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WITHIN-BAND SPRAY DISTRIBUTION OF NOZZLES USED FOR HERBACEOUS PLANT CONTROL.

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ABSTRACT

Described are the spray patterns of nozzles setup for banded herbaceous plant control treatments. Spraying Systems Company nozzles were tested, but similar nozzles are available from other manufacturers. Desirable traits were considered to be as follows: an even distribution pattern, low volume, low height, large droplets, and a single nozzle or short boom. The nozzles that best matched these traits are as follows: a TK2 flooding tip, a TF2 "Turbo" flooding tip, and 3 each XR8002 flat-fan tips spaced 19 in. apart—all best at 15 psi. Also, 2 each 9502E (even) flat-fan tips on a 20-in. boom attached to a wand on a spraygun had a fairly even distribution (C.V.=0.38-0.40) and was superior to a regular wand for applicator control.

INTRODUCTION

Herbaceous weed control treatments are being increasingly applied to improve survival and growth of both pine and hardwood seedlings. Banded and spot applications over rows and seedlings have lower costs than broadcast applications with enhanced biodiversity. Spot applications can be best made using discontinuous bands, where the sprayer is turned off and on between seedlings. Applications are usually made in the Spring season when windy conditions are common and drift a problem.

No publication has yet described the within-band distribution of commonly-used nozzle setups and new nozzles. The objective here was to obtain and provide pattern descriptions and make recommendations for use based on the following desirable traits:

a. Even distribution across the swath, with slightly less over the seedling and well-defined edges, to optimize band-wide control and minimize seedling damage.
b. Low volume per acre, to lower application costs and increase efficiency.
c. Low nozzle height, to reduce drift potential.
d. Use of a single nozzle or short boom for ease of application with taller woody and herbaceous obstructions. Long booms tend to rock and tip causing a change in rate and uneven distribution.
c. Large droplets, to minimize drift, that are sufficient in density to assure complete coverage to optimize control.

All but the last trait was studied, which will warrant further research. Nozzle setups suitable for both backpack and machine sprayers were tested.

Use of trade names is for the reader's information and does not constitute official endorsement or approval by the U.S. Department of Agriculture to the exclusion of any other suitable product or process.

METHODS

New or only slightly-used nozzles were tested using water. The test nozzles were all manufactured by Spraying Systems Company, Wheaton, Illinois, and their nozzle codes will be used. Similar nozzles can be obtained from other manufacturers.

A 3-ft by 9-ft spray-table was constructed from corrugated fiber-glass having troughs and ridges 3-in. apart and 0.5-in. deep. The spray-table was slightly tilted to capture runoff in beakers spaced 3-in. apart. A small amount of surfactant was sprayed on the table surface prior to and after each run to facilitate complete drainage. A CO_2-sprayer was used to ensure constant pressure, with pressure gauged only at the CO_2 tank output. The lowest pressures within the manufacturer's recommended operating range were tested to yield the largest droplets and lowest outputs. Nozzles were mounted on a spray wand, a boom, or some on a fabricated spraygun-wand setup (described later) for testing, and all were hand held.

A 5-ft spray swath was used with 1 or 2 minute runs. Gallons-per-acre (GPA) were calculated from these measurements with an assumed 2 mph travel speed. A coefficient of variation (C.V.) was calculated for each test using the collections from the 3-in. intervals across the 5-ft swath.

RESULTS

Figures 1 shows the spray distribution patterns for single nozzles. Figures 2 shows distributions of two nozzles on a short boom that can be used on the spraygun-wand setup shown in Figure 3. Figure 4 shows the pattern for a commonly-used three-nozzle setup for machine applications. On the pattern figures, the operating pressure in pounds per square-inch (PSI), nozzle height (HT) in inches, GPA, and C.V. are shown.

The nozzles that best matched the desirable traits and appear best suited for banded and spot applications were:

1. Regular flooding nozzle, 0.2 gpm, (TK2.0) at 15 psi
   Draw-back: height was 22 in.
2. Turbo flooding nozzle, 0.2 gpm, (TF2.0) at 15 psi
   Draw-backs: height was 19 inches and tapered edges.
3. 3 each extended range 80° flat-fans, 0.2 gpm, (XR8002) at 19 in. spacings and 15 psi
   Draw-back: GPA was 18.
4. 2 each 95° even flat-fans, 0.2 gpm, (9502E) at 20 in. spacing and 15 or 20 psi
   Draw-back: heavier in center and height of 19-21 in.

None of the nozzles or arrangements applied lower amounts in the center of the swath. Forward movement during application will probably make edges less tapered.

It was observed that the flooding nozzles had larger droplet sizes than the flat-fan nozzles. The completeness of coverage with the larger droplets, especially from the Turbo flooding nozzle, needs to be described in further tests.

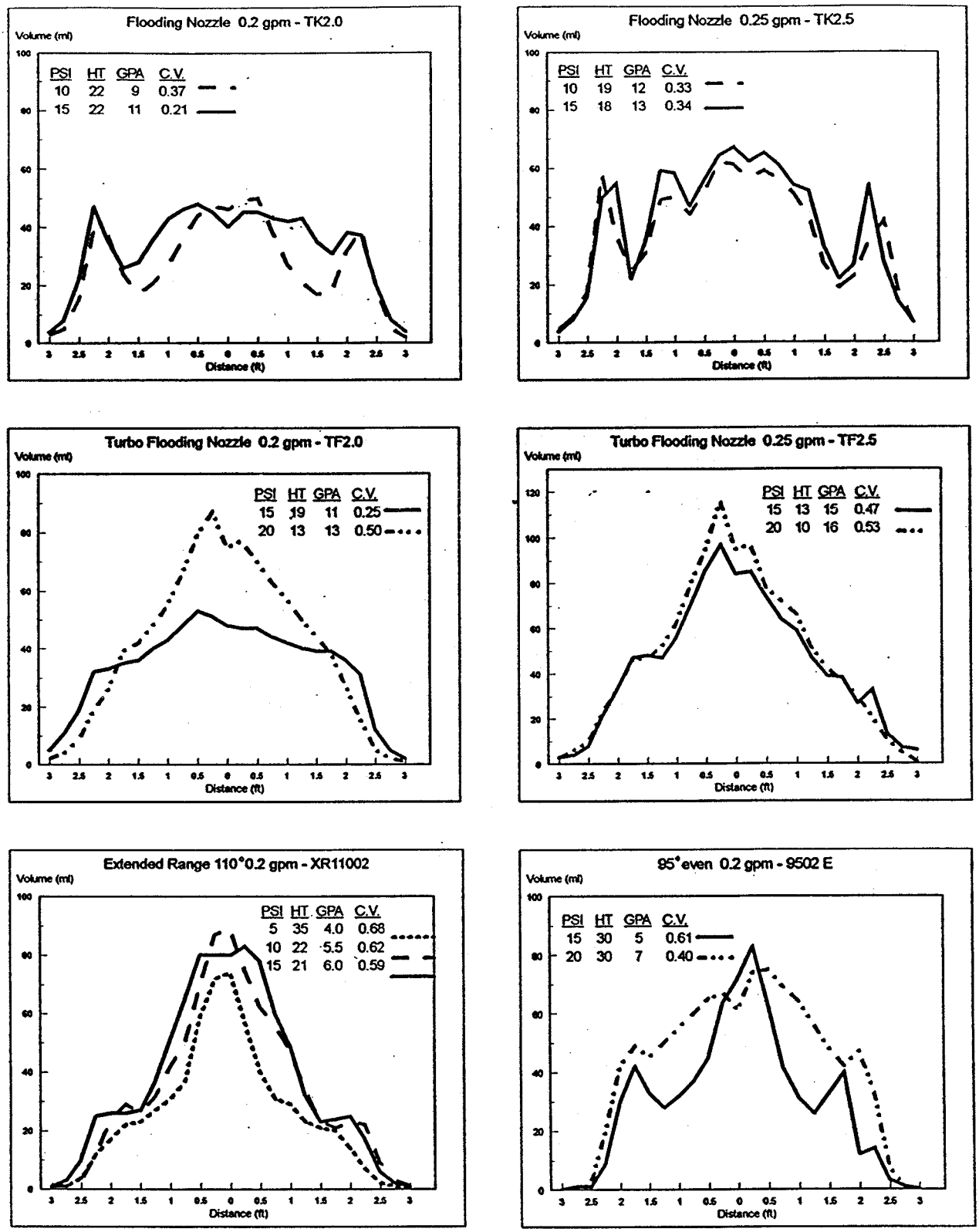

Figure 1. Spray distribution patterns for single nozzles with the operating pressure in psi (PSI), the mounting height in inches (HT), the gallons per acre at 2 mph (GPA), and the coefficient of variation (C.V.).

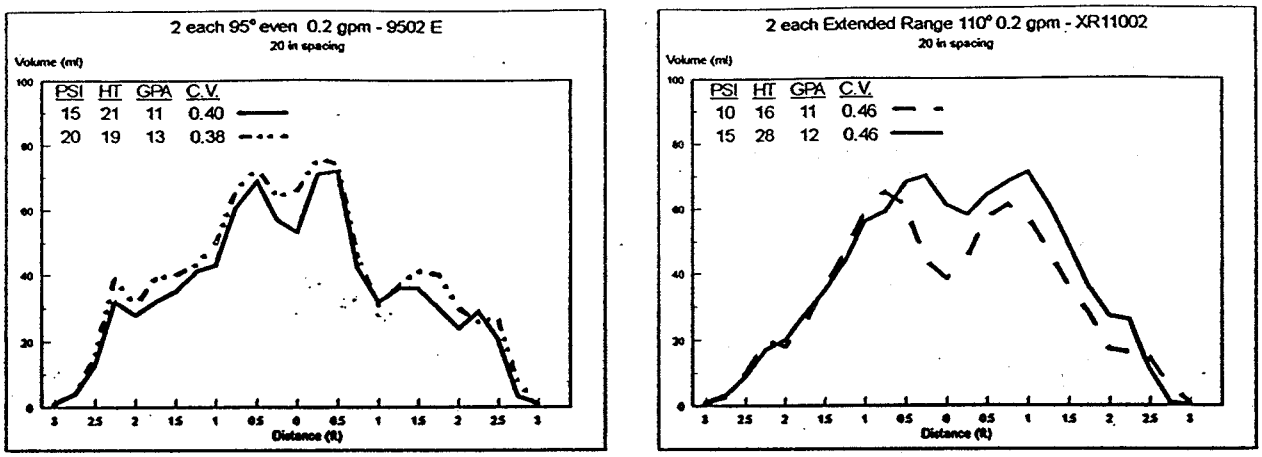

Figure 2. Spray distribution patterns for two nozzles spaced 20 inches apart.

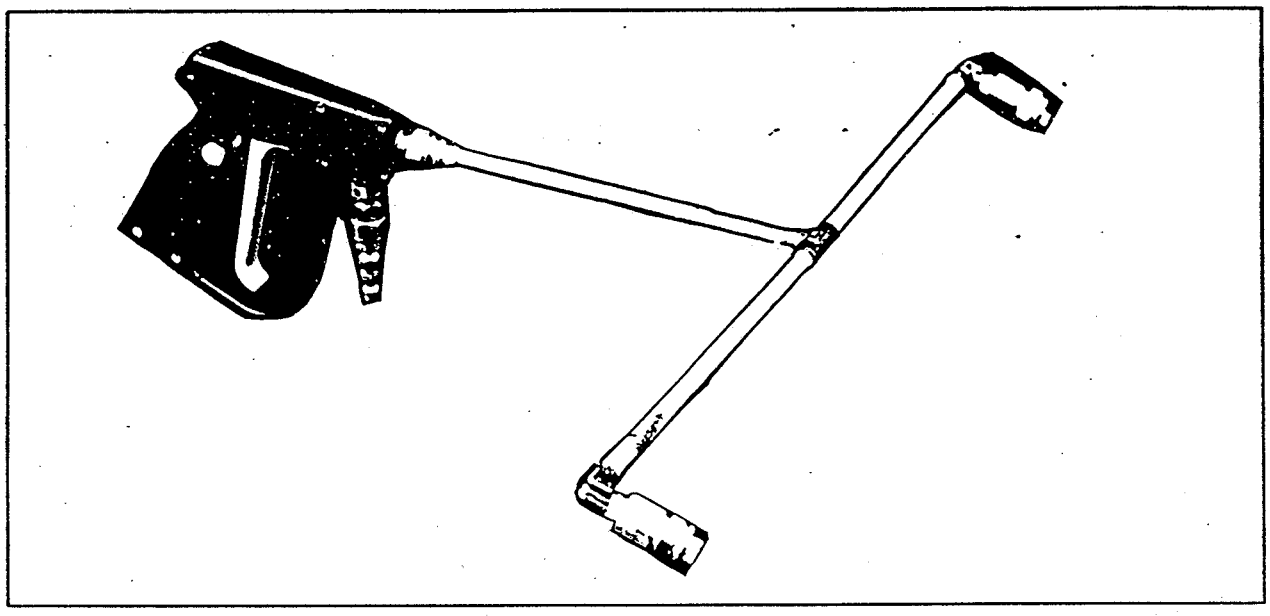

Figure 3. A spraygun-wand setup for use with the two nozzles, consisting of a Gunjet, 9 inch wand, and 20 inch boom.

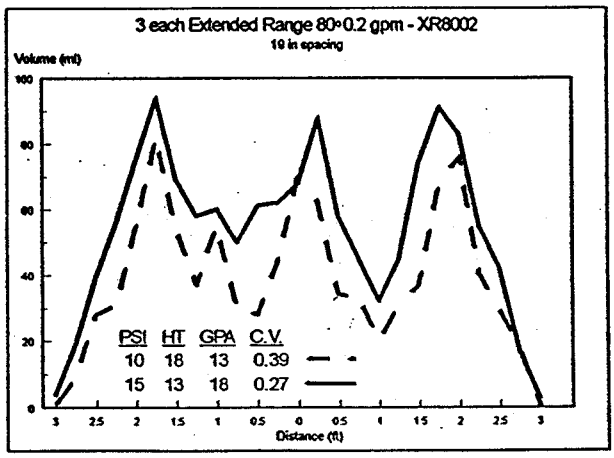

Figure 4. Spray distribution pattern for three 80° nozzles spaced 19 inches apart.