dimethyl-2-pyrimidinyl)amino] carbonyl]amino]sulfonyl]benzoic acid—in 215 liters water/ha (23 gallons/acre)

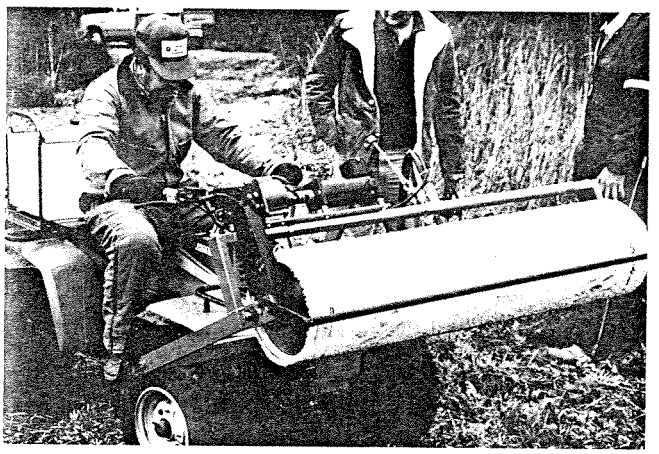

Figure 1—*Single-passenger four-wheeler mounted with a carpet-covered roller-wiper assembly. An electric motor turns the drum during application, and the chemical is added from a drip pipe mounted above the roller. The tank is mounted on the rear of the four-wheeler.*

3. Roller-wiping of the vegetation with a solution of 1% glyphosate and 0.1% sulfometuron in water (figure 1).

The herbicide compositions in treatments 2 and 3 are identical. We present the component amounts in different formats because the exact rate used in treatment 3 (roller-wiper) depended on the amount of contact between the roller-wiper and the vegetation itself. The chemicals were applied on May 1, 1990.

Treatments 2 and 3 involved a single pass over the entire length of the plot. The spray boom and roller applications began at 7:15 am and ended at 8:05 am. The wind was calm and there was no rain that day.

Side test. During treatments with the roller-wiper, it became apparent that the system needed a monitoring device to determine the saturation of the roller. As designed, the carpet roller had to be infused with a steady flow of herbicide solution and subsequently, the roller unexpectedly used more liquid per acre than the spray boom did. An additional trial was carried out to determine how long the roller would hold sufficient residual herbicide to control weeds adequately once the pump was stopped and no more chemical was added to the roller. The roller mechanism was continuously rotated in the side test, and a continuous transit was made over vegetation and terrain similar to that found in the formal study.

Measurements and data analysis. On June 7, 1990, the percentage of vegetation control was estimated for each plot. These percentages were based on the reduction in plant cover between the treated band and adjacent untreated vegetation. The determinations were made beginning at 0.9 m (3 feet) from the end of the plot and then every 1.8 m (6 feet) for the 20.1-m (66-foot) length of the plot. The 11 sample points (in size 1.03 m^2 or .00025 acre) per plot were averaged, and the plot averages were compared by analysis of variance ($P < 0.05$) and orthogonal comparisons of 1. untreated check versus spray boom + roller-wiper and 2. spray boom versus roller-wiper.

Results and Discussion

Both application methods controlled the vegetation, but the spray boom was more effective than the roller-wiper (table 1). On the sprayed plots, weed control averaged 94% (reduction in weeds compared to controls) and ranged from 89 to 97% across blocks. On the wiped plots, weed control averaged 63% and ranged from 11 to 85% across blocks.

The wide range in weed control on the wiped plots occurred because the roller did not contact enough of the vegetation when the terrain changed slightly, causing the roller to kick up on one side or to pass above the vegetation. Also, the roller-wiper often did not come into contact with vegetation that was shielded by the taller grasses as the roller pushed the grass over. This was a serious problem later in the season as these escaped plants developed.

A flexible roller or a jointed and flexible roller assembly might increase contact with the vegetation by allowing the roller to move down as the terrain changes. Mowing the cover or treating the plant cover earlier in the growing season, while the vegetation is shorter, might increase contact as well.

The roller treatment created a narrower band of controlled vegetation than the spray boom treatment did. Roller-wiping resulted in about a 1.2-m-wide (4-foot) band and spraying resulted in a 2.1-m-wide (7-foot) band of effectively controlled vegetation.

Table 1—*Percentage of herbaceous plants (weeds) killed by spray boom and roller-wiper application of glyphosate and sulfometuron, by blocks (#1–5)*

	% Reduction in herbaceous plants*					
Treatments	#1	#2	#3	#4	#5	Mean
Untreated controls	0	0	0	0	0	0
Spray boom	97	94	89	94	95	94
Roller-wiper	11	85	71	69	81	63

*Compared to untreated controls.

The spray boom treatment therefore increased production by 75% over the roller treatment. However, a 2.1-m (7-foot) swath may be no more desirable than a 1.2-m (4-foot) swath when herbicide use is limited to narrow bands in which the seedlings will eventually be planted rather than broadcast over the whole site.

The side-test. In the informal side-test, weed control began to decrease after 18.3 m (60 feet) of transit once the pump was stopped and the rotating drum was no longer infused with a steady flow of herbicide solution. About 50% control was obtained for a distance of 60.9 m (200 feet). By the time the four-wheeler had gone 100.6 m (330 feet), weed control was only 30%. No weed control was apparent after 140 m (460 feet).

Conclusions

The roller treatment controlled the contacted vegetation even though a low concentration of herbicide solution was used. The problem with the roller-wiper was its inability to contact enough vegetation because the wiper rode over plants when the four-wheeler was not level and overlapping plants often shielded others from contact. Without modifications, the roller assembly is not a practical alternative to the spray boom unless drift must be minimal. For example, drift control is especially important near property lines and near sensitive areas within a property.