



HARVESTER-MOUNTED HERBICIDE APPLICATORS

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INTRODUCTION

Boreal mixedwood stands often regenerate to aspen and birch, even when the majority of the original stand was coniferous. Aerial spraying of herbicide can reduce hardwood regeneration, but the public has expressed concerns over this practice. Applying herbicide directly to the stump during harvesting is one alternative with several potential advantages: it should decrease or eliminate the need for broadcast spraying, reduce the total amount of herbicide used (and thus the application cost), and allow the application of herbicides only where needed. As well, stump application may be a suitable technique for use with other products such as biocontrol agents (e.g., *Chondrostereum purpureum*) and urea.

To prevent prolific sprouting and suckering, the herbicide must reach the cambial layer of a *freshly cut* stump; this timing is difficult to achieve in a follow-up manual operation, and finding stumps on sites with heavy underbrush is problematic. To reduce worker exposure to the herbicide and to avoid a costly manual operation, the cut-stump treatment is best integrated with the felling operation. In 1992, Avenor Inc. (now Bowater Pulp and Paper Canada Inc., Thunder Bay, Ont.) and the Northwestern Ontario Science and Technology Unit of the Ontario Ministry of Natural Resources developed a prototype applicator suitable for simultaneous harvesting and stump spraying. Although the initial trials showed promise at controlling sprouting (Hollstedt 1995), further development was required to better position the nozzles and synchronize the application with the felling cycle. In 1995, FERIC was asked to bring the concept to an operational stage and subsequently refined the design based on analysis of slow-motion video and film of the spraying action.

HERBICIDE APPLICATORS FOR FELLER-BUNCHERS

In the U.S., two known sprayers are mounted on feller-bunchers. Vidrine and Adams (1993) reported on a device for applying herbicide to the stumps of undesirable hardwoods during the operation of a shear-head feller-buncher, and the USDA Forest Service has developed a device for applying fungicide to stumps with a saw-head feller-buncher (USDA 1994). In both cases, however, the operator must spray the stump while holding the cut tree in the felling head, resulting in a loss of productivity.

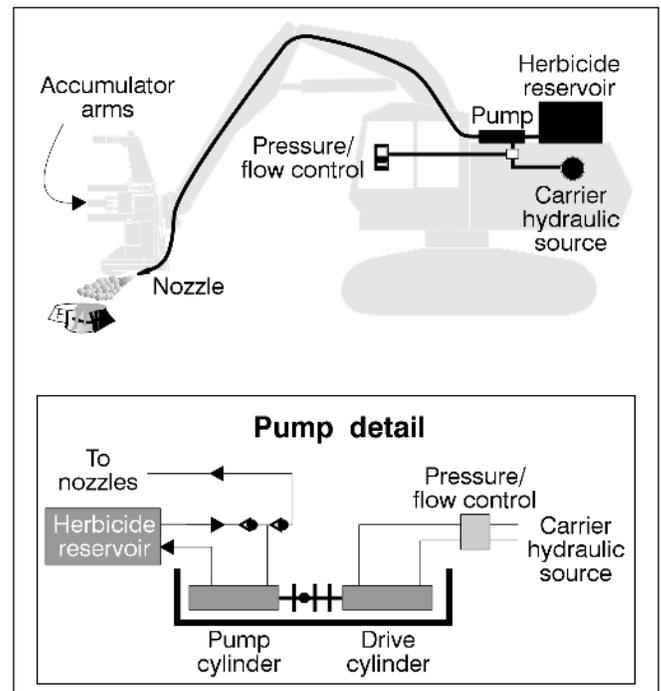


Figure 1. The Avenor-FERIC feller-buncher sprayer.

One principal design criterion for the Avenor-FERIC sprayer was to automate the spraying and thereby reduce the need for operator input, with its corresponding productivity loss. The applicator is powered by the machine's hydraulics and activation of the accumulator arms triggers the spraying. The pump uses two hydraulic cylinders mounted in a bracket; one cylinder connects to the hydraulic system and drives the second cylinder, which pumps the herbicide (Figure 1). A control box in the cab regulates the hydraulic pressure and flow. Two nozzles with check valves, nested inside the felling head's skids on each side of the saw blade, direct the spray directly onto the stump. An on/off switch lets the operator spray only the desired stumps and a variable delay matches the spray timing to the position of the harvesting head over the stump so operators can harmonize the spraying with their felling style. The quantity of herbicide sprayed (20 to 400 mL) can also be adjusted from the control box by varying the length of the spraying time.

FERIC, Avenor Inc., and Midwest Logging Contracting tested the redesigned system in fall 1996 on a Koehring feller-buncher working west of Thunder Bay (Ont.). Installation of the system took about 4 hours and required the services of a mechanic and a welder. Colored water was used to permit visual assessment of the application during this test. The full stroke of the pump cylinder was used, and sprayed approximately 390 mL/stump. It took about an hour to establish an ideal setup for the operator, after which the application was very consistent. However, the system was tested with a far greater amount of liquid than necessary and trials to fine-tune the spray rate are pending.

HERBICIDE APPLICATORS FOR SINGLE-GRIP HARVESTERS

Although no herbicide applicators are manufactured specifically for single-grip harvester heads, several Nordic manufacturers have developed sprayers for applying urea and stump-rotting agents during commercial thinning operations (Frohm and Thor 1993). The only model currently available in Canada is the Droppen R-500 (Figure 2), available from Silvana Import Trading Inc. On this model, a small nozzle within the saw bar's mounting plate delivers liquid to the cut surface as the chain saw fells the tree. An electrically controlled cylinder pumps the liquid, and a control device in the cab permits changes to the volume and duration of the spray. The device has not been tested in Canada, but could be used for herbicide application by single-grip harvesters.



Figure 2. The operator of a Valmet 701 harvester demonstrating the spray (white) produced by the Droppen R-500 sprayer.

SUMMARY

The Avenor-FERIC and Droppen applicators are available for the most common harvesters in eastern Canada (i.e., circular-saw feller-bunchers and single-grip harvesters with chain saw heads). Further trials are planned to test the long-term reliability and operational feasibility of the feller-buncher sprayer. More studies are also required to determine the optimal volume and concentration of herbicide required to achieve acceptable coverage of the cut surface and control of sprouting.

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