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Soil Fertility Guide

MARYLAND DEPARTMENT OF AGRICULTURE

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EC-2

CALIBRATION OF A MANURE SPREADER USING THE WEIGHT-AREA METHOD

Introduction

Calibration is a way of checking and/or adjusting a manure spreader to ensure that a nutrient source is being applied uniformly and at the desired rate. It is important to properly calibrate a manure spreader to minimize the potential for over- or under-applying nutrients to your crops.

The weight-area method is one method of calibrating manure spreaders when using solid and semi-solid manure. This method involves spreading manure on a collection surface of known dimensions, weighing the manure on the collection surface, and calculating the application rate. The application rate is then converted to a per-acre basis.

Use of the weight-area method is not advisable for calibrating spinner spreaders applying poultry litter because a portion of the litter often slides beyond the collection surface. The load-area methods are more accurate for poultry litter. Consult EC-4, “Calibration of a Manure Spreader Using the Load-area Method (with Drive-on Scales)” or EC-5, “Calibration of a Manure Spreader Using the Load-area Method (with Estimation of Density and Load Weight)” for information on these calibration methods.

Manure application rates across a field for some types of spreaders can be quite variable even at the same ground speed and with identical equipment settings. Multiple measurements of actual application rates are required to ensure that the calculated average rate is truly representative of the average rate across the field.

> **NOTE:** A minimum of five measurements is recommended for the weight-area method of calibration.

Before continuing, determine the spread pattern of the spreader. For some box spreaders, the swath width is the width of the spreader. For spinner spreaders, spreaders with vertical beaters and many liquid spreaders, material is spread for some distance on each side of the spreader and the ***effective swath width*** must be determined to maximize application uniformity. Consult EC-1, "Calibration of Manure Spreaders: Uniformity, Spread Patterns and Effective Swath Width," in the *Soil Fertility Guide* series for information.

Weather Conditions

It is important to take note of the weather conditions before conducting a calibration. If the weather is windy or rainy, it would be a good idea to reschedule the spreader calibration for a different day as both of these conditions can affect the accuracy of your measurements.

Using the Weight-area Method

The following equipment is needed to perform the weight-area method of calibration:

- bucket
- scale (with a capacity of 50 pounds and accuracy to a tenth of a pound)
- collection surfaces such as plastic sheets or tarps
- stakes or flags

We'll refer to the collection surfaces as ***plastic sheets*** for the rest of this publication as they are most commonly used. The steps for using the weight-area method of calibration are as follows:

Step 1. Make note of equipment settings using the information at the top of the worksheet on page 6 as a guide for the kind of information you want to track. Record these settings on the top of the worksheet.

In addition to recording equipment settings, use the worksheet to record calibration data. Calculations used in the weight-area method are provided on the worksheet.

Step 2. Cut five plastic sheets of manageable size. A length and width of 4 feet by 5 feet works well. Weigh the sheets and record the total weight in pounds on line **A1** of the worksheet.

Step 3. Measure the length and width of one plastic sheet in feet. Record these measurements on lines **B1** and **B2**, respectively, of the worksheet.

Step 4. Calculate the collection surface area in square feet. Enter the value on line **B3** of the worksheet.

Step 5. Position the plastic sheets on the field so that they are on the second of three passes (see Figure 1 on page 3). Use the effective swath width that you have previously determined is necessary to maximize application uniformity (refer to EC-1, "Calibration of Manure Spreaders: Uniformity, Spread Patterns and Effective Swath Width").

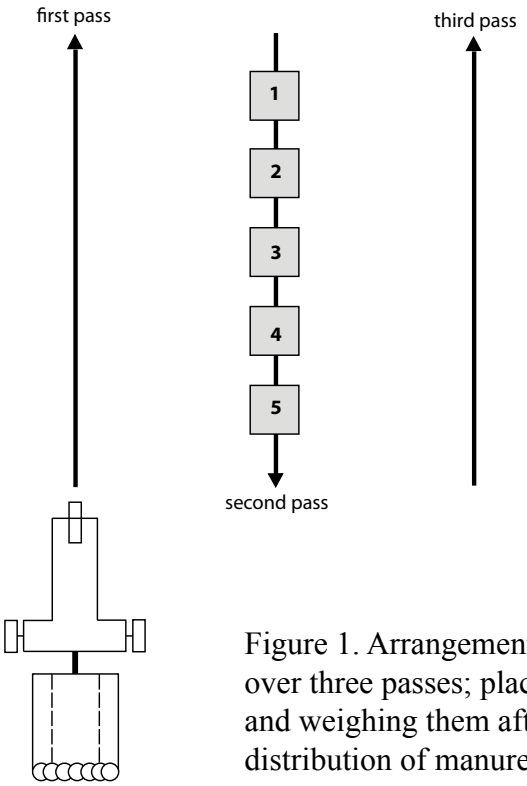

Figure 1. Arrangement of plastic sheets and travel pattern over three passes; placing plastic sheets on the second pass and weighing them after the third pass accounts for lateral distribution of manure from the pass on each side.

Secure the plastic sheets to the ground using stakes or flags to prevent the sheets from moving during application. Flatten plants and stubble so that the sheets lie as flat as possible.

Step 6. Load the manure spreader. Start spreading manure on the first pass, approximately 50 feet before entering the calibration area, at the speed and settings you typically use when spreading manure.

Step 7. Continue spreading on the second pass, making sure to drive the spreader over the center of the plastic sheets, using the same speed and settings as the first pass. Use the effective swath width that you have determined is necessary to maximize application uniformity.

Step 8. Finish spreading on the third pass using the same speed and settings as the first two passes.

Step 9. Collect each plastic sheet and the manure it contains and weigh each separately. Record the weights in pounds on line **A2** of the worksheet. If one of the plastic sheet weights is radically different from the others, consider excluding it from the average as an "outlier."

For example, if the weights of manure (in pounds) on 5 plastic sheets were 15.1, 13.7, 7.1, 14.2 and 13.0, the measurement of 7.1 pounds would be the outlier.

Step 10. Calculate the total weight of the manure and plastic sheets in pounds. Enter the value on line **A3** of the worksheet.

Step 11. Calculate the total weight of the manure in pounds. Enter the value on line **A4** of the worksheet.

Step 12. Calculate the average weight of manure in pounds applied to the collection surface. Each plastic sheet is considered a collection surface. Enter the value on line **A5** of the worksheet.

Step 13. Calculate the application rate in tons per acre. Enter the value on line **C1** of the worksheet.

If the current application rate is different from the recommended application rate, adjust the settings on the manure spreader or change your driving speed to increase or decrease the application rate, as needed. Repeat the calibration procedure until you identify the tractor speed and manure spreader settings that will enable you to approximate the recommended application rate. Maryland Department of Agriculture (MDA) policy requires that the average application rate should be within 10% of the recommended rate.

Two copies of the worksheet are included so all data for each calibration attempt can be recorded.

Recalibrating the Spreader

For manure spreaders handling solid or semi-solid manures, recalibrate whenever the consistency of a manure is different from the manure used for the last calibration. Consistency of manure can vary due to changes in any of the following:

- bedding
- feed components
- manure management practices
- any factor that affects the moisture content of manure

Application rates change over time as equipment gets older and components wear. Periodic recalibration of spreaders is encouraged even if all factors appear to be similar.

Record Keeping

Keep calibration worksheets and nutrient application records with your nutrient management plan. This information will be needed in the event that MDA conducts a plan implementation review.

Reference

Brodie, H. L. and G. L. Smith. 1993. *Calibrating Manure Spreaders*. Fact Sheet 419. University of Maryland Extension, Maryland Institute for Agriculture and Natural Resources, College Park, MD 20742.

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WORKSHEET
EC-2, "Calibration of a Manure Spreader Using the Weight-area Method"

Tractor_____ Spreader model_____ Ground speed_____

Gear_____ Gate setting_____ PTO_____

Apron chain setting_____ Other_____

Date of spreader calibration_____

(**A**) calculation of average weight of manure (lbs)

A1) total weight of plastic sheets (lbs)					
	Sheet 1	Sheet 2	Sheet 3	Sheet 4	Sheet 5
A2) weight of manure and plastic sheets (lbs)	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**
A3) total weight of manure and plastic sheets (lbs) (see line **A2)** [(**a**) + (**b**) + (**c**) + (**d**) + (**e**) = **A3**]					
A4) total weight of manure (lbs) (**A3** - **A1** = **A4**)					
A5) average weight of manure (lbs) (**A4** / **5** = **A5**) where 5 = number of plastic sheets					

(**B**) calculation of collection surface area (sq ft)

B1) length of plastic sheet (ft)	
B2) width of plastic sheet (ft)	
B3) collection surface area (sq ft) (**B1** x **B2** = **B3**)	

(**C**) calculation of application rate (t/ac)

C1) application rate (t/ac) [(**A5** x **43,560**) / (**B3** x **2,000**) = **C1**] where 1 acre = 43,560 square feet and 1 ton = 2,000 pounds	

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A5) average weight of manure (lbs) (**A4** / **5** = **A5**) where 5 = number of plastic sheets					

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