Phosphorus Best Management Practices

Protecting Water Quality

Manure Spreader Calibration

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Definition:

Procedures for determining the actual rate of manure applied by a spreader (e.g., in tons or gallons per acre) and adjusting it to obtain the desired agronomic rate for a field or group of fields.

Purpose:

To assure that manure is applied to a field at the desired application rate, one that meets the nutrient needs of the crop (sometimes in combination with fertilizer), while minimizing adverse environmental effects such as phosphorus (P) runoff or nitrate leaching. Applying manure at an unknown rate may result in excessive amounts. Excessive manure rates increase the amount of phosphorus susceptible to surface runoff, which can lead to more P reaching streams and lakes, and increase the potential for nitrate leaching. Manure calibration is also important to achieve desired agronomic manure rates, thereby maximizing the economic return from manure nutrients.

How Does This Practice Work?

Application rate is defined as the *amount of material* applied per *unit area of land*. For manure, it is usually expressed in tons per acre (solid or semi-solid) or gallons per acre (liquid or slurry). To calibrate a manure spreader, you need reliable estimates of both *amount applied* and *area covered*. There are a number of different ways to estimate each parameter.

Method 1. Based on Single Spreader Load (All manure types)

Estimate **amount applied**, or spreader capacity, based on: (a) measured volume of spreader (converted to tons or gallons), (b) weight of spreader load directly, if there is access to scales, or (c) manufacturer's rated spreader capacity. Estimate **area covered** by one spreader load by measuring the width of one spreader pass and multiplying by the distance traveled to empty the spreader, using measuring wheel or counting number of tractor tire revolutions. Calculate manure application rate by dividing **amount applied** by **area covered**.

Method 2. Application Rate Based on Spreader Loads Applied to a Field (All manure types)

This method estimates application rate after manure has been applied to one field. Determine amount of manure per spreader load by a procedure in Method 1 above. Then count the number of loads applied to the field, determine the accurate acreage of the field and calculate manure application rate for the field.

Method 3. Application Rate Based on Plastic Sheet Subsample (Solid or semi-solid)

This method involves measuring the amount of manure spread on a plastic sheet of known area. It is most useful where making an accurate estimate of spreader capacity is difficult, e.g., a heaped box spreader. Cut a minimum of

three plastic sheets of equal size. (20 to 40 sq. ft. is a reasonable size.) Place sheets in intended path of spreader and secure to the ground. Spread manure and weigh amount of manure on each sheet.

Application Rate (tons/acre) = (lbs. of manure on sheet x 22)/size of sheet (sq ft).

Calculate average application rate.

To evaluate the spreading pattern, place a series of plastic sheets across the anticipated manure path and calculate the application rate for each one separately. This process will quantify the unevenness in manure distribution and can serve as a guide for the desired amount of overlap in adjacent passes and the resulting swath width.

Method 4. Average Application Rate Based on Storage Volume Applied to Fields

This is not a calibration method in the same way as the others described above, but it is a way of approximating the average rate of manure applied to fields after emptying the manure storage. It requires knowing the capacity of the manure storage or an estimate of the portion applied on a given acreage. It can serve as a check on estimated application rates applied to fields.

Application Rate = Manure storage emptied (tons or gallons)/Area covered (acres).

Whichever calibration method is used, it will probably be necessary to adjust the application rate to obtain the desired rate by changing a combination of tractor speed and spreader control, followed by a recalibration of the spreader by the same method. Two or more rates are typically needed for different crop types or varying nutrient needs.

Where This Practice Applies and Its Limitations:

Spreader calibration applies to all land uses and site conditions where manure is spread on crop fields. The main limitation of spreader calibration is the assumption that the procedures and materials used in calibration (tractor speed, manure density, load size) will continue to be used consistently when fields are spread. Variability in manure spreader rate can affect the reliability of the calibrated rate, especially for Method 3, because of the small amount of area on the plastic sheet. Since the optimum application rate is based on nutrient analysis of manure, a change in the nutrient content of manure being applied requires a change in application rate, and therefore, a recalibration.

Effectiveness:

Manure calibration is essential to assure that the target rate is being achieved. It is most effective in preventing water quality degradation on fields that are most susceptible to runoff or leaching of nutrients. It is on these fields that excessive manure rates are most likely to contribute to environmental damage.

Cost of Establishing and Putting the Practice in Place:

The cost of spreader calibration is primarily the time of the operator needed to carry out the procedures. Costs of equipment and materials will vary with the specific method but are fairly minimal. A measuring wheel is useful for Method 1, and plastic sheeting, pail and a small hanging scale are needed for the plastic sheet method. Weighing the entire spreader (options for Methods 1 and 2) requires wheel scales or access to a drive-on scale, but it is unlikely that these would be purchased strictly for spreader calibration. Adjusting manure application rates to achieve an optimum agronomic rate can provide economic return to the farmer by assuring that manure is applied at a rate that meets crop nutrient needs and avoids wasting a nutrient resource.

Operation and Maintenance:

Spreader calibration needs to be repeated whenever there is a significant change in manure characteristics (e.g., moisture content or bedding), when equipment changes (spreader or tractor) or when a different application rate is desired.

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For Further Information:

Contact local Cooperative Extension, USDA-NRCS or Soil and Water Conservation District office.