Calibrating Manure Spreaders

Manure spreader calibration is an important step in nutrient management planning. With proper calibration, a producer can eliminate application rate guesswork, allowing for better use of manure nutrients and hence reduction in the risk of environmental pollution. There are three basic methods of calibrating manure spreaders: (1) using truck scales to weigh loads; (2) using plastic sheets in the field, and (3) counting loads of known volume or weight. In this fact sheet the three methods will be described.

Method 1: Using Truck Scales

This is the most accurate method. It works well for solid, semi-solid, and liquid manures. Both the tractor and spreader need to be weighed, as weight from the spreader is transferred to the tractor drawbar. If possible, use local truck scales as these allow you to weigh the tractor and spreader together. If truck scales are not available, some local Cornell Cooperative Extension (CCE) and Soil and Water Conservation District (SWCD) offices have portable scales. With portable scales, weigh each axle individually (Figure 1).

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

For tractors with dual tires, or large flotation tires, put the scales side by side to have a pad wide enough; this typically means using four scales to weigh one axle. Weights need to be read on both the outside and the inside scales.

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. You can measure the length of the pattern with an acreage measuring wheel (may be available at local CCE or SWCD office as well), an extra long tape measure, or the tractor wheel method. The latter means that you would need to mark the tire with chalk or a similar easy-to-see marker, measure the distance of one tire revolution and then count revolutions as you spread. The number of tire revolutions multiplied by the distance of one tire revolution will give you the pattern length. The 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 by the application acreage. Divide this by 2000 to get tons per acre. To convert to gallons per acre, you need to know how much your manure weighs. A manure test will give you the density in pounds per gallon. If you do not have a test (you should get one…) weigh the manure in a 5-gallon pail. The weight of the full pail minus the weight of the empty pail divided by 5 equals the manure weight in pounds/gallon.

<u>An example for Method 1:</u>

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 Plastic Sheets

This method can be used for solid and semi-solid manure if you do not have truck scales. You will need three equally-sized plastic sheets or tarps and three 5-gallon pails. Use 4 by 7 feet, 6 by 6 feet, or 56 by 56 inches sheets (other sizes can be used, see below).

Step 1: Determine tarp and pail weight.
Weigh each pail separately with one tarp in each, and record the weights.

Step 2: Stake sheets and apply manure.
Stake the sheets at different intervals along your spread line. Apply the manure, using your preferred gear and engine speed. Be sure you are driving at the desired speed and spreading normally when you go over/past the sheets.

Step 3: Collect, weigh and determine rate.
Carefully put each tarp, including manure, into a pail, and reweigh them. Subtract the weight of the empty pail and tarp from the full weight. Take an average of the three weights and determine your rate per acre from Table 1.

Table 1: Tarp calibration chart for Method 2*.

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

*If you used a different sheet size, first calculate the area of an individual sheet (multiply length and width in feet and divide by 43,560 to get size in acres), then divide the weight of the manure (in lbs) by this total acreage. Divide by 2000 for a rate in 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

The third method is the "field size" method, where you know your field size and average manure load (in tons/load or gallons/load), apply manure evenly to the whole field, count the loads applied, and calculate rate per acre by dividing the total amount of manure by the total acreage of the field. This method works with solid, semi-solid, and liquid manures. If you do not have accurate field acreages, you can get them from your local SWCD or NRCS office. To get the weight or volume of the spreader, we can weigh the tractor and spreader as in Method 1. If no scales are available, we can also use the manufacturers listed volume of the spreader but remember that you may not get liquid tankers completely full, since manure foams. A general guideline is to assume 90% of the stated capacity unless you see manure up to the fill opening (in that case, assume 100%). For rear or side discharging spreaders, the capacity needs to be determined from the manufacturer's manual. Be sure to notice any statements of capacity 'struck level' (level) or 'heaped'. If your spreader capacity is measured in bushels, assume that 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 you could determine the density of the manure (in lbs per cubic foot) by weighing a 5 gallon pail of manure and multiplying the weight by 1.5.

In Conclusion

Spreader calibration is very important – it gives us the ability to manage manure nutrients more accurately, it can save money, and it is a requirement for Concentrated Animal Feeding Operations (CAFOs) and other farms that need to follow Natural Resources Conservation Service Standard 590.

For more information

Cornell University
Cooperative Extension

Nutrient Management Spear Program
http://nmsp.css.cornell.edu

Shawn Bossard, Kristen Bossard, Joe Lawrence,
Quirine Ketterings

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