# Applicator for Liquid Nematicides in Research Plots[1]

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An improved four-row liquid-nematicide applicator for research plots was designed and constructed. Advantages of the new design are: (i) the operator is not exposed to chemicals; (ii) changes of chemicals and rates are quickly accomplished, saving time and labor, and allowing for more versatile plot design; and (iii) the metering device provides a more accurate application rate. The unit, which is transported on an equipment trailer pulled by a 0.454t (0.5-ton) pickup truck, can be attached to most farm tractors (Fig. 1).

The basic frame of the nematicide applicator was made from two 5.72 cm × 5.72-cm (2.25 × 2.25-in.) solid tool bars on 50.8-cm (20-in.) centers, connected by four tool-bar extension clamps. A three-point hitch and holding bracket for a 7.59-$m^3$ (224-$ft^3$) oxygen cylinder was attached to the front tool bar (Fig. 2). Injection knives, gauge wheels, and control valves were mounted on the rear tool bar. The injection knives (1) cut into the side of the bed and minimized moisture loss; thus the seedbed remained firm, with minimum loss of fumigant to the atmosphere (2). The injector knives were easily removed, which permitted the use of one or two knives per row and plots one to four rows wide.

The flow diagram (Fig. 3) illustrates the flow of air and liquid nematicide through the system and also equipment used to hold, control, and meter the nematicides. A two-stage oxygen regulator maintained a constant air pressure from the compressed oxygen cylinder to seven nematicide containers (Fig. 2). Cut-off and pressure relief valves in the pressure line prevented excess pressures that could damage the system.

The nematicide containers were made from 11.36-liter (3-gal) stainless steel sprayer cans. The plunger for hand-pressurizing the sprayer can was removed, and a stainless steel patch was welded over the opening. The original outlet tube in the container was replaced with a stainless steel tube. A stainless steel pressure inlet tube, 2.54-cm (1.0 in.) long × 0.317 cm (0.125-in.) OD was welded into the top of the sprayer can opposite the outlet tube. The male connection of a stainless steel, quick-coupler was attached to the end of each air inlet and liquid outlet tube. Pressure was supplied to the inlet of the nematicide container through 0.635-cm (0.25-in.) OD polyethylene tubing with a female quick-coupler attached to one end for rapid changing of nematicide containers.

Pressurized nematicides flowed through 0.635-cm (0.25-in.) OD polyethylene tubing, a 90-$\mu$m (pore-size) filter, the manifold, and the needle valves (Fig. 3). Filters were used to insure a residue-free nematicide supply through the small needle valves. Three quarter-turn valves were used to control the direction of the flow of nematicides to all or part of the metering manifold. Two separate metering systems are available when valve A (Fig. 3) is closed, allowing two nematicides to be applied simultaneously. The application of one nematicide through all eight valves is possible by opening valve A and closing either valve B or C and opening the other. The use of valves A, B, and C, and the combination possible with the injector knives, permitted the use of a variety of plot sizes and treatments.

The eight adjustable needle valves for metering the nematicide (Fig. 4) were adjusted by a micrometer dial connected to the stem of the needle. The micrometer dial was divided into 25 divisions per revolution with 10 revolutions from a closed to a completely open position. The metered nematicide then flowed through 0.317 cm (0.125 in.) OD polyethylene tubing to the injection knives. All connections, control valves, and metering valves were made of type 316 stainless steel to minimize chemical corrosion.

Data were obtained from 12 test runs to determine the accuracy and variability of the system. The eight micrometer needle valves on the nematicide applicator were set to deliver 50 ml of water each. After each test run, the micrometer dial was rotated and reset to the original setting. The coefficient of variability (C.V.) for this test was 5%. A similar test with eight disk type orifices gave a C.V. of 15%.

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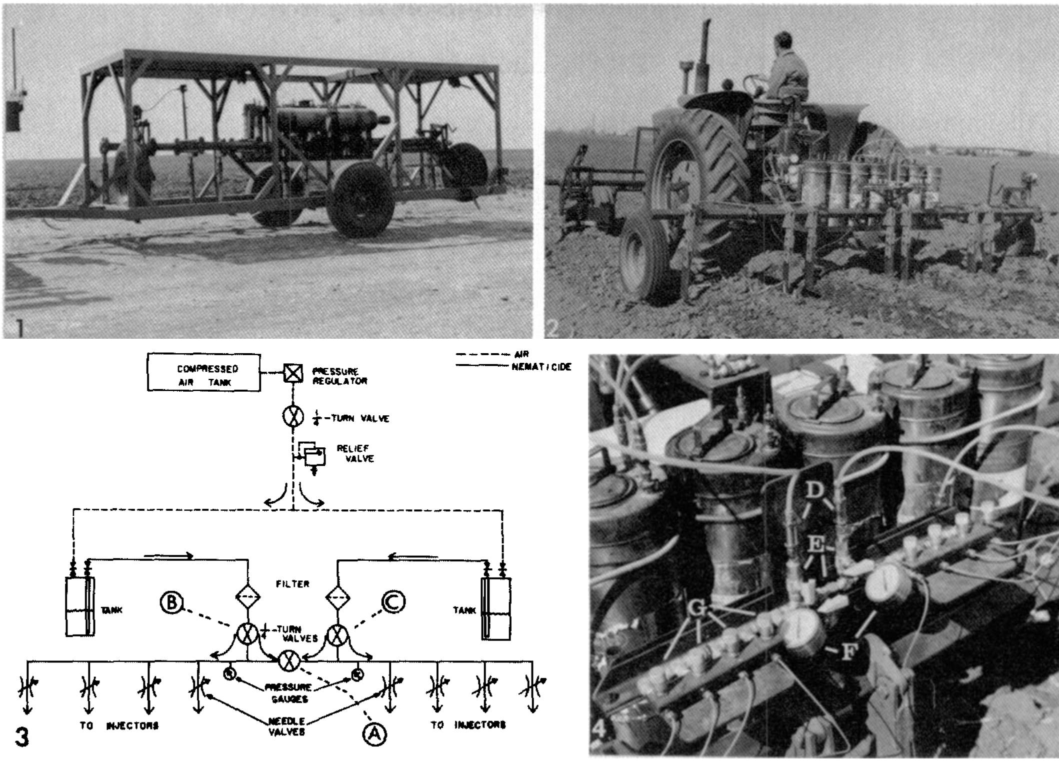


FIG. 1-4. Liquid nematicide applicator for research plots: **1**) Applicator loaded for transport; **2**) Applicator in operation, note injection knives cutting into side of bed; 3) Flow diagram for applicator; **4**) Filter (D), control valves (E), pressure gauges (F), and needle valves (G), used to control liquid nematicide.

Flow rates through the needle valves can be varied from 30 to 500 ml/min. With selected ground speeds and pressures, an application rate of 4.67 to 467 liter/ha (0.5 to 50 gal/acre) can be accurately applied with a high degree of repeatability.

The pressure regulator, pressure control valves, and metering system are easily removed to avoid damage to the applicator while being loaded and transported. A speedometer mounted on the right gauge wheel avoided the need to calibrate the tractor speed each time the applicator was mounted on a different tractor.

## LITERATURE CITED

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