Manure application and management plans — two sides of a coin

Nutrient management plans and accurate application go hand-in-hand to improve soil and a farm's bottom line.

by Scott Fleming

Manure management and nutrient management plans rely heavily on mapping software and computer technology. When creating one of these plans, we often focus on the software and lose sight of what really happens in the field. However, both the nutrient application equipment and the plan itself must work together to get the job — and the "management" — done.

Every applicator that hits the field affects the soil, and thus, the management plan. Let's take a look at how various manure application methods affect both nutrient availability and plan creation.

Applying the nutrients

The means by which manure interfaces with the soil is one of the greatest factors affecting manure and nutrient plans. The decision whether to directly inject or surface apply manure changes most aspects of a plan.

For starters, manure injection always results in soil disturbance. The injection and subsequent incorporation affect the potential for soil loss in a field. Manure injection also does something we cannot see — it changes the fertility available for next year's crop.

When manure is injected directly into the soil, 50% to 70% of the nitrogen in the manure is available for next year's crop, depending on the manure source. Reduced ammonia gas losses result in less nitrogen loss from direct injection versus any type of surface application. Simply stated, the faster manure is incorporated into the soil following application, the greater the fertilizer value from the manure.

Surface-applied manure can take on several forms. If manure is surface applied and incorporated within a couple of days, the first-year available nitrogen is reduced to 40% to 55% of total nitrogen. If manure is surface broadcast and incorporated after the four-day window, the first-year available nitrogen is reduced by half of what would have been available when injected or surface applied with immediate incorporation.

Calibrating the equipment

Equipment calibration is vital to getting the most out of manure. Manure application equipment should be treated no differently than commercial fertilizer application equipment. After all, we are applying the ultimate, complete fertilizer to the soil. The first step to treating manure like a fertilizer is knowing exactly how much manure is applied.

With liquid manure, this tends to be a little easier. For starters, liquid manure is commonly applied using a dragline. It has become commonplace to have an inline flow meter in the liquid system. The flow meter requires calibration to ensure it is accurate but requires little work outside of calibration. Flow meters run in the background, accurately recording application rates on the fly.

When manure is applied load by load, record keeping can become more complicated. One way to overcome this hurdle is by maintaining an actual logbook. On large farms, a logbook is often essential to maintaining a discharge permit. An accurate record of weather information, as well as soil conditions, drain tile flow, and other environmental criteria are typically required to be recorded in the log. This can be an online document filled out daily by the applicator or a paper logbook in the cab of each tractor. A big benefit to keeping a manure logbook is the ability to review and calculate the manure application rate.

The simplest but least precise method to dial in the application rate is using manufacturer rated manure spreader capacities. This method is generally less accurate because spreaders are rarely filled to manufacturer recom-

mendations. For example, solid spreaders heaped beyond the manufacturer's struck level capacity or liquid spreaders that are not completely filled because of manure foaming are not filled to manufacturer's specifications.

A quick web search generally provides manure spreader capacities, which, with a little estimation, fine-tunes the applied load. Manure spreader capacities are often listed in bushels or cubic feet. See Figure 1 for helpful conversion factors for different manure types.

The most accurate way to determine how much manure is applied by each load is with a scale. Many large operations have a truck scale on site. If a truck scale is unavailable, local conservation departments or soil and water district offices may have a set of portable scales available. It's best to weigh several loads of manure to establish an average load weight.

Once the load has been determined, calculate the applied area. To do this, apply a typical load of manure using the same settings as normal. Then measure the length and width of the applied area. After that, multiply the length by the width and divide that by 43,560 square feet per acre to determine the acres covered. Finally, divide the quantity of manure by the acres covered to determine the rate per acre.

Here is an example of the equation:

Gallon or tons per load/acres covered = rate per acre

4,600 gallons per load/(15 feet wide x 1,500 foot long)/43,560 feet^2 per acre = 8,906 gallons per acre

Common manure conversions

To convert from:	To:	Multiply by:
Bushels	Cubic feet	1.24
Gallons	Cubic feet	0.134
Gallons	Pounds	8.3 (liquid)
Cubic feet	Gallons	7.48
Cubic feet	Tons	0.031 (liquid) or 0.0275 (solid)
Cubic feet	Pounds	62 (liquid) or 55 (solid)

Source: Penn State University

Another method better suited for solid manure involves getting down and dirty. Place a tarp on the ground and stake the corners to prevent it from moving. Then apply manure to the tarp in the same manner as in the field. Next, apply manure on either side overlapping the standard amount. Now comes the fun part! Remove the tarp, taking care not to lose any manure from the edges. Weigh the tarp to determine how many pounds of manure are applied to the known area of the tarp.

Simple arithmetic allows us to scale up from pounds per tarp to tons per acre:

Pounds per tarp/tarp area (sq. ft.) = pounds per sq. ft.

Pounds per sq. ft. x 21.8 (This is 43,560 sq. ft. per acre/2,000 pounds per ton) = tons per acre

All this math may be a little tough to digest on the fly, but nearly every land grant university has a publication on this subject and a quick web search provides numerous explanations. There are even a few support videos for added guidance.

Dial it in

This year, the entire agriculture sector is under intense economic pressure. Margins are narrow on both the agronomic and livestock sides of the system. With more data comes more opportunities for efficiency.

A manure or nutrient management plan is a record of past and intended future nutrient applications. These highly detailed records will help bridge the gap moving forward, further conserving resources and your bottom line.

No feeder takes a one-size-fits-all approach to feeding cattle; why would every field get the same application of fertilizer regardless of manure application? When all nutrients are accounted for, the opportunity to sharpen input applications will lead to a strong bottom line thanks to both equipment and planning. ■

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