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Standard Guide for Evaluating the Usefulness of Herbicides on Corn (All Types)¹

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INTRODUCTION

When compared to other fields of science, the area of biological sciences and specifically herbicide research is relatively new. The usefulness of research in this field depends a great deal on the individual skill, resourcefulness, and experience of the investigator. The guide presented here is prepared for use by persons with a broad knowledge of agriculture, biology, and research techniques.

It is beyond the scope of this guide to furnish detailed, step-by-step procedures. Because of the complexities of weed science research and the special interests of some researchers, there is considerable variability in the procedures used and much variability in the methods of reporting the results. This guide is prepared to provide for greater uniformity among researchers in procedures and reporting so that the results from different individuals may be more accurately compared or combined to facilitate the preparation of recommendations and herbicide labels.

This guide was prepared to be as flexible as possible while adhering to the minimum of basic requirements. It is recommended that those using this guide be familiar with corn production practices in the area in which the experiments are to be conducted. Furthermore, it is important that the flexibility incorporated into this guide to accommodate variations known to occur, not be unnecessarily overused to justify inappropriate procedures or reporting.

1. Scope

1.1 This guide covers procedures for the generation of sufficient quantity and quality of data to accurately judge the efficacy and crop safety of a herbicide for weed control in corn.

1.2 This guide covers the testing of herbicide formulations, applied with ground or aerial equipment.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Refer to Section 7 for specific hazard statements.*

2. Referenced Documents

2.1 ASTM Standards:

E 380 Practice for Use of The International System of Units (SI) (the Modernized Metric System)²

E 549 Guide for Preparing Field Sprayer Calibration Procedures³

E 550 Guide for Preparing Granular Pesticide Ground Applicator Calibration Procedures³

E 642 Practice for Determining Application Rates and Distribution Patterns from Aerial Application Equipment³

3. Summary of Guide

3.1 The evaluation of herbicides for weed control in corn is research in which practical corn production is simulated on field plots so accurately that results can be applied directly to commercial corn production. This guide describes procedures to help ensure that results will reliably apply to farm situations. Minimum standards for reporting data are set forth so that results from different researchers can be compared or combined. These include approximate times for taking data and the reporting of weed control data in terms of percent control of each species or other data that can be converted to percent control by computations.

4. Significance and Use

4.1 This guide should be used to provide uniform and reliable information for:

4.1.1 Determining the value of a herbicide for use on corn,

4.1.2 Registration and labeling with appropriate use of Good Laboratory Procedures (GLP's), and

4.1.3 Developing recommendations to users.

5. Apparatus

5.1 *Description*—The research equipment should be of a type that provides an application similar to and at least as accurate in rate of application, droplet size, and distribution

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² *Annual Book of ASTM Standards*, Vol 14.02.

³ *Annual Book of ASTM Standards*, Vol 11.05.



as equipment generally used in corn production. Examples of this equipment include:

5.1.1 Liquid Applications—Boom sprayers (single or multiple nozzle), offset broadcast nozzles, irrigation equipment, hand gun, aerial (fixed wing and helicopter) and directed sprayers to include recirculating and shielded sprayers and wiper applicators.

5.1.2 Granular Applications—Granular applicators (both aerial and ground) and fertilizer spreaders. These applicators include those used for materials mixed with or impregnated on dry fertilizer.

5.2 Preparation—Equipment must be clean and free of significant contamination before each use. Equipment should be so constructed, maintained, and adjusted to give reliable performance during application.

5.3 Calibration—Research equipment must be selected and operated so that a known amount of material is uniformly and accurately distributed over the target area. In order to achieve this accurate distribution, the research equipment must be calibrated to deliver the desired amount. The major factors influencing calibration are speed of travel and nozzle flow rate. The viscosity of the spray solution can affect flow rate, hence calibration may need to be checked for individual spray solutions if their viscosity varies.

5.3.1 Speed of Travel—The speed of travel should be accurately measured, that is, in feet or metres per minute, and should always be measured under the same conditions as those under which the treatments will be made.

5.3.2 Nozzle Flow Rate—Flow rate is determined by measuring the amount of solution discharged over a period of time, that is, gallons or litres per minute. If the sprayer is equipped with multiple nozzles, each should be measured to ensure uniform distribution. The range in flow rate should usually be no more than 10 % (about 5 % above or below the average for all nozzles on the sprayer).

5.3.3 Calculations of Volume Rate—Once the speed of travel and flow rate are determined, the deposit per unit area can be calculated using the formulas below. If:

A = gal/min for sprayer (see 5.3.2) or

B = fraction of acre covered/min =

$$\frac{\text{Speed, ft/min}}{1} \times \frac{\text{Width of Spray Swath, ft}}{43\,560 \text{ ft}^2/\text{A}}$$

or

C = L/min for sprayer (see 5.3.2) and if

D = fraction of hectare covered/min =

$$\frac{\text{Speed, m/min}}{1} \times \frac{\text{Width of spray swath, m}}{10\,000 \text{ m}^2/\text{ha}}$$

then the volume rate in

$$\text{Gal/acre} = \frac{A}{B} \text{ or } \text{L/hectare} = \frac{C}{D}$$

5.3.3.1 In the use of sprayers, large changes in volume rate can best be made by changing nozzle orifice size. Moderate to slight changes in volume rate may be made by changing the speed or pressure, or both.

5.3.4 Granular Equipment—Granular herbicide applicators are calibrated by collecting the total amount of material discharged over a measured distance, determining the area covered as a fraction of an acre or hectare and dividing this area into the pounds or grams collected. This will yield the total amount of material deposited per unit area. To deter-

mine the amount of active ingredient deposited, convert the percentage of active ingredient of the formulation to a decimal and multiply it by the amount deposited. Changes in granular equipment calibration are usually made by changing the gate setting. Calibration speed and application speed should be the same and constant.

6. Materials

6.1 Herbicide Formulations—Candidate materials will generally be obtained from various producers or independent researchers. The user should have a copy of appropriate Material Safety Data Sheet (MSDS) and should know the following about each material:

6.1.1 Chemistry or class of chemistry (may not be available because of confidentiality).

6.1.2 All available toxicology so the necessary handling and reentry precautions can be determined. This information should include acute oral, skin and eye irritation data, and Ames mutagenicity data.

6.1.3 Formulation characteristics so the appropriate application procedures can be selected.

6.1.4 Percent of active ingredient in the formulation to be tested.

6.1.5 Activity—Information such as spectrum of weed control, effective rate(s), time of application (pre-plant, preemergence or postemergence) degree of crop safety etc., will be helpful in selecting the test site, determining rate(s) of application, and designing the experiment. For new materials, some or all of this information may not be available.

6.2 Herbicide Carriers—Sprayable herbicide formulations generally require dilution in a carrier to facilitate even distribution over the target area. Granular formulations are usually not further diluted. Carriers may be water and sprayable or dry fertilizers. If water is used as a carrier, initial testing of the herbicide should be done with clean (tap or well) water. Use of water with unusual amounts of colloidal clay or organic matter or water with unusual amounts of salts, may cause atypical results.

6.3 Spray Mixture Additives—Materials may be added to the spray mixture for the purpose of altering the biological or physical properties of the mixture. Examples of materials which may be added include; surfactants, spray oils, thickening agents, antifoam agents and compatibility agents.

6.4 Documentation—See Section 11 for items that should be documented.

7. Hazards

7.1 Safety Precautions—Herbicidal materials may possess one or more toxicological properties which may be harmful or fatal to humans or wildlife, or both. Carefully read and follow precautionary information contained on the label. If such information is not available either on the label or from the supplier, exercise the same protective actions as would be exercised with a known hazardous material. Such protective actions should include any or all of the following:

7.1.1 Eye goggles or face shield.

7.1.2 Gloves to protect hands.

7.1.3 Protective clothing to prevent skin contact.

7.1.4 Appropriate respirator to prevent inhalation of dust, mist, or vapor.

7.1.5 Reentry to treated field may be restricted for a