



Spreading the Wealth of Dry Manure with Proven Precision ROI

Adoption of advanced application technology is providing an economic alternative to costly commercial fertilizers, while also organically building soil biology.



It's often said, farmers can't manage what they don't measure. The inability to do either on a consistent, accurate basis has made it difficult to consistently quantify the economic and biological benefits of applied manure.

But recent advancements in dry spreading technology is allowing growers to precisely capture and calculate the value of manure as a cost-effective nutrient source that organically strengthens the soil.

While dry rate control is a mature technology to apply supplemental sources of nitrogen (N), phosphorus (P) and potassium (K), return on investment is becoming more definable with the ability to create as-applied maps, track and record load weight and execute variable-rate manure spreading prescriptions.



CROP CARE

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Economic Incentive

“Manure application is an imperfect science,” says Eric Richer, agriculture and natural resources assistant professor at Ohio State University. “Advancements in technology will resonate with farmers who understand the nutrient value of manure and the logistical needs of applying it where it’s needed. There’s real potential.”

For years, Jim Palmer, who farms with his son, Mitchell, had as much as 3,000 tons of dry manure delivered and custom spread across their 2,000-acre primarily irrigated corn and soybeans operation in Elm Creek, Nebraska. Grid samples taken every four years hinted at the biological benefits of manure, but cursory, if any reliable information on load weights or application rates made it difficult for the Palmers to consider reducing their annual investment in commercial fertilizer.

But they also couldn’t justify spending \$120-\$140 per acre to have manure delivered and inconsistently spread at 25 tons per acre across 200-300 acres without confirmation that what they paid for was what they got.

“There could be as much as a 5-10 ton variance between what we wanted applied and what actually went into the field,” Jim says. “If we were 10 tons long, we know we didn’t get enough applied where we wanted it, let alone the pass-to-pass consistency.”

In 2019, the Palmers invested in their own spreader, a 950 Tubeline, and also added the Topcon Athene SL2 system, which combines dry rate control with load cells that provide real-time product weight readings, on-the-go calibrations and as-applied maps. They run the system through a John Deere 2630 display in one of their three Deere 8R series tractors that pulls the spreader 6-7 miles per hour through the field. They are rotating manure applications, covering approximately 500-acre sections of the farm every four years.

In addition to reducing spreading costs by almost 50% to \$70-\$80 per acre, the Palmers are stretching their commercial fertilizer investment further than ever. Jim estimates they are annually saving at least \$100 per acre in dry fertilizer costs and over the course of 4 years, will save \$300-\$400 per acre in commercial fertilizer expenses alone to maintain the same nutrient levels in fields they spread manure.

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“The price of fertilizer is always going to go up,” Mitchell says.

“

But when we look at soil test results that show a field is low in phosphorus, it’s a relief knowing we’ll be able to elevate those levels with a targeted manure application. We don’t have to worry about a huge commercial fertilizer bill for the next 3 years to get those nutrient levels where we want them to be...

”

Mitchell Palmer, farmer, Elm Creek, Neb.

The Palmers have been building soil biology through years of manure spreading, but even a first-year application on low-CEC soils can produce a positive impact on yield. Early results of an ongoing Ohio State fertility study (*Meeting Tri-State Fertility Needs, 2021 eFields On-Farm Research Report p. 96-97*) comparing the effect of three different, but equally-applied sources of N, P and K on corn yield, showed that fields spread with manure out-produced those with compost and commercial fertilizer.

Test sites spread with a flat rate of manure by a Kuhn Knight ProTwin Slinger, yielded 213 bushels per acre, compared to 202 for compost-applied fields and 190 for those with commercial fertilizer. Each of the test plots part of the 2021 trials received the target 2-year crop removal rates of N, P and K, based on Tri-State fertility needs for corn.

The fields recorded 1.7% organic matter content and 4.4 CEC, according to Richer, who is leading the research project funded through a three-year grant. Baseline data was collected from three different locations and participating growers were asked to weigh in and weigh out their manure and for permission to pull samples every week.

“We more than doubled the nutrient density for phosphorus, potassium, sulfur and in our case, calcium, with composted manure, and preliminary results support manure as a viable nutrient replacement to commercial fertilizers,” Richer says. “Perhaps we can hang the yield benefit of manure on the prolonged availability of nutrients throughout the growing season.”

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The 'Magic' of Manure

Aside from the use of auto-steer in two of the trials, no other precision technology was part of the 2021 research, and Richer acknowledges the enhanced benefits that modern spreading systems can provide, especially when applying different types of manure.

“Three out of the five growers we worked with had sawdust-based manure and two had straw-based manure,” Richer says. “The straw runs through the spreader pretty rough, so having the ability to vary the rate is something that would improve the consistency of that coverage in the field.”

While automated management of dry manure spreading can cut fertilizer costs without sacrificing crop quality, building a better biological environment is equally important, especially in regions where nutrient retention is a challenge.

In the Northern Plains and Midwest, the availability of P throughout the growing season is often a limiting factor to raising a profitable corn crop, says Brady Bjornson, senior product manager at Topcon Agriculture. Developing a comprehensive soil health profile beneath the surface ensures the proper amount of manure is being applied on top.

“If I’m in those areas, I need to maximize the value of applied phosphorus, but then I still might have to backfill with potassium, nitrogen or micronutrients. Remember that 1% of organic matter is worth 50 pounds of available nitrogen the following growing season,” Bjornson says. “Soil and topography maps can identify nutrient deficiencies in the field, and you create a variable-rate prescription to spread manure in areas most in need.”

Dry manure management is increasingly similar to that of granular fertilizers, says Bjornson, in that more accurate data is driving the decision-making process not to deplete and degrade soil health. But active monitoring and mapping also prevents over-application of manure that could turn soils toxic.

In 2021, the Palmers variable-rate spread manure on 200 acres, going from 10 tons per acre to as much as 40 in the same field, based on recent grid sample data. With soil types ranging from sand to heavy ground, some areas recorded barely double-digit parts-per-million P while others were close to 100.

“It was eye-opening and allowed us to be more targeted with applications. We wondered if we’d steal too much nitrogen credit by not applying a flat rate of manure across the entire field, but visually, we didn’t see a negative impact on yield,” Jim says. “I think there is a little magic in manure that’s hard to quantify with data. It does something

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Worth the Weight

to kick-start our soils and we have just seen healthier crops in fields where we've consistently applied organic manure vs. commercial fertilizer.”

While dynamic rate control capabilities drive economic ROI, the load cell feature - unique to the Athene system - provides peace of mind by eliminating headaches and hassle associated with spreader calibration, according to Bjornson.

Typically, proper calibration requires a time-consuming spread or catch test with a skid- or front-end loader. “Every load, you need to get a density cup reading and calibrate at least once per day,” he says. “When a load cell is tied to the rate controller, every second or tenth-of-a-second, you are getting a recalibration event, so this eliminates the need for a catch-test.”

With the amount of manure that co-ops and custom application businesses spread, higher efficiency and improved accuracy can be valuable tools to enhance customer confidence. After more than 20 years of “eye-test” analysis, Copeland, Kansas, custom applicator Alex Koehn says the ability to provide more accurate data on exactly how much manure was spread and where reinforces trust.

For Koehn, the ease and accuracy of dynamic on-the-go calibrations and real-time weight readings are invaluable efficiency tools, especially when spreading up to 500,000 tons of manure on variable western Kansas soils for Jerry’s Manure Spreading LLC. The company runs three different models of JBS manure spreaders, each controlled by an Athene SL2 system run through Case IH Pro700 displays in Steiger 600 tractors.

“We’re also running two external radio modem (ERM) Wi-Fi modules for mobile weight readings. I can pull those up through the SL2 on the in-cab monitor or remotely on the Digi-Star Cab Control app,” Koehn says. “The fact that I know how much each load weighs before I start spreading and then exactly how many acres I’ve covered, and that manure was perfectly applied on each acre, takes a lot of the guesswork out of the process.”

The metrics and mobility are especially attractive for the next generation of farm customers who are looking to push crop production with technology that also provides biological benefits. Preserving soil structure is increasingly important, Koehn says, with conservation conscious customers managing manure application as a method of soil health improvement.

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“ I feel manure is one of the shortest, and maybe even the shortest path to build organic matter content to the point where soils have better moisture and nutrient retention capacity...”

Alex Koehn, Jerry's Manure Spreading LLC, Copeland, Kan.

Koehn says. “Especially in raising a profitable corn crop, having enough N, P and K is essential, and properly spread manure can provide all three.”

3 Metrics Needed to Accurately Calculate Crop Available Nutrients in Manure

To maximize the economic and biological benefits of properly applied manure, the University of Nebraska-Lincoln Extension assembled a resource to estimate and calculate crop available N, P and K.

While nutrient content can vary depending on factors including source, moisture content, and collection and storage methods, a thorough understanding of nutrient concentration in manure is as important as that of commercial fertilizers.

Advanced application technology is allowing growers and custom applicators to map acres, record weight and adjust rates in real-time, which translates to data-driven decisions on how, when and where to capture the most ROI with manure.

To accurately credit crop available manure nutrients, university researchers outlined 3 pieces of required information:

1. Nutrient Concentration at Time of Application. The concentration of individual nutrients in manure measured as pounds of nutrient per unit of manure (ton, 1,000 gallons, or acre-inch).
2. Application Rate. The rate at which manure is applied to the land measured as tons, 1,000 gallons, or acre-inches.
3. Nutrient Availability Factors. The percentage of nutrients in manure available to the crop in a given year.

Access the full guide and crop available nutrient content **calculator here**.

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Broader Application Ahead for Dynamic Spreading Technology

Precision spreading of dry manure is gaining momentum as a cost-effective organic alternative to commercial fertilizers, especially among large feedlot operations and custom applicators. Since 2019, Jim Steinke, vice president of sales and marketing with Ag Express Technology, has had success pairing Topcon Agriculture's Athene SL2 system with manure spreaders for more accurate application and mapping.

But he sees a more diverse market developing for the technology. While some farmers are adapting the system to spread other dry fertilizers like lime, Steinke sees potential to improve the accuracy of cover crop application.

"The ability to put weigh bars on a spreader and tie into the SL2 system to provide dynamic spreading based on weight, just like with manure, is something I think we'll see more of," Steinke says. "Applicators can monitor and control the spinners through hydraulic pulse width modulation (PWM) sensors and map the acres."

He acknowledges that the majority of farmers still tend to drill in cover crops, and many using spreaders are covering less acres. Still, Steinke suggests that more accurate tracking could be valuable if cover cropping becomes a more incentivized practice.

"That's when I think we see this technology gain momentum in this area of agriculture," he says.



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