Determining Spreader Capacity for Calibration

Once a desired application rate has been determined based on crop utilization and field conditions, it is important to be able to achieve that actual application rate as closely as reasonably possible in the field. Although there are many methods of calibrating a piece of manure application equipment, the ground speed of the equipment is often the ultimate determinate of application rate. In fact, the transmission speed of the tractor is commonly the limiting factor in accurately matching desired application rates. Utilizing a ***Ground Speed - Application Rate Chart*** based on actual available ground speeds for the particular tractor or truck being used is often the most practical option for managing application rates. The following simple formula can be used to easily develop a user-friendly chart like the example provided:

Rate/Acre = C ÷ W ÷ T ÷ S × 29,700

C = capacity of spreader (tons or gallons)*
W = width of a pass with applicator (ft - consider overlap)
T = time required to empty spreader at the selected PTO RPM (seconds)*
S = ground speed of equipment at a particular gear and the selected PTO RPM (mph)
** If using a drag hose, enter gallons per minute pumped for C, and enter 60 for T.*

Example:
6200 gal tanker (6,500 minus unused volume)
30 ft application width (60 ft splash plate with full overlap)
410 sec to empty at 1700 RPM
JD 8300 tractor @ 1700 RPM: Gear #1 = 1.1 mph; Gear #2 = 1.4 mph; Gear #3 = 1.8 mph; *etc.*

What is the application rate when in each gear @ 1700 RPM?

Gear #1 Rate/Acre = 6,200 ÷ 30 ÷ 410 ÷ 1.1 x 29,700 = 13,600 gal/acre
Gear #2 Rate/Acre = 6,200 ÷ 30 ÷ 410 ÷ 1.4 x 29,700 = 10,700 gal/acre
Gear #3 Rate/Acre = 6,200 ÷ 30 ÷ 410 ÷ 1.8 x 29,700 = 8,300 gal/acre

A completed chart can easily be used by the equipment operator to achieve a desired application rate with reasonable accuracy.

Example: Ground Speed – Application Rate Chart
JD 8300 tractor with 6500 splash plate tanker at full overlap

Gear @ 1700 RPM	MPH	Application Rate (gal/A)
1	1.1	13,600
2	1.4	10,700
3	1.8	8,300
4	2.3	6,500
5	2.7	5,500
6	3.1	4,800
7	3.5	4,300
8	4.1	3,700

Verify Actual Application Rate
It is equally important to routinely measure actual application rates to verify the accuracy of the predicted rate. Variables such as manure consistency, wind, and operator differences make this invaluable. The following formula can be used to quickly calculate the actual rate in field:

Rate/Acre = C ÷ W ÷ L × 43,560
C = capacity of spreader (tons or gallons)
W = width of a pass with applicator (ft - consider overlap)
L = length of pass required to empty spreader (ft)

•Natalie Rector, Michigan State University Extension. Revised June 2008 •

Determining Spreader Capacity for Calibration

Knowing the actual capacity in gallons or tons of manure application equipment is critical in accurately calibrating and recording field application rates. The following are some relatively simple methods for determining spreader capacity for calibration purposes:

Liquid Tankers:

The gallon capacity of liquid manure tankers is generally known; however, it is important to recognize that there should be unused capacity. Filling a tanker all the way to the very top will greatly increase the risk of manure splashing out during transport and spilling onto roads and driveways.

Liquid Open Spreaders:

The gallon capacity of open spreaders such as box or v-bottom spreaders may be expressed in the operator's manual; however, most must be calculated. A simple tape measure can be used to determine gallon capacity based on 7.48 gallons per cubic foot.

Box Spreaders

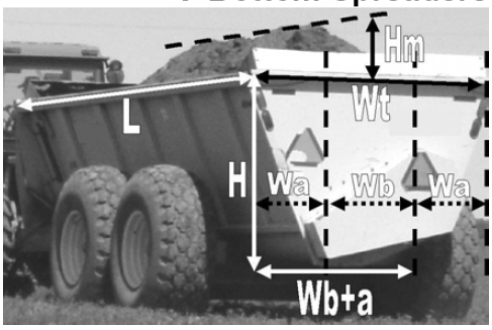
For box spreaders with liquid manure:
Volume = L × W × H × 7.48 = gallons

For V-bottom spreaders with liquid manure:
Volume = L × W_{b+a} × H × 7.48 = gallons

Solid Manure:

For solid manure, capacity is measured in tons. Ideally a scale, fixed or portable, would be used to measure the actual weight of the spreader with and without its load for each specific type of manure. The difference would be the capacity. If a scale is not conveniently available, there is an alternative method, based on the volume of the spreader and the manure's density. A similar formula as above can be used for solid manure, but the mound on top of a solid spreader also needs to be calculated.

V-Bottom Spreaders



For box spreaders with solid manure:
Volume (cubic feet) = [(L × W × H) + (½ × L × W × H_m)]

For V-bottom spreaders with solid manure:
Volume = [(L × W_{b+a} × H) + (½ × L × W_t × H_m)]

A small scale such as a spring scale can be used to measure the net weight in pounds of a five gallon bucket of manure. When weighing a bucket of manure, attempt to duplicate the density (packing) of the manure in the actual spreader and deduct the weight of the empty bucket. A gallon is 7.48 cubic feet, so multiply the weight of the five gallon bucket by 1.5 to convert gallons to cubic feet and follow the formula below to calculate the capacity of the spreader in tons:

Weight (tons) = Volume *(cubic feet)* **×** ***Density*** *(lbs. per 5 gal. bucket x 1.50) ÷ 2000*

KEY (all measurements in feet):

W = width	L = length	H = height	W_t = width of top
W_a = width of angled portion	W_b = width of bottom	$W_{b+a} = W_b + W_a$	H_m = height of mound

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