On-Farm™ Network

A program of the Iowa Soybean Association

UPDATE

Agronomic research and economic performance

April 2008

Advancing Agricultural Performance™

Inside:

IOWA SOYBEAN ASSOCIATION

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On-Farm UPDATE

Agronomic research and economic performance

A publication of the Iowa Soybean Association On-Farm Network™

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NRCS Natural Resources Conservation Service

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IFLM Integrated Farm Livestock Management Demonstration Program

On-Farm Network™

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Manure:
Iowa's renewable natural resource

Manure may be the most economical soil fertility booster available to Iowa farmers.

Then again, it may be one of the most costly. It depends.

There are a number of factors that determine how valuable manure might be. These include:

1. Type of manure (pork, beef, dairy, poultry) and age of animals
2. Type of ration
3. Type of storage (solid/dry from open or covered storage, liquid from an under-building pit, liquid from an earthen lagoon, etc.)
4. Length of storage and time of year
5. Type of application (surface broadcast, surface broadcast-incorporated, injected)
6. Nutrient analysis of the manure, time and method of sampling (during agitation, during spreading, core sampling of dry manure, etc.)
7. Nutrient availability from the manure as applied
8. Accuracy/uniformity of application
9. Distance hauled
10. Soil type, field management history
11. Crop to which it is applied
12. Source of manure (your own operation, or purchased from outside)
13. Price of commercial fertilizers

While all of these should be considered, probably the most important factors are the nutrient analysis and availability, the combined cost of product and application, and the application method.

Cost of application is determined by the type of application (broadcast or injected) and the distance the manure must be hauled to the application site. Putting on more per acre can mean lower hauling costs if fields are near the storage site. If you can put on 100% of the crop's needs with manure, you might not need other fertilizers. But how much manure must you apply to meet the crop's needs?

This depends on nutrient analysis and the percent of the nutrient that can be used by the crop that year.

The jury is still out on the availability of nutrients, particularly nitrogen. Iowa Soybean Association On-Farm Network™ studies have shown a wide range of N availability, from around 50% and up. If you have a nutrient management plan, you have to calculate that 100% of the nitrogen from liquid swine manure is available that first year and apply accordingly. When we average all our studies, we can say definitively that you can't count on 100% of the N being available the first year.

Another consideration with manure is how often it should be applied to a field. Timing applications every 3 to 5 years seems to be the norm for growers with a ready supply of manure. The limit on frequency of use is more a function of the P and K in the manure, which may accumulate in the soil to excessive levels with more frequent applications.

The table below is a somewhat scientific guess as to how much of Iowa's annual fertilizer needs might be met with manure. It assumes that all manure has the same N, P and K analysis (we know that's not true) and that we'd be able to capture and use all of the wastes from the state's dairy farms, cattle feedyards, swine facilities, and poultry operations. But it shows that we have plenty of farm land in the state to be able to make good use of all the manure our livestock and poultry can produce.

The following pages are intended to arm you to make better decisions about manure use in crop production. This information is important, whether you're producing livestock, crops, or both.

Table 1. Iowa's Natural Crop Nutrients

Commercial Animals Typically Confined in Iowa	Numbers[1]	Annual Manure Production (tons)[2]	Total Nutrients Available		
			N (lbs.)[2]	P_2O_5 (lbs.)[2]	K_2O (lbs.)[2]
Dairy Cattle	213,000	4,260,000	51,120,000	25,560,000	51,120,000
Beef	860,000	9,460,000	113,520,000	56,760,000	113,520,000
Hogs[3]	1,100,000	13,475,000	188,650,000	121,275,000	148,225,000
Broilers	1,700,000	15,300	994,500	994,500	688,500
Layers	38,000,000	399,000	13,965,000	31,920,000	19,950,000
Turkeys	3,600,000	126,000	5,040,000	5,040,000	3,150,000
Total annual manure production in Iowa		27,735,300	373,289,500	241,549,500	336,653,500
Lbs. per acre, spread over 12 million acres of Iowa corn land			*31.11*	*20.13*	*28.05*

1 2007/2008 data from USDA National Agricultural Statistics Service
2 Based on numbers from Iowa State University publication PM 1811, as revised in 2003
3 Based on sow numbers from Dec. 2007, USDA Hogs & Pigs Report, calculated with *Farrow to Finish* estimates from PM 1811.

What is the fertilizer value of manure?

Sharp increases in commercial fertilizer prices have growers looking for ways to reduce the impact of these high prices on crop production. Livestock and poultry manure are the best – probably the only – available alternatives to commercial fertilizer in much of Iowa.

If stored, handled and applied properly, manure can supply large quantities of nutrients while boosting yields and improving soils. There is value in both the nutrients and the soil improvement benefits. The problem is how to establish a value for those benefits.

Part of the problem with manure is that it is what it is. You can't call your dealer and order different levels of N, P, and K, as you can with commercial fertilizers. You can have it analyzed for these nutrients, assign values to each of these three components, and then total them up to establish a price. But this doesn't consider other factors that are part of handling and applying manure, such as the fact that manure can't be handled or applied like commercial fertilizer.

A major factor in determining final value is whether the manure is produced on the farm where it will be used, or if it's being purchased and hauled for some distance.

Other factors are:

- difficulties in estimating accurate manure nutrient content,
- manure nutrient availability,
- residual effects (that may not be seen for more than a year),
- the exact effect of manure on yields, and
- the cost of hauling and applying differs from one farm to another and custom application cost may differ from one county to another.

Additionally, mandatory manure management planning puts additional constraints on the task of estimating exact manure nutrient value, whether the manure is generated on the farm or purchased from other sources.

Arriving at an accurate price for manure that considers all these factors may be complex. We've tried to simplify it using data from Iowa Soybean Association On-Farm Network™ replicated strip trials comparing liquid swine manure alone and supplemented with an additional 50 lbs. of nitrogen. These results of 11 'Manure+50' strip trials on corn after soybeans are summarized in Table 1.

Growers provided us with their manure application rate, application timing and method, and manure nutrient analysis in most cases. In a few trials we used average manure nutrient content based on published information from Iowa State University.

The second column of Table 2 shows the estimated per acre application cost of liquid swine manure in dollars, assuming that transporting and applying costs $0.015 per gallon. The next four columns show the value of the nutrients applied through the manure, based on the cost as commercial fertilizer (N, P_2O_5, and K_2O). The fertilizer price assumptions used are listed at the bottom.

The last three columns show the difference between the value of grain produced and the cost of manure nutrients applied and commercial fertilizer for three different scenarios based on yield results of replicated strip trials shown in Table 1. The first of these three columns (Manure) shows values if only manure is applied. The next column is if nutrients applied with the manure are valued the same as those from commercial fertilizer and assuming that the yields of both treatments were the same. The last column shows the difference between grain value and the cost of nutrients applied for the 'manure+50' strips.

The results showed that, on average, the nutrients from manure cost only about a third as much as those from fertilizer. The table shows corn after soybeans, but this is also true for corn after corn. The absolute difference was about $100/ acre. The same difference was found between the value of grain produced and the cost of manure or commercial fertilizer when all nutrients were applied as liquid swine manure. A larger difference was observed when an additional 50 lbs. of N per acre were applied with the manure in 2007 trials.

All comparisons were made with current corn prices. Higher expected market prices right now mean manure can be hauled profitably over longer distances.

Table 1. 2007 injected swine 'manure + 50' strip trials for corn after soybeans

Trial ID	N rate		Yield		
	Manure[1]	Fertilizer	Manure	Manure+50	Difference
	lbs. N/acre		bu./acre		
ST2007001A	123	50	176	198	23
ST2007002A	123	50	169	181	12
ST2007013A	138	60	219	230	11
ST2007015A	126	50	208	216	8
ST2007046A	150	80	191	198	8
ST2007048A	150	50	202	213	11
ST2007059C	122	50	186	187	1
ST2007113A	175	50	175	194	19
ST2007114A	175	50	161	190	29
ST2007411A	150	60	188	216	28
ST2007517A	170	50	186	197	12
Average	**146**	**55**	**187**	**202**	**15**

[1]Manure rates are based on manure analysis.

Table 2. Value of nutrients supplied by liquid swine manure in ISA "Manure+N50" trials corn after soybeans in 2007

Trial ID	Manure application cost	Manure expressed as commercial fertilizer				Crop value minus fertilizer cost if fertilized with		
		N	P_2O_5	K_2O	Total	Manure	Fertilizer	Manure+50 lbs. N fertilizer
					$/acre			
ST2007001A	51	62	51	26	138	651	564	716
ST2007002A	45	62	45	18	125	631	552	653
ST2007013A	48	69	27	16	111	830	766	842
ST2007015A	68	63	65	30	158	766	676	772
ST2007046A	45	75	45	18	138	718	625	708
ST2007048A	45	75	45	18	138	761	668	781
ST2007059C	45	61	45	18	124	698	619	677
ST2007113A	53	88	53	21	161	648	539	699
ST2007114A	53	88	53	21	161	590	482	683
ST2007411A	45	75	45	21	141	705	609	794
ST2007517A	53	85	53	21	159	691	585	712
Average	**50**				**141**	**699**	**608**	**731**

Assumptions: A gallon of manure costs $0.015 for hauling and applying.
Prices: corn-$4.00/bu, N-$0.50/lb., P_2O_5-$0.50/lb., K_2O-$0.30/lb.
If data are not available, then assume 1,000 gal. of manure has 30 lbs. P_2O_5 and 20 lbs. of K_2O.
Yields with commercial fertilizer equal to yields with applied manure.

Proper application is *very* important

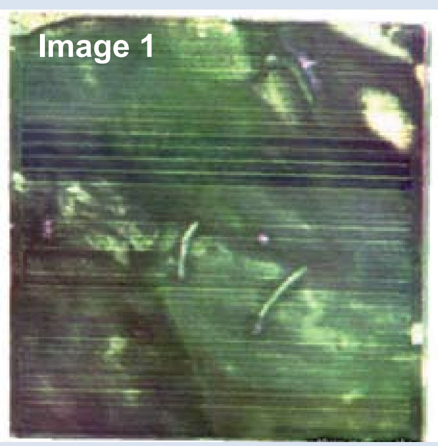
One of the challenges of spreading manure is applying it evenly so the desired fertilizer rate is applied uniformly across the entire field.

Unlike commercial fertilizer, manure composition can vary from load to load. Application equipment may not be able to apply it evenly because of variations in particle size, moisture content, bedding, etc., that are difficult to accommodate with standard application equipment.

While the load-to-load issues are not easily addressed, the uniformity of the equipment application can be – if you first recognize the problem. If you don't check to see if you have a problem with application uniformity, you won't see it and therefore won't know that you should fix it.

It's important that growers make a practice of monitoring application uniformity, using aerial imagery, stalk nitrate testing, etc. In most cases, manure is applied by a contractor or service provider with specialized application equipment, and not by the crop producer or the livestock producer.

Image 1 (below) is an aerial image that shows non-uniform manure application. In this cornfield, the streaks across the field are in 40-ft. patterns.



The field shown was one of six corn fields belonging to the same grower who had purchased poultry manure that was custom applied by a contractor. Aerial imagery showed the same streak pattern in every field. In this case, the applicator spread the manure in passes roughly 40 ft. wide. This can be documented in the photo.

To obtain a yield check, individual rows were hand-harvested in an area the width of the pattern. (Top graph on right.) These checks documented a difference of more than 30 bu./acre between the center and the edge of the streaks.

This difference in yield could be caused by a difference in P or K, by compaction, or by several factors other than N. However, a stalk nitrate test (lower graph on right) confirmed that the rows with yield loss were also N deficient. Armed with the yield variation and stalk nitrate test information, the grower submitted a damage claim to the insurance company of the application provider. The insurance company contested the claim, saying there was no yield loss because the field had grain yields similar to county average. The yield and stalk data collected helped to show that application was not uniform and that it did impact yield.

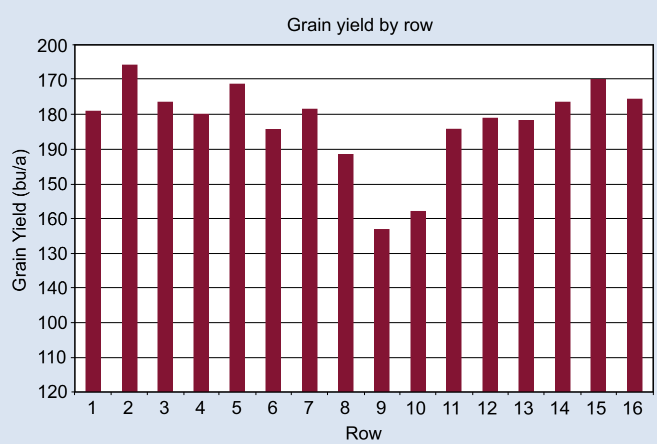
Image 1 makes it obvious that there was a problem and the width of the pattern shows that it stemmed from the manure application. The spot marked by the arrow on Image 2 shows where the manure was stockpiled in the field before spreading. The diagonal line from there up and across the field is the path of the spreader as it applied the last load of manure after having covered the whole field in a pattern parallel to the rows.

In addition to yield losses resulting from non-uniform N application the year the manure was applied, there are several years' worth of P and K that were not applied correctly, and as

a result, cannot be counted on. This is another potential loss for the grower.

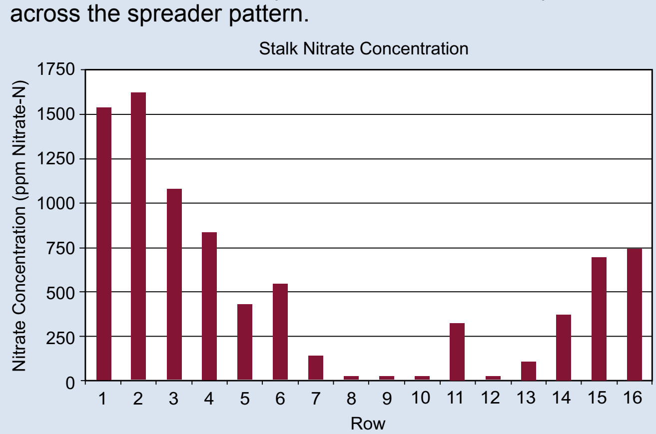
Admittedly, manure application is usually more uniform than it was in this case. Even with a uniform application, there's the uniformity of the product to consider. The less uniform the product, the greater the chance of seeing nitrogen deficiencies scattered throughout the field.

Often, growers apply additional N to help mask the differences in color that can be seen from uneven application. A uniformly green crop is not a guarantee that nitrogen was applied well. It could mean that much of the field was over-fertilized to cover areas where nitrogen was low.



Above: Hand-harvested row-by-row yield from an area the same width as the manure application equipment.

Below: Stalk nitrate analysis results, shown row by row, across the spreader pattern.



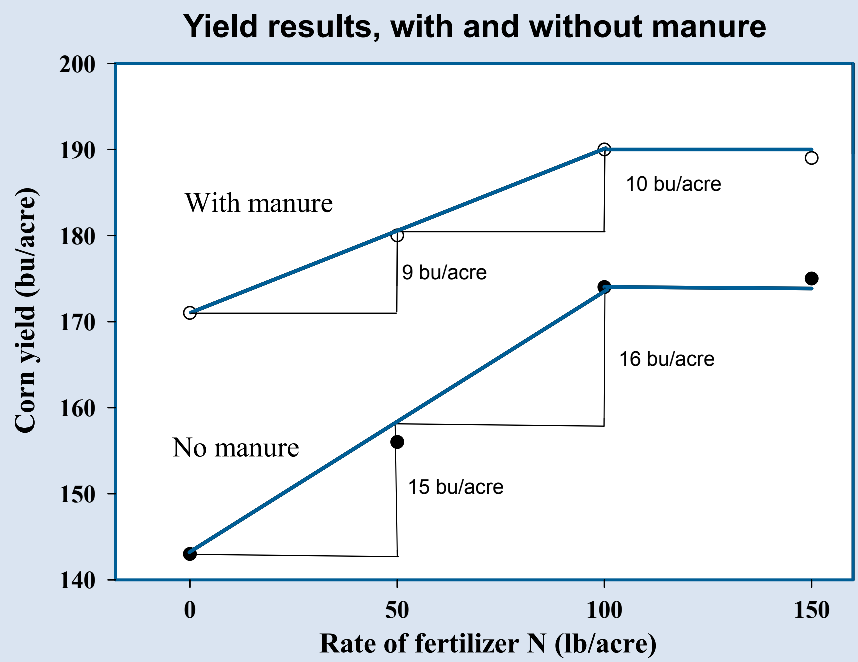
Manure can boost yields beyond its nutrient contribution

Unlike commercial fertilizer, manure contains much more than N, P, and K and a few trace elements. Manure is a biological product. Because it is biological, there can be variances in nutrient composition. We know there are enzymes and bacteria in manure that act on or with the soil. Because soil, too, is biological, the way manure impacts it, and subsequent crop yield, can vary from field to field.

One of the biggest benefits from manure is the higher yields that can occur when it's used properly.

Quite often the yield boost from manure is more than can be accounted to or explained by the N, P, and K it contains.

Below is an illustration of a trial done in 2004 comparing grain yields from both manured and non-manured areas of the field. Nitrogen fertilizer was added to both the manured and non-manured areas in strips at a number of different rates.



For this particular trial, the manure was dry solid, containing some bedding. It came from a hoophouse for hogs.

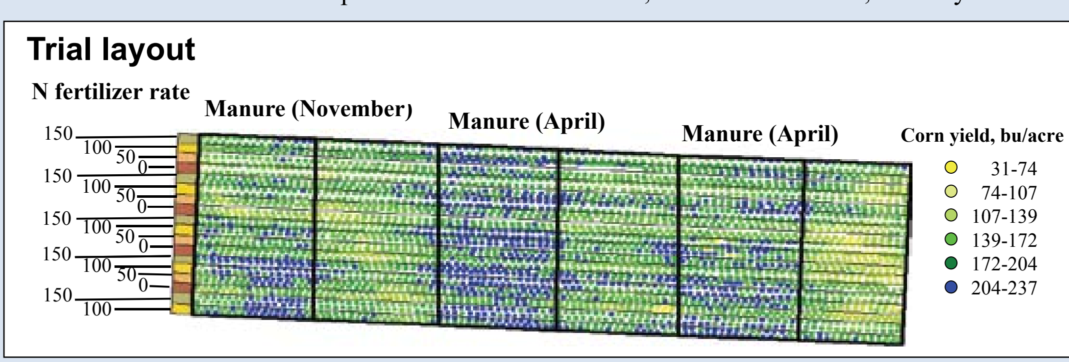
The manure was tested and then applied to the field at a rate that would be expected to supply 160 lb. total N/acre. Additional fertilizer N was added in strips the length of the field at rates of 0, 50, 100, and 150 lb. N/acre. This was first year corn after soybeans.

The yield results comparing the manured and non-manured areas of the field with no additional fertilizer showed a difference of almost 30 bu./acre. This is not surprising since we know we need to add nutrients in a corn-soybean rotation. That is why we typically add 100-150 lbs. N/acre of fertilizer N to corn following beans.

The yields from the non-manured areas that received 100 and 150 lbs. N fertilizer per acre were not different, suggesting that the 100 lb. N/acre rate was adequate to produce optimal yields. Yet, this 'optimal' yield was 19 bu./acre less than the yield from the manured strip.

It's not surprising that the yields were similar from the manure-only treatment and the non-manure 100 lb. N/acre rate. It could be concluded that the manure had a credit of about 100 lb. N/acre. But when adding another 100 lbs. of N fertilizer to the manure resulted in an additional 19 bu. per acre, it becomes apparent that there is an additive effect from using both commercial fertilizer and manure. In other words, it took the same amount of added commercial fertilizer N to optimize profitability, whether the field received manure or not. The benefit of the manure was the extra 30 bu./acre, then, and not the equivalence of 100 lb. N/acre.

The lower yield response, suggesting lower N credits from the manure, is likely a result of the high carbon content in the hoophouse manure.



In summary, it is not clear why the manure increased the yield, but it is clear that the increase was more the than we could have expected from just the N credits attributed to the manure.

Optimize corn yields with manure?

Table 1

Examples, Nitrogen Strip Trials 2001-2007

	Fertilizer N		Grain Yield		
Year Rotation	Low Rate	High Rate	Low Rate	High Rate	Diff.
	--------lb N/acre--------		-----------------bu/acre-------------------		
2001 C-SB	80	130	176.8	175.6	-1.2
2002 C-SB	70	120	192.5	195.4	2.9
2003 C-C	130	180	166.6	166.2	-0.4
2004 C-SB	60	110	199.7	206.1	6.4
C-C	110	160	172.0	178.3	6.3
2005 C-SB	60	110	191.8	197.6	5.8
C-C	110	160	182.1	193.9	11.9
2006C-C	120	150	188.4	192.5	4.1
2007 C-C	125	150	177.1	182.1	5.0

Manure Management Case Study – 2004-8

Type of Manure: Chicken

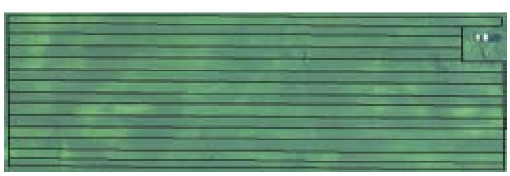
Rate of application: 4 ton/acre (150 lb total N/acre based on analysis)

Time of application: January

Method of application: Broadcast and incorporated in April

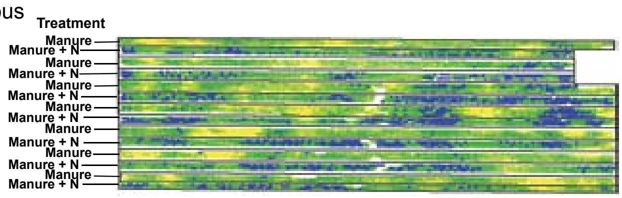
Fertilizer treatments: 50 lb/acre of anhydrous

Grain yields: 173 bu/acre with manure alone
205 bu/acre with manure plus N.



Corn yield, bu/acre

- 31-140
- 140-165
- 165-190
- 190-215
- 215-250



Manure Management Case Study – 2004-9

Type of Manure: Liquid swine

Rate of application: 3000 gal/acre finishing

Method of application: Injected

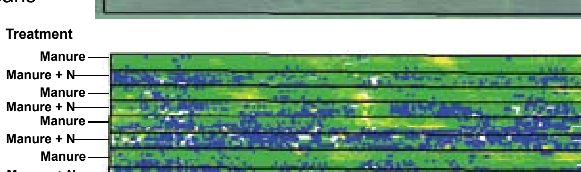
Fertilizer treatments: 50 lb/acre of anhydrous

Crop: Corn after soybeans

Grain yields:
213 bu/acre with manure
229 bu/acre with manure plus N.

Corn yield, bu/acre

- 31-140
- 140-165
- 165-190
- 190-230
- 230-250



Commercial nitrogen helps maximize profits

A major challenge in working with manure is trying to predict the amount needed to optimize crop yields. We'd all like a simple answer on how much manure to use, but the reality is that manure management is a complex compilation of many factors. In addition to the composition of manure, other factors such as the soil biology, weather, and management practices can have a big impact on what will be available to the crop.

Because these are difficult to predict, it is extremely important to evaluate how well a given practice is working. Manure has all the complexities of commercial fertilizer plus extra difficulties. Some of these include the consistency of the product, the difficulty in applying things uniformly, and understanding when the nutrients will become available.

For a base of understanding, on the left are some evaluations done by a Hardin County grower who has used two sources of manure and commercial fertilizer on his fields over the years. This grower evaluated his commercial fertilizer (preplant NH_3) at two different rates. The higher rate is his normal practice and the lower rate was a comparison to determine the impact of reducing the N rate. These were replicated at least three times and the yields were measured with yield monitors on combines equipped with GPS. The results are shown in the table for 7 years of trials. You can see the yield differences at the different N rates in the table. It is apparent that usually the optimal N rate on this farm is around 100 lbs. N/acre or less.

In his 2004 trial results, look at the 'corn following soybean' trial. This compares 60 lbs. and 110 lbs. of N/acre, with the strips receiving 110 lbs. yielding 6.4 bu./acre more.

Now look at the manure trials for the same year. The table shows the N credits assumed for both the injected hog manure and chicken manure. For the chicken manure trial, which was corn after soybeans, manure was applied on the entire field at a rate to equal 150 lbs. total N/acre. If we assume that 60% of the N in poultry manure is available the first year, then 90 lb. N/acre would have been available the first year.

The grower then applied an additional 50 lbs. N per acre in strips across the field, alternating with strips that received no additional fertilizer N. Adding the 90 lbs. we assumed was available from the chicken manure to the additional 50 lbs., the treated strips had 140 lbs. of N available. The yield difference was 32 bu./acre, in favor of the strips with added N.

When you compare this to the grower's commercial fertilizer trial described earlier, you can see that the N equivalence assigned to the manure doesn't work.

A similar trial was done in 2006, in which the grower applied the same manure rate with 90 lbs. equivalence and then applied alternating strips of 25 lbs. and 75 lbs. of additional N/acre, (making the comparison 115 vs. 165 lbs. N/acre). In this case, the yield difference was 15.6 bu./acre.

Going back to 2004, the same grower set up another trial that showed similar problems with injected hog manure. In this case, hog manure was applied at a rate of 3000 gal./acre to the entire trial area and established strips with and without an additional 50 lb N/acre. The field was first-year corn.

Iowa State University assumes the injected hog manure is 100% available in the first year. Using 40 lbs. N/100 gallon of manure, the manure applied contained 120 lbs. N/acre. This meant the treated strips should have had 170 lbs. of N per acre available. The yield difference was 16 bu./acre. A similar trial in 2007 on a corn-on-corn field compared manure at a rate to supply 180 lbs. N/acre with alternating strips of an additional 50 lbs. N/acre, making the comparison 180 lbs. N/acre vs. 230 lbs. N/acre. The strips with added commercial N yielded 20 bu./acre more.

This is similar to most of the trials with manure that we saw on many fields in 2007, summarized in our "2007 On-Farm Network Agronomic Strip Trial Summary." The average yield increase when growers added 50 lbs. of commercial fertilizer on top of the full amount of N from manure as recommended by fertilizer equivalents was about 15 bu./acre for corn-on-soybeans and 12 bu./acre for corn-on-corn. (Details on p. 12-13 of the "2007 On-Farm Network Agronomic Strip Trial Summary," found at http://www.isafarmnet.com/agronstudies/07summarysts.pdf.)

'Manure plus 50' trials suggest benefits from additional nitrogen fertilizer

Growers working with the On-Farm Network™ began looking at the yield boosting benefits of manure with 'Manure plus 50' trials in 2000. Applying manure at a rate that supplied 100% of the expected nitrogen (N) needs of corn and then applying alternating strips with and without an extra 50 lbs. of fertilizer N allowed growers to test the N-sufficiency levels of injected liquid swine manure for corn.

In 2007, growers successfully completed 11 trials for corn-after-soybeans and 6 trials for corn-after-corn using liquid swine manure. Liquid swine manure was injected, in either fall or spring, at an average rate of 145 lbs. N/acre for corn-after-soybean and 168 lbs. of N/acre for corn-after-corn based on analysis of the manure being applied. (Tables 1 and 2). Strips were replicated at least 3 times within each trial. Service providers collected 9 stalk samples (10 stalks per sample) from each treatment for late-season stalk nitrate testing to see if nitrate levels were deficient, optimal, or excessive for the growing season.

On the average, supplementing manure with an extra 50 lbs. of fertilizer increased yield by 14.6 bu./acre for corn-after-soybeans and by 12.1 bu. for corn-after-corn. Several fields had yield responses higher than 20 bu./acre, resulting in large economic penalties for the yield loss on the area of the field that didn't receive the extra N.

Table 1
2007 injected swine 'manure + 50' strip trials for corn after soybeans

Trial ID	N rate		Yield		
	Manure[1]	Fertilizer	Manure	Manure+50	Difference
	---------- lbs. N/acre ----------		------------ bu./acre ------------		
ST2007001A	123	50	176	198	23
ST2007002A	123	50	169	181	12
ST2007013A	138	60	219	230	11
ST2007015A	126	50	208	216	8
ST2007046A	150	80	191	198	8
ST2007048A	150	50	202	213	11
ST2007059C	122	50	186	187	1
ST2007113A	175	50	175	194	19
ST2007114A	175	50	161	190	29
ST2007411A	150	60	188	216	28
ST2007517A	170	50	186	197	12
Average	**146**	**55**	**187**	**202**	**15**

[1]Manure rates are based on manure analysis.

Table 2
2007 injected swine 'manure + 50' strip trials for corn after corn

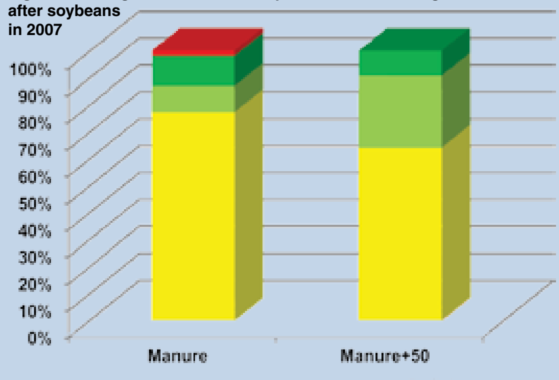
Trial ID	N rate		Yield		
	Manure[1]	Fertilizer	Manure	Manure+50	Difference
	---------- lbs. N/acre ----------		------------ bu./acre ------------		
ST2007104B	175	50	212	217	5
ST2007104C	175	50	200	207	7
ST2007321B	180	50	131	151	20
ST2007383A	150	50	177	198	21
ST2007566A	165	50	183	203	20
ST2007091A	165	50	161	161	0
Average	**168**	**50**	**177**	**189**	**12**

[1]Manure rates are based on manure analysis.

Table 3
Eight years of 'manure + 50' for corn after soybeans

Year	Number of sites	Rainfall (March-May) ----- in. -----	Manure N rate lb. N/acre	Yield Manure	Yield Response
				----- bu./acre -----	
2000	11	6	195	153	2
2001	17	12	163	157	5
2002	16	8	168	189	3
2003	6	9	165	189	0
2004	12	14	156	200	8
2005	15	9	187	198	2
2006	15	10	163	188	5
2007	11	11	145	187	15
Average		**10**	**168**	**182**	**5**

Fig. 1 Percentage of corn stalk samples in different categories for corn after soybeans in 2007



Pre-harvest stalk nitrate testing is a part of the N-sufficiency assessment. Almost 80% of the stalk samples collected from the manure-only treatments were deficient in nitrate for corn-after-soybeans (Fig. 1). We saw the same trend for corn-after-corn where stalk samples were collected.

The yield increase from the additional 50 lbs. of N was greater than the yield increases growers saw in their 'Normal minus 50' and Normal plus 50'conventional fertilizer trials. (Details on pp. 6-8 and 10-11 of "2007 On-Farm Network™ Agronomic Strip Trial Summary," at www.isafarmnet.com/agronstudies/07summarysts.pdf.) This suggests that the credit system for manure recommendations in Iowa needs improvement.

In looking at historical data from these trials (Table 3), the biggest response to extra N came in 2007. This can be attributed to above average spring rainfall in many places, but also to the fact that growers applied slightly lower manure N rates last year than in the past. It should be noted that 145 lbs. N/acre (the average applied in manure for these trials) applied as commercial N fertilizer is usually at the higher end of the optimal range for corn-after-soybeans in Iowa.

Tips for better manure management

This issue has illustrated that there are many complexities with managing manure. There are also many benefits to using manure if managed correctly. Some of the key points the N evaluations that have been made with the on-farm network are:

1. Make sure you know what you have.

Although book values exist for making basic assumptions, taking representative samples of the manure being applied is important. Depending on the type of manure and storage, several different sampling strategies are recommended. (See http://www.extension.iastate.edu/Publications/PM1558.pdf)

2. Make sure you apply it uniformly (both load to load and row to row).

With the increase in manure brokering and contract application, more fields are being applied by custom applicators. Discussing with the applicator how the application is being checked for uniformity should be part of the negotiation for the services. Further checking your field(s) after it has been applied for tracks, or product spread patterns is a good idea. Aerial images of the fields can help document performance. Letting a custom applicator know you are going to take aerial images might help keep everyone on their best behavior.

3. Don't just assume it will behave as commercial fertilizer.

Manure is an organic source of crop nutrients. As such, its characteristics differ greatly from commercial fertilizer. One of the key differences is the amount of carbon that can be present in manure and how that can affect the N availability. Bedding material and undigested feed can add carbon that can result in microorganisms not releasing some of the N in the first year. The specifics vary according to how manure is handled both prior to application and how it is applied and incorporated. In general, the faster you can incorporate it after application, the more N you will keep in the soil. To optimize N management, realize that N from manure can be lost from the soil. You don't apply UAN or urea in the fall for the same reason. And waiting for soil temperatures to drop below 50 degrees before applying fall NH_3 but applying manure in September makes no sense for N management.

4. Monitor your management.

Continually evaluating what works and what doesn't work is the best way to learn how to manage the crop nutrients. And evaluation is more important for manure than for commercial fertilizer sources. There are a number of tools that can help monitor your management, but the first step is to focus on what you are evaluating (i.e., enough N, uniformity, efficiency, compaction, etc.) Then tools like aerial imagery, stalk nitrate testing, soil nitrate tests, and yield testing can help collect the appropriate evaluation data.

5. Think of it as a system, not just a fertilizer application.

There are many factors besides N, P, and K that you need to track during every growing season. As you know, no two growing seasons are alike. Crop rotations, tillage, manure availability and other factors affect crop performance. Nutrient balance is affected by these factors, as well as by application methods and timing. Considering all these together as part of a system will help you understand the impacts and adjust or adapt to the need for supplemental nutrients.

For more information on the Iowa Soybean Association On-Farm Network™ go to www.isafarmnet.com or write to us at:

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