Microspray Applicator and Enclosure for Administering Chemicals to Plants

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In our research on producing herbicide-tolerant hybrid poplars through somaclonal variation in microculture (Michler and Bauer, 1987; Michler and Bauer, 1988; Michler and Haissig, 1988), we had to test herbicide-tolerant plants in the greenhouse by spraying small volumes of herbicide on them. To do this, we needed an accurate, small-volume spray applicator. It was necessary to apply volumes of 10^-5 liters to single immature trees at concentrations equal to field dosages. Other available small-volume spray applicators did not allow for application of single-tree dosages (McWhorter et al., 1988).

The maximum plant size for efficient application with minimal drift was 15 to 18 cm or less crown diameter, sprayed from a maximum distance of 76 cm.

We developed a suitable applicator by retrofitting a Sigma Spray Unit that produced a fine mist spray from an aerosol propellant system (Fig. 1). The propellant was nonflammable, but contained chlorofluorocarbons and had to be used in a well-ventilated area. Replicated tests showed the aerosol was non-toxic to the hybrid poplars used in our research (Michler and Bauer, 1988). The commercial sprayer was modified by detaching the bottle from the spray unit, shortening the feed tube to the sprayer to 3.5 cm, and attaching a flexible latex rubber hose, 11 cm long, 3.2 mm i.d., to the feed tube (Fig. 1, left). The rubber tube was then taped to the side of the spray head for easy loading of spray mixtures. The aerosol was fed into the rubber tube with an attached 1-ml glass disposable syringe calibrated in 0.01-ml increments. Herbicide was then uniformly applied to each plant by dispensing the liquid with four short bursts of aerosol through the tube.

Test plants were placed in a large cardboard box lined with a commercial plastic 75-liter garbage bag (Fig. 1, right). A sheet of cardboard with the same dimensions as the bottom of the box was placed inside the plastic bag to support the bag in an open position. The box was placed at a 45° angle on a greenhouse bench. The plant was supported in an inclined position by a plastic bag filled with potting mix to allow the spray to be directed into the container at a slightly downward angle to prevent liquid aerosol from mixing with the herbicide, which can occur if aerosol cans are tilted too far. Safe cleanup simply required removing the plastic liner bag from the box and discarding it. Hazardous chemicals that require special disposal may require additional decontaminating procedures.

Because of its accuracy, this unit could be used to spray isolated plant parts. Intact leaves, fruits, flowers, or other plant organs could be isolated and sprayed for physiological studies of translocation, susceptibility to disease pathogens (Weir et al., 1987), and efficacy of chemicals.

This microspray applicator was economical. The Sigma Spray unit, without replacement aerosol refills, cost $11.00. The average cost was about $0.01 per herbicide application. The cost decreased after extended use because the only additional expense was aerosol refill cans. Compressed air containers may be substituted for chlorofluorocarbon aerosol to reduce environmental hazards.

This small-volume spray applicator could be useful in the greenhouse and field for various plant sciences.

Literature Cited


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Fig. 1. (left) Microspray applicator consisting of (a) shortened feed tube, (b) sprayer head, (c) latex hose, (d) 1-ml glass syringe. (right) Simple enclosure for microspray application consisting of a plastic bag liner, cardboard box, cardboard support, plant support, and box support.