



Calibrating Manure Spreaders

Introduction

Manure spreader calibration is an important step in nutrient management planning. Proper calibration can eliminate application rate guesswork. In this fact sheet four basic methods for calibrating manure spreaders are described.

Method 1: Using Drive-Over Scales

This method works well for solid, semi-solid, and liquid manure sources. Both the tractor and spreader need to be weighed, as weight from the spreader is transferred to the tractor drawbar. Ideally, use farm scales that weigh the tractor and spreader together. If farm scales are not available, portable scales can be used, weighing each axle individually (Figure 1). For tractors with dual tires or large flotation tires, put scales side-by-side for a wide enough pad; this typically means using four scales to weigh one axle, noting weights for each scale per axel.



Figure 1: With portable scales, weigh each axle separately.

Step 1: Determine weight of the manure.

Whether you are using portable or large-scale truck scales, first weigh the tractor and spreader empty, record each axle weight, and then repeat the procedure with a fully loaded spreader. The full weight minus the empty weight equals the weight of the manure.

Step 2: Determine application area.

Measure the width and length of the application pattern. The width is easily measured with a

regular measuring tape or acreage measuring wheel. The length can also be determined using a GPS unit. Length times the width divided by 43,560 (square feet per acre) equals the total acreage covered.

Step 3: Calculate rate.

To determine the application rate in pounds per acre, divide the manure weight (step 1) by the application acreage (step 2). Divide this by 2000 to get the application rate in tons per acre. To convert to gallons per acre, a manure density value is needed. A manure test will give you the density in pounds per gallon. For guidelines on manure sampling, analysis and interpretation, see [Agronomy Fact Sheet 38](#).

An example for Method 1:

Manure weight (full – empty): 33,720 lbs
Manure density: 8.43 lbs/1000 gallons
Spreader pattern width: 40 feet, length: 500 feet

Application rate in gallons per acre:
(Step 1) amount: $33720/8.43=4000$ gallons
(Step 2) area: $(40*500)/43560=0.46$ acre
(Step 3) rate: $4000/0.46=8712$ gallons per acre

Method 2: Using Tarps

This method can be used for solid and semi-solid manure. It uses three tarps of a known size (e.g. 4 by 7 feet, 6 by 6 feet, or 56 by 56 inches) and 5-gallon buckets.

Step 1: Determine tarp and bucket weight.

Weigh each bucket separately with one tarp in each and record the weights.

Step 2: Stake sheets and apply manure.

Stake the tarps at different intervals along the spreading pathway. Apply the manure, using the preferred gear and engine speed.

Step 3: Collect, weigh and determine rate.

Carefully put the tarp, including manure, into the bucket and reweigh. Subtract the weight of the empty bucket plus tarp from the full weight. Repeat three times. Determine the average weight of manure in lbs and use Table 1 to derive the application rate in tons per acre.

Table 1: Tarp calibration chart for Method 2*.

Weight of manure Pounds	Size of plastic sheet		
	6' x 6'	4' x 7'	56" x 56"
	Manure application rate (tons per acre)		
8	5	6	8
10	6	8	10
12	7	9	12
14	8	11	14
16	10	12	16
18	11	14	18
20	12	16	20
22	13	17	22
24	15	19	24
26	16	20	26
28	17	22	28
30	18	23	30
32	19	25	32
34	21	26	34
36	22	28	36
38	23	30	38
40	24	31	40

*If you used a different tarp size, first calculate the area of an individual tarp (length x width in feet divided by 43,560 for size in acres), then divide the manure weight (in lbs) by the calculated acreage. Divide by 2000 for tons/acre.

An example for Method 2:

Size of three tarps used: 6 feet by 6 feet
 Weight of the manure: 20 lbs, 21 lbs, and 19 lbs

Application rate in tons per acre:
 Average amount for the three tarps: 20 lbs
 From Table 1: manure application rate = 12 tons/acre

Method 3: Counting Loads

Field size and average manure load (in tons or gallons per load) can be used to determine rate of application of solid, semi-solid, and liquid manure sources. To determine the weight or volume of the spreader, weigh the tractor and spreader as in Method 1, or, if scales are not available, use the manufacturer listed volume of the spreader. If you use the listed volume, remember that manure foams so assume 90% of the stated capacity unless you see manure up to the fill port (in that case, assume 100%). If the spreader capacity is measured in bushels, assume 1 bushel equals 1.25 cubic feet. A cubic foot can vary in weight depending on the density of the manure. There are 7.5 gallons in a cubic foot so the density of the manure (in lbs per cubic foot) can be determined by weighing a 5-gallon bucket filled with manure and multiplying the weight by 1.5.

Method 4: Flow Meters

Flow meters are increasingly being used to set and record liquid manure application rates. Flow meters can be installed on the manure application equipment itself (draghose systems,

tank spreaders) and/or for hose systems on the pump at the manure source. Installation of two flow meters in draghose systems (at the pump and on the applicator in the field) has the benefits of providing an additional check on system operation and verifying that each flow meter is functioning correctly. Calibration of meters (flow per minute) can be done by recording time during emptying a known volume or mass of manure. Meter accuracy can also be confirmed using the manufacture prescribed verification process to check measured outputs against the original calibration certificate. If any parameter is out of the labeled range, the meter must be returned to the supplier for repair/re-calibration. Some companies offer on-line tools that may help convert gallon per min rates to gallon per acre rates targeted in nutrient management plans.

In Summary

Spreader calibration is key for management of manure nutrients. Calibration is requirement for Concentrated Animal Feeding Operations (CAFOs) and other farms following the Natural Resources Conservation Service (NRCS) Practice Standard 590. Here four calibration methods are presented.

Additional Resources

- Martin, J., and D. Beegle (2014). Manure Spreader Calibration. Agronomy Facts 68. Penn State Extension. <https://extension.psu.edu/manure-spreaders-calibration>.
- Know How Much You Haul! Nutrient and Pest Management Program. University of Wisconsin, Madison. <https://lplc.org/wp-content/uploads/2019/03/Section-7-Manure-Spreader-Calibration.pdf>.

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of discharge levels from agricultural land.

For more information



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2021 (originally released in 2007 with co-authorship by Kristin Bossard)