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# PORTABLE TRIPOD-MOUNTED BOOM SPRAYER
## for applying herbicides on tall shrubs

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A tripod-supported boom sprayer was developed and used to spray herbicides on shrubs up to 15 feet tall on experimental plots where use of other spray equipment was not feasible. A pneumatic pressurized sprayer with 10 diaphragm nozzles, geometrically spaced along the outer 20 feet (6.1 m) of a 25-foot (7.6-m) boom, distributed the spray uniformly. Brush leaves were well covered with droplets of relatively uniform size at low dosages. The volume of spray applied per acre could be readily changed from plot to plot by varying the number of revolutions of the boom over the circular plot. Each revolution of the boom applied either 1 or 2.5 gallons per acre, depending upon the size of nozzle orifice and spraying pressure used.

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For spraying chemicals on small test plots, the technique to be used must produce a uniform and reproducible spray pattern. In addition, it must simulate the treatments on large-scale operational spray jobs. Such jobs are usually done by aircraft. To obtain such effects on a small test plot, low-volume foliar sprays are commonly applied from a boom mounted on a moving vehicle[1] or one which is hand-carried across the plot. This technique is adaptable for applying a spray uniformly on stands of low growing vegetation on relatively smooth terrain, or on denser and taller vegetation where trails can be built for easy movement of a vehicle.[2]

Specially designed equipment is required, however, for controlled applications over tall brush wherever construction of adequate trails is not feasible. For spraying over shrubs and trees of variable height in the forests of Puerto Rico, personnel of the U. S. Agriculture Research Service designed a portable boom-jet sprayer, mounted at the top of a telescoping pole.[3] This method allowed spraying a circular plot around a fixed center point.

To obtain uniform spray coverage over a circular plot, we developed a rotating boom sprayer, mounted on a relatively lightweight aluminum tripod (*fig. 1*). This sprayer was used to spray shrubby vegetation, up to 15 feet tall, on hundreds of plots at several locations in California and Hawaii. In designing the boom sprayer, we wanted even distribution of relatively uniform-sized droplets and the capability of quickly adjusting total volume of spray material from 1 to 10 gallons per acre.

### DESIGN

These requirements could not be met by a revolving boom-jet sprayer, but were fulfilled by geo-

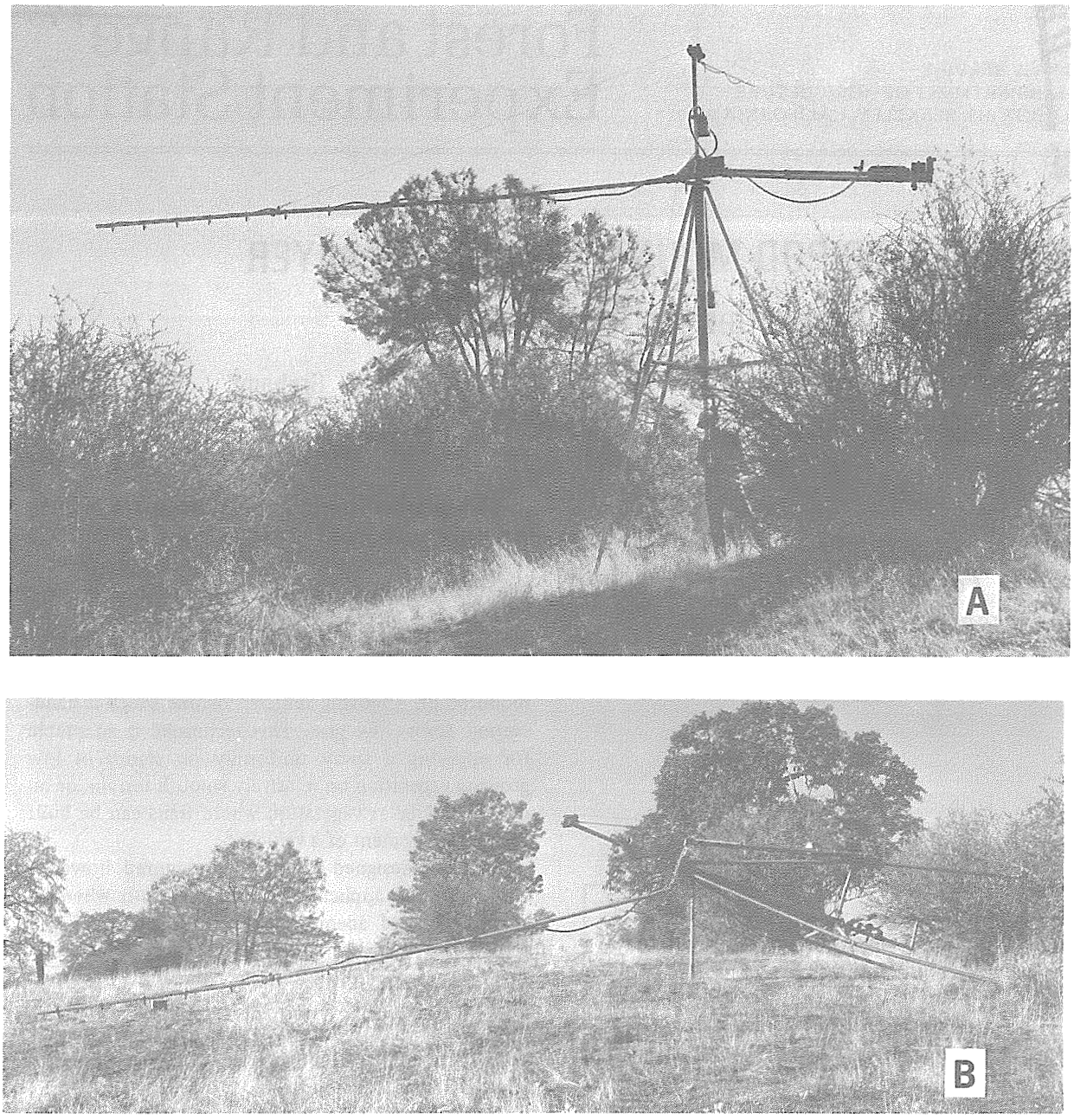


**Figure 1**—The tripod-mounted sprayer stands 15 feet high and has a counter-balanced 25-foot boom (A). It is placed in horizontal position for servicing (B).

metrically spacing 10 spray nozzles along the outer 20 feet (6.1 m) of a 25-foot (7.6-m) long rotating boom (*fig. 1A, B*). The nozzles rotated over a doughnut-shaped plot of 1885 square feet—0.043 acre—leaving an unsprayed hole of 10-foot diameter around the tripod. Initial spacings of the 10 nozzles were calculated from a formula, with each nozzle located to cover a concentric band which represented 10 percent of the total plot area. Actual delivery from each nozzle was measured under the centrifugal force generated during rotation of the boom at a standard speed. Nozzle locations were then shifted

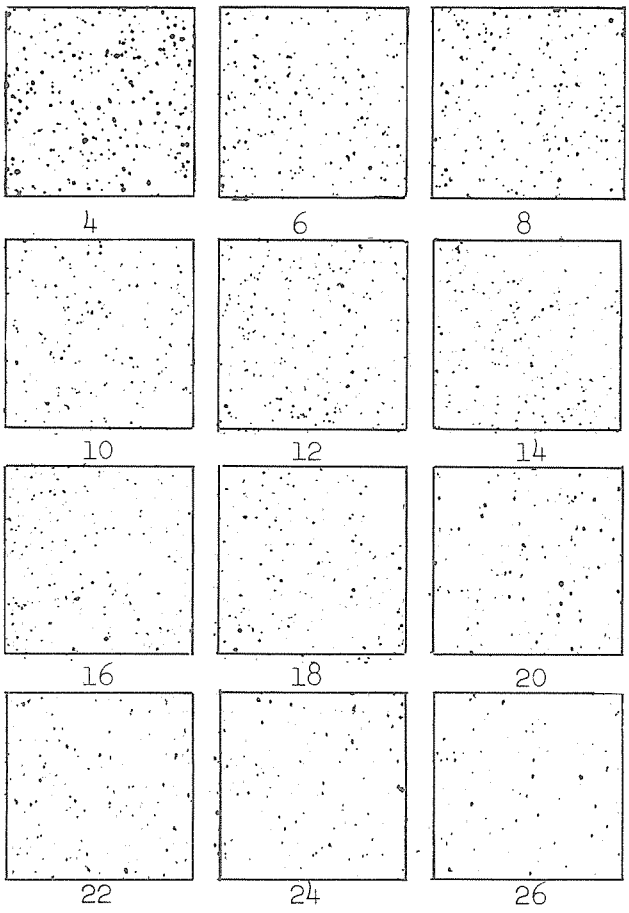


Figure 2—Spray pattern on 1-inch squares from applications of 1 gallon per acre at 2-foot intervals along the radius of the 50-foot-diameter (1885 square foot) sample plot.

slightly to match areas being sprayed with the delivery rates.

## SPRAY PATTERNS

Spray delivery from the boom was calibrated with 10 tee-jet nozzles (No. 800067) to deliver 1 gallon per acre from a single boom rotation at the standard speed of about 5 seconds per revolution. This nozzle size produced a theoretical droplet-size range of 200 to 800 microns, and it gave a coverage of 72 or more droplets per square inch of leaf surface at the minimum application volume of 1 gallon per acre.[4] In tests of 1, 3, and 5 gallons per acre, the desired volumes were obtained by one, three, or five revolutions of the boom. In other tests of 5- and 10-gallon volumes, using No. 8002 nozzles, the volumes were obtained from either two- or four-boom revolutions after suitable spray pressure adjustments (*figs. 2, 3*).

The patterns of spray were recorded by the technique described by Graham.[5] Any effects of wind movement could be avoided fairly well by spraying a plot during periods of 10 to 30 seconds when wind movement was minimal. The actual spraying was carefully observed, and observations about spray drift were recorded. For plots where the spray had drifted materially, the boundaries were adjusted after the spray effects became visible so that the plot included only the properly sprayed area.

## SPRAY OPERATION

For servicing, the tripod was placed in a near-horizontal position with the boom folded outward (*fig. 1B*). The spray-solution container on the mast (*fig. 1A*) was pressurized, and the spray boom was charged. After the tripod and boom had been hoisted into operating position (*fig. 1A*), the cylinder of nitrogen gas used to supply uniform pressure within the system also served as a counterbalance for the long boom. The boom was manually rotated by turning a short crank at the lower end of a central rotating shaft. Speed of rotation was timed until the proper speed became constant.

To begin spraying, a spring-loaded cam was manually pulled into its operating position. With the cam held in this position, an electric solenoid on-off switch would strike the cam as the boom rotated, thus automatically triggering the start and end of

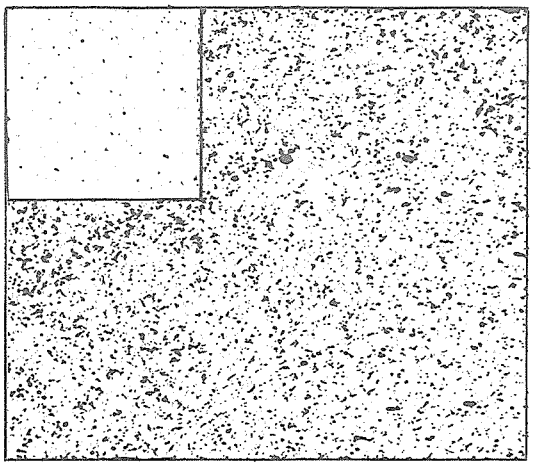

Figure 3—Comparison of spray patterns. In the larger square, 10 gallons per acre (8002 spray nozzles) were sprayed. In the smaller square, the standard 1 gallon per acre per revolution was used.

spraying for a single revolution. For dosages requiring more than one revolution, the cam was released so that spraying continued for the desired number of boom rotations. To stop spraying, the cam was again moved and held in its operating position so that the spray was automatically shut off at the point where it had started.

This tripod sprayer worked well mechanically. With a minimum crew of three persons in good physical condition, it took an average of 15 to 20 minutes per plot to move and assemble the sprayer, and to spray a plot on moderately difficult terrain. With an untrained crew, and working under difficult conditions, as long as 1 hour was needed to spray a plot and move on to the next plot. A fourth crewmember, to keep records and act as a relief on strenuous jobs, decreased time required per plot and promoted safety on the job.

The tripod sprayer was somewhat cumbersome to handle even though it could be quickly broken down into three subassemblies for transport between plots. The total weight of about 260 pounds (117.9 kg) was supported mainly by two legs of the tripod while it was being lifted into an erect position for spraying. The different parts of the sprayer could be disassembled, folded, and telescoped for packing into boxes about 8 feet (2.4 m) long. This allowed easy transport, even by air freight, between widely spaced study locations.

The crews were thoroughly trained in the safety precautions about handling the sprayer, the spray materials, and the highly pressurized cylinders. All workers wore hard hats and protective outer clothing, and used cleansing solutions.

## NOTES

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## The Authors

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