An Efficient Sprayer for Application of Chemical Sprays to Experimental Field Plots

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The various weed control conferences have done much for weed control research. Uniform plans for the various phases of weed control research have yielded valuable results. If any phase of the weed control research program coordinated by the North Central Weed Control Conference lacks uniformity it is in connection with the methods of applying chemicals to experimental field plots.

The North Central Weed Control Conference has recommended low gallonage, concentrated sprays in many situations. It is highly important that the research worker maintain careful control over the rates of application of a chemical in any investigation, but it is especially important when a potent chemical such as 2,4-D is being applied as a low gallonage concentrated spray. For example, if equipment used in experimental work is calibrated to deliver 5 gallons of spray mixture per acre at 30 pounds pressure when traveling 4 miles per hour, changing the speed to 3 mph without changing the pressure changes the rate delivered from 5 to 6.4 gallons per acre. This is an error of 28% in rate of application alone. Let us suppose that the speed changes from 4 to 5 mph and the pressure drops from 30 to 25 pounds. In this case the amount delivered drops from 5 gallons per acre to 3.5 gallons per acre. This is an error of 30% in rate of application. With most of the equipment available for application of experimental chemicals, these errors in application are common and the estimates of errors given are conservative. The use of knapsack sprayers and other hand equipment without constant speeds and pressures is subject to even greater errors.

In the Plan of Coordinated Projects for Weed Control Research for the North Central Region in 1949, the experimental design suggested for most investigations is a randomized block with two or three replications. Suppose that we are trying to evaluate the effect of two formulations of 2,4-D on the yield of wheat. Let us assume further that the technique and plot size chosen are expected to give a standard error of about 14% per unit. This is a conservative figure for weed control experiments. If the assumption made above is correct, to have a four out of five chance at the 5% level of detecting a 30% true difference of average yield between two formulations of 2,4-D, four replications would be required. Eight replications would have the same chance of detecting a 20% difference, and 14 replications would have the same chance of detecting a 15% difference.

The purpose of this paper is to describe the construction and operation of an efficient sprayer for applying chemical sprays to experimental field plots. This has aided greatly in reducing both the standard error and the time required for applications in replicated experiments. The general appearance of the sprayer is shown in Fig. 1.

General Considerations

The frame is constructed from 1/4-inch angle iron, the utility cart, the compressed air storage tanks, the wheels were obtained from a war surplus army air corps oxygen tanks, the speedometer came from a junked automobile, and the shut-off valves are regular knapsack sprayers with pressure and bottom outlets added. The two sprayers are constant speed by using a shut-off valve for each tank added. These shut-off valves are controlled by a set of operating rods which are easily accessible to the operator in the process of changing solutions, the tanks in place by a canvas strap and a coiled spring. The Shut-off valve for each rank added. The quick-action shut-off valves are controlled by a set of operating rods which are easily accessible to the operator in the process of changing solutions, the tanks in place by a canvas strap and a coiled spring.