Manure: The new commodity

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Introduction

Rising commercial fertilizer prices have caused manure nutrients to become a valuable and much sought-after commodity. Crop producers that have not traditionally used manure as a nutrient source for crop production are now looking to use manure to replace all or some of their commercial fertilizer inputs. Livestock producers are also looking for a way to capitalize on increasing feed input costs by selling manure.

Component pricing

The most common method of valuing fertilizer is component pricing. The manure is sampled and analyzed to determine the nutrient content. This analysis is used to determine the value based on commercial fertilizer prices. A typical hog finishing manure might test 50-35-25 pounds of Nitrogen (N), Phosphorus (as P_2O_5), and Potassium (as K_20) per 1,000 gallons. If the manure was injected with minimal losses and the nitrogen was readily available a 3,000 gallon rate would provide 140 pounds of nitrogen per acre. If N was valued at $0.70 a pound there would be $98 of N value. In addition you have 105 pounds of P_2O_5 and if valued at $0.85 per pound, would equal $89 per acre. You would also receive 75 pounds of K_2O valued at $0.70 per pound or $52 per acre. That would bring the total to about $240 per acre. In addition the manure would contain other components such as sulfur, iron and organic matter. This method may not take into account potential nutrient losses and crop utilization. If one has very high phosphorus or potassium soil test levels the application of additional fertilizer may not provide any additional yield increases. One also needs to be cautious if entering into a long term agreement based on fertilizer values that are at 3 to 4 times historic prices.

Bulk commodity

Another method used to price manure is to price it as a bulk commodity where you have sellers and buyers. If you are in an area that has an abundance of supply and limited demand it will drive the price down. If demand outstrips supply it will bid up the price until it balances out with the demand. The nutrients would have a different value depending on the location and local situation. Transportation and distribution costs become a factor in what the value is and how much the buyer can negotiate on price. If there is an over abundance of manure in one area and the livestock producers are faced with high transportation costs to move it out of the area they may be willing to reduce the price if they can avoid significant transportation costs. Dry poultry manure with high phosphorous levels lends itself to greater transportation distances because of the high nutrient density.

Transportation costs

Transportation costs can be broken down into to general categories. The first is commercial or custom hauling. Iowa has developed a very significant and important industry around commercial hauling for both liquid and dry manure. Commercial haulers usually base their rates on a per gallon basis, with a variety of premiums and discounts. Premiums are based on distance, rates, and set up fees to name a few.

If you use $.015 per gallon as a base rate a producer might spend $45 per acre to get manure applied. Even if there was a surcharge of $.002 per mile for going each extra mile it would only add $6 or $12 to the cost of going an extra mile or two. Comparing that cost with the $240 of potential value in the manure explains some of the excitement about constructing new hog finishing facilities by farmers that just produce grain.

Some producers may decide to haul their own manure. This could be a crop producer who wants to haul someone else's manure to his own farm or it could be a livestock producer. If the farmer already has a tractor that is adequate for pulling an applicator there are additional opportunities for savings. If producers are interested in calculating their own costs they can download http://www.extension.iastate.edu/agdm/crops/xls/a3-29machcostcalc.xls which is a spreadsheet that will help them calculate the fixed and variable costs of operating machinery. As the spreadsheet demonstrates, a person who uses a tractor that they already are using in their crop operation can lower the fixed costs and overall costs of hauling manure.

Limitations

Some of the concerns with using manure are compaction from application, uniformity of the product, uniformity of application, fixed analysis, impact on planting date, increased weed pressure, or increased disease pressure to name a few. The "net present value" of applying phosphorus and potassium on very high testing soils may not equal the cost of the application. Manure is not always a uniform product. Even from year to year we are seeing differences in manure analyses because of changing animal diets that include phytase, dried distiller grains and synthetic amino acids. These rations can potentially have a lower nutrient analysis making them less value on a per 1,000 gallon basis. This also increases the cost of application per unit of fertilizer. This highlights the importance of a good manure nutrient analysis program. Other things to consider may include the need for your fields to be documented in a manure/nutrient management plan on file with the DNR, application separation distances, implementation of the Iowa P Index and other requirements.

Valuing manure

In the past we didn't sell manure in Iowa. More frequently were trying to negotiate for the reimbursement of the cost of hauling. When dealing with liquid hog manure most of the hog operators were receiving between $0 and $20 per acre to offset the cost of hauling. This may change as fertilizer costs increase. Pork producers that have faced high feed costs are now trying to increase their revenue by selling the nutrients in the manure. Some are trying to get to where they would receive two-thirds of the nutrient value equivalent of fertilizer. There are some spreadsheets available to help calculate the value of manure as a fertilizer. One of the products is

the *ISU Manure Nutrient Value Calculator*. The order form is available at http://www.ipic.iastate.edu/information/MNV.orderform.pdf.

The spreadsheet compares the value of commercial fertilizers with manure. It also estimates the acres needed. It includes the Iowa P-Index formulas and summary reports. There is also a downloadable spreadsheet from the ISU Extension site at http://www.extension.iastate.edu/agdm/livestock/xls/b1-65manurecalculator.xls. Another manure calculator spreadsheet is available to download from Bob Koehler's web site at the University of Minnesota: http://swroc.coafes.umn.edu/Bob/koehler_main_page.html.

Manure has a lot of valuable nutrients. It can be very cost effective to haul where needed. It is important to utilize the nitrogen component. A producer needs to know the quantity of manure available, the nutrient analysis of the manure, the crop needs, the current soil tests and the handling and application costs. The application of manure may result in increased or decreased yields when compared to traditional fertilizers depending on anyone of a number of reasons. The crop producer needs to predict how well they can manage the manure and what the overall impact will be over a number of years. You will then be better able to determine the value of the manure in your farming operation.

Manure transportation and application

The costs of transporting and applying manure usually fall into two general categories. The first is hiring it custom-applied. The second is to do it yourself. There are advantages and disadvantages to both. You may want to compare the costs of both methods.

With commercial haulers you know fairly close as to what the cost per acre will be for the application costs. You don't have any investment in equipment or any of the issues of dealing with hired labor. On the other hand you have less control over the timing of the work, the quality of the work, and the skill used in agitation and application of the nutrients. On the other hand you may have access to better equipment with better technology such as flow meters and auto steering than if you used your own equipment. The application may be quicker and timelier than if you do it yourself. Some of the liability associated with the application of manure may be shifted to the commercial hauler when transporting on public roads.

Commercial hauling rates vary depending upon the supply and the demand for the service. Other factors that become a part of the rate that commercial haulers charge include the total number of gallons to be hauled, the application rate per acre, the amount of agitation, the distance to haul, the type of application or injection, the technology used, and the season of the year. Rates will also vary depending on the application method such as the use of an umbilical system, semi tanker transfer system, or dry handling system. They may also include such things as "fuel price" increases that are passed through.

Fixed and variable costs

Whether you are a commercial hauler or a private hauler you can break the costs down into two general areas. The first is fixed costs and the second is variable costs. These are often known as the DIRTI FIVE - Depreciation, Interest, Repairs, Taxes, and Insurance.

Fixed costs are the costs that you incur because you are involved in the activity. You have start up costs such as licensing fees if you need one. You may also need liability insurance. The fixed costs include depreciation and opportunity costs which are part of the machinery costs. A large manure tank wagon is going to sit still more days than it will be used unless you travel from state to state. A manure tank wagon could cost well over $75,000 and the tractor another $175,000 or more. Then there are the agitation pumps and service vehicles. A commercial hauler with three rigs and support equipment could have well over $1,000,000 of equipment that is depreciating and tying up capital.

Variable costs are those costs that you pay when you operate. Fuel is a major cost along with repairs. Repairs can vary tremendously depending upon the age of the equipment, the skill of the operator, the maintenance program and the type of use. Wagons that spend a lot of time on the road will have accelerated tire wear. Operators that drive through ditches and ravines will have more repairs. Operators who operate at night tend to have higher repairs as well. Deeper injection may require more fuel than shallow or surface application.

Calculating costs

For someone looking at getting started in the commercial manure hauling business they would want to try to identify the expenses and income potential. You would have significant investment in tractors, tankers, and agitation equipment and support vehicles to name just a few of the capital items. You would also have expenses in overhead, labor, repairs, fuel, fuel transportation, taxes, insurance and certification fees.

You can use spreadsheets to give you some general ideas about what the costs might be. One example is *ISU Machinery Cost Calculator* found at http://www.extension.iastate.edu/agdm/crops/xls/a3-29machcostcalc.xls that will help calculate costs. If you assume that you use a $180,000 tractor to pull a $80,000 manure tank wagon and you use it for 500 hours a year for ten years, the cost of interest is 6%, labor costs $13 per hour, fuel at $3.50 per gallon and you cover 2000 acres in a season it would cost $13.23 per acre to own the two pieces plus $22.40 per acre to operate it for a total cost of $37.21 per acre or a total cost of $74,418. This doesn't include any of the agitation equipment or overhead expense. It includes the interest and depreciation, taxes, insurance, repair costs, fuel, and labor.

If you applied 3,500 gallons of nutrients per acre and charged a penny a gallon you would generate $35 per acre or $70,000 in revenue leaving you with a significant shortfall by the time you added in all of the overhead costs.

If you applied on 5,000 acres with the same rig and did that in 909 hours of work your total costs for the two pieces of equipment would drop to $23.41 per acre or a total of $117,064. If you charged $35 on 5,000 acres you would generate $175,000 and be able to start to cover some of the other expenses. One of the major variables is accurately estimating the number of gallons that you will haul and the time to do that. A spreadsheet that may be useful in doing that is the *Estimating Field Capacity of Farm Machines* found at http://www.extension.iastate.edu/agdm/crops/xls/a3-24fieldcap.xls. It can help you estimate the acres you can cover and the time to do it. It also helps you think about the speed you travel, the size of your toolbar and the turnaround time or efficiency.

You would then need to go through the list of equipment and other overhead expenses and estimate your costs for the other items to see if there might be enough income to pay all of the cash and non-cash costs and have a reasonable return to management. Many commercial haulers have underestimated the expenses and overestimated the revenue resulting in haulers exiting the industry.

One other item of concern is to set a fee structure that takes into count some of the variables you may encounter such as hauling farther distances or excessive road time in between sites. You may also have down time due to the time required for agitation, breakdowns or weather delays as well. For example, if you increase the hauling distance from one mile to two miles it can increase your time to make a round trip by 40%. If you increase the hauling distance from 2.5 miles to 3.5 miles the time requirement might increase by 25%. Commercial haulers typically get paid by the gallons that go through the meter and if you increase your trip time by 25% you will decrease your revenue per hour by 25% so rates need to reflect that.

If you are hauling your own manure and you already have your own tractor and labor is not a restraint the cost of hauling may be less. Your ownership costs for the tractor will be spread out over more hours. However, you need to watch what your investment in the manure tank wagon is because if it is a large investment and you don't use it on a lot of acres the tractor savings may be more than offset by the increased ownership costs of the tank wagon. If that is the case one might be able to lower the costs by looking at joint ownership or short term leasing of the item.

If you were looking at spreading dry manure you would go through the same process. You might be looking at a semi tractor, a side dump trailer, a loader, and a spreader. You might also have some significant overhead costs such as insurance, licensing and employment taxes.

With higher fertilizer prices it will pay to haul manure farther if you need to better utilize the nutrients on lower testing fields. You need to use the fertilizer in the most environmentally sustainable method. You need to utilize soil tests in making decisions about where to apply and how much to apply. It may be more economical to apply lower rates based on phosphorus and supplement the nitrogen to better utilize the phosphorus and potassium over more acres. We need to test the manure and understand the variability of the content of the nutrients that can occur.

Selling and buying manure

As with anything related to manure in Iowa, there are rules, regulations and requirements for selling and buying manure. Regulatory requirements for selling manure in Iowa are highly correlated to the need for a manure or nutrient management plan and the type of facility that is producing the manure. If you are planning to buy manure produced outside of Iowa or sell manure to someone located outside of Iowa, please be sure to check the regulatory requirements of other states. Sales or distribution of manure is regulated by either the Iowa Department of Natural Resources (IDNR) or the Iowa Department of Agriculture and Land Stewardship (IDALS).

Selling manure from confinement facilities that require a manure management plan

Manure from confinement facilities requiring a manure management plan may be sold under one of four methods and still meet manure plan requirements. These methods are defined by the type of manure being sold.

Method 1. Selling manure under Iowa Code chapter 200.

Manure may be sold under Chapter 200 of the Iowa Administrative Code which is regulated through IDALS. Manure sold under Chapter 200 is manure that has been manipulated in some manner, such as having other ingredients added, being dried or composted or being bagged for commercial distribution. Manure sold under Chapter 200 requires secondary containment around the manure storage structure. Manure sold under Chapter 200 requires a guaranteed analysis. A copy of the IDALS license and the DNR manure management plan form for the sales of manure must be submitted to the DNR in place of the regular manure plan forms.

Method 2. Selling manure under Iowa Code chapter 200A or the "Bulk Dry Animal Nutrients Products Law."

This is the most common method for selling dry manure. Manure that meets the definition of "dry" manure can be sold under Chapter 200A which is regulated by IDALS. The difference between Chapter 200 and 200A is that dry bulk animal nutrient product is defined as any unmanipulated animal manure sold in bulk form to which a label cannot be attached, the manure contains one or more recognized plant nutrients, the manure promotes plant growth, the manure does not flow perceptibly under pressure, the manure is not capable of being transported through a mechanical pumping device designed to move liquid and the constituent molecules of the manure do not flow freely among themselves, but do show a tendency to separate under stress. Manure sold under Chapter 200A requires a guaranteed analysis. Manure sold through Chapter 200A does not require implementation of the Iowa Phosphorous Index. However, a copy of the IDALS license and the DNR manure management plan form for the sales of dry manure must be submitted to the DNR in place of the regular manure plan forms. Manure sold under Chapter 200A does not require secondary containment.

Method 3. Distribution of manure through a manure agreement.

If you choose not to sell manure via method 1 or 2 as identified above, or if you plan to sell liquid manure from a confinement facility, you may do so through a manure agreement. In this case, you as the seller complete a manure agreement with the purchaser for either the cost of the manure or the cost of application of the manure or the cost of both. For this method you will be required to meet the application rate limits and conditions of your manure management plan as required by the DNR(DNR Form 542-4000) . This will include implementing the Iowa Phosphorus Index on all fields receiving manure through the agreement. In addition, the purchaser of manure is required to keep records of commercial fertilizer application to ensure nutrient application rates in the manure management plan are not exceeded. The purchaser of the manure is required to share these records with the owner of the manure management plan on an annual basis. One example for keeping these records includes the DNR Form 542-8167, "Statement of Intent" to report planned applications of commercial fertilizer to the DNR. Use of this form is not required. It should also be noted that if you as the manure generator, charge for the application of manure from your farm to others, the DNR considers you to be a commercial

manure applicator and you will be required to be certified as a commercial manure applicator.

Method 4. Distribution of manure through manure sales form.

This method is very similar to Method 3, but does not require a formal manure management plan. However, the requirements include all of the components of a manure management plan. If your operation has an established practice of selling manure or includes a type of livestock for which selling manure is a common practice, you must submit the following information to the DNR: estimate of number of acres required for land application of manure from your farm; annual animal production; manure volume generated; manure sales form; a statement of intent from the purchaser(s) or past sales records and, if required the Iowa P Index and factors used in the Iowa P Index calculations. The DNR does not require use of specific forms for the sale of manure or the statement of intent to purchase manure, but links to examples may be found in the Additional Resources section at the end of this fact sheet. The owner of the manure shall maintain copies of the current manure management plan and signed copies of the sales forms from each purchaser for five years after each sale.

Selling manure from confinement facilities that do not require manure management plans

If you are not required to have a manure management plan, you may sell manure via methods 1 or 2 above if it is dry manure, or via a private contract. It is not necessary to have a private contract, but is possible the purchaser could sue the seller if the product fails to meet expectations for its intended use, therefore implementing a contract can help to protect the seller.

Selling manure from permitted open feedlots

The DNR has no regulations on selling manure from permitted open feedlots, so you will be required to comply with all DNR requirements pertaining to a Nutrient Management Plan. So, similar to manure from confinement feeding operations, manure will have to be distributed and or sold through manure agreements as part of the nutrient management plan. (See methods 3 or 4 above).

Selling manure from non-permitted open feedlots

Because non-permitted open feedlots are not required to meet nutrient management plan requirements, there are no regulations for selling manure. They may choose to sell dry manure under Chapter 200 or 200A, but are not required to so. It may be beneficial to sell manure from these types of facilities via a private contract to protect the seller, but it is not necessary.

A portion of this paper was adapted from Iowa Manure Manager Series, Volume 10, Buying and Selling Manure located on the WEB at http://www.agronext.iastate.edu/immag/pubsimms.html