Consider Manure Application Issues this Fall

The dry conditions this year have raised concerns about fall manure application, potential impacts on water quality, residual nitrogen in the soil, nutrient availability and potential nutrient losses for next year’s crop. The following is a compilation of the most frequently asked questions we receive at Iowa State University Extension and Outreach and the corresponding answers from a panel of Extension, DNR, and commercial manure applicator experts. Additional manure management resources can be found on the Iowa Manure Management Action Group (IMMAG) Web Page at: http://www.agronext.iastate.edu/immag/homepage.html

Mahdi Al-Kaisi, Extension Soil Management/Environment Specialist and Professor in Agronomy, Iowa State University

1. We have had many comments about how soil cracking may affect manure application and movement of manure in soils. Is there a concern?

The current drought in Iowa has created unfavorable soil conditions not only for plant development and growth, but also changes in soil structure. These changes in soil structure may include fracturing and cracking of the upper 6 to 15 inches of most Iowa soils. However, continuous fracturing and cracking to depths greater than 15 to 20 inches occurs only in a few Iowa soils, primarily those soils high in clay content with expansible clay minerals. Soils that have high clay content within the soil profile, more than 45% clay, are generally limited to flood plains adjacent to rivers and streams and some upland landscapes in southern Iowa. These high clay content soils are a minority of the soil types that occur in Iowa.

The question is what is the potential for rain water or liquid manure to leach to tile drainage lines and groundwater in dry soils experiencing cracks and fractures? The short answer is that such potential is small for nearly all Iowa soils. For those few soils with continuous cracks or fractures extending to the depth of drainage tiles the cracks and fractures would be required to be directly above the tile line.

Please read more information on this issue at: http://www.extension.iastate.edu/CropNews/2012/0815al-kaisi.htm

Rich Rausch, President, Iowa Commercial Nutrient Applicators Association

1. As president of the Iowa Commercial Nutrient Applicators Association what advice can you give commercial manure applicators about applying manure in dry soils?

With the ground being so dry and warm I believe it is still too early to apply manure. We need to consider what early application will mean for nitrogen supply to the corn next spring. I am not concerned about application and cracking soils here in NW Iowa where we have had some rain and application season is still a couple of weeks away.

Matt Helmers, Associate Professor, Agricultural and Biosystems Engineering, Iowa State University

1. What kind of potential water quality issues do livestock producers and commercial manure applicators need to be aware of when applying manure this fall when we have dry soil conditions?
While the potential for soil cracking and rapid movement of manure to tile lines may not be as great a concern as other areas of the corn belt where higher clay content soils are present care should be taken to observe whether there is any direct movement of manure to tile lines by taking a look at the exit of the drainage systems, if possible. A concern if manure were to make it to the stream is that low stream levels would not allow for very much dilution so that any movement to streams could have a detrimental local effect on stream water.

2. **What kinds of practices can they implement to protect water sources?**

Care should be taken to minimize risk of any direct movement of liquid manure to tile lines. A major thing that applicators can do is take the time to observe the tile line exit to make sure there has not been rapid flow to the tile line. If there were one could take precautions to try to plug the tile line. For future reference one thing producers might consider doing is installing a control structure where risk of movement out the tile can be greatly minimized.

**John Sawyer**, Extension Soil Fertility Specialist and Professor in Agronomy, Iowa State University

1. **In places where crop development has been hampered by dry conditions, can we expect to see residual nitrogen in the soil? How would we account for that residual nitrogen and what should we do to plan for nitrogen needs for the next crop year?**

If corn production was drastically affected by drought conditions in 2012, then carryover fertilizer, manure, or soil derived plant-available N could be used to adjust the N application rate for a 2013 corn crop.

There are two ways to estimate carryover nitrate-N from 2012 corn fertilization. The direct way is to sample the soil profile (a minimum of two feet) after corn harvest and measure the nitrate-N concentration. Sampling would be by one-foot increments. If dry conditions persist, most applied N should remain in the top two feet. Sampling to three feet would be preferable, especially where rainfall may have moved nitrate deeper in the profile. To add up nitrate-N in the sampled soil profile, multiply the concentration in each foot by four to get the nitrate-N amount per foot and then add the amounts together. One would not want to account for all of the nitrate-N as a subtraction from the next corn N recommendation as there is always some nitrate in the profile at the end of the season. A suggestion from research conducted in Wisconsin (and should be appropriate for Iowa) is to only account for nitrate-N greater than 40 lb nitrate-N (two foot depth) or 50 lb nitrate-N/acre (three foot depth), with the remaining amount then subtracted from the normal rate recommendation.

A second way to estimate carryover nitrate-N is to use the 2012 corn grain yield. Take the total N applied for the 2012 corn crop and subtract the 2012 corn grain yield in bu/acre from that total applied N. Then assume 50% of that amount will remain available to the 2013 crop if precipitation is normal or below normal for the fall/winter/early spring. The nitrate-N remaining will vary depending on the actual rainfall and potential losses from fall through spring. For example, if the 2012 crop N application was 190 lb N/acre and the 2012 corn yield was 50 bu/acre, then the unused N would be 190-50 = 140 lb N/acre. The 140 lb N/acre times 50% leaves 70 lb N/acre to subtract from the 2013 rate recommendation.

As a conservative approach, and due to uncertainty with either estimation method, a minimum rate recommendation of 50 lb N/acre should be considered. If fall/spring precipitation is well above normal, then the carryover nitrate would not be likely, especially in soils with high leaching potential. Sandy soils are not likely to retain carryover nitrate.

Spring soil profile sampling for nitrate-N is an option, especially due to concerns about residual nitrate remaining after the fall/winter. In addition, such sampling could allow for a spring preplant or sidedress fertilizer or manure application based on profile nitrate-N results, and instead of a fall application. Use of the late spring soil nitrate test (LSNT) to determine carryover nitrate may miss considerable nitrate deeper than in just the top foot. Therefore it would be better to sample the deeper profile before planting.

There could be considerable variation in nitrate levels across fields, due to yield level, banded N application, and soil/topography. Therefore, many cores (at least 12) should be collected per sample, and multiple samples per field. Since the cores are by one-foot depths, mixing in the field will be needed to obtain a representative sample for each depth. Keep the soil from each depth as a separate sample to send to the lab.
2. With crops maturing at a record pace or being harvested early due to drought conditions we anticipate manure application season will start early. How will early manure application affect nutrient availability and potential nutrient losses, if any?

With the potential for early fall grain harvest this year, and early silage harvest, carefully consider the risks of early N fertilizer or manure application. With typical warm soils in late summer and early fall, conversion of fertilizer and manure ammonium to nitrate will be rapid. This places the applied N at risk for loss if wet conditions develop. For many years now the ag industry in Iowa has followed the “wait until 50 °F and cooling” before anhydrous ammonia application. That would also be a good practice for manure with high ammonium-N content (liquid swine manure as an example). Early fall application of manure with high organic matter and low ammonium N content (bedded manure as an example) could provide more time for mineralization of organic N to ammonium. However, the ammonium N would be subject to nitrification to nitrate, with the nitrate then at risk of loss if wet conditions occur.

3. Are there practices manure applicators can use to better manage manure nutrients during fall application?

For N, and especially with manure that has a high fraction as ammonium-N, apply after soils are cold and continue to get colder. This will reduce the conversion of ammonium to nitrate in the fall. If applied early, there is a high probability that all ammonium N will be converted to nitrate before winter. If soils remain exceptionally dry, then microbial activity will be slower than normal, which should reduce the conversion rate to nitrate. However, conversion is very dependent on length of time and rainfall/resupply of soil moisture.

If soils are not conducive to injection of liquid manure, and manure placement is shallow and exposed to the air, then the potential for volatile loss is greater. Injected manure should have soil coverage to “trap” ammonia and limit loss.

Mark Hanna, Extension Agricultural Engineer, Iowa State University

1. How will dry soils affect manure application equipment?

Excessively dry soil may result in more abrasion and faster wear to tools such as discs, knives, sweeps, etc. that are engaged in the soil. Also, dry soil has more mechanical resistance, i.e. it’s more difficult to penetrate with tillage tools. Equipment operators should check application depth when starting to apply in a field.

2. What adjustments can be made to equipment to assure better injection and manure distribution?

Manure tank wagons typically have adequate weight when loaded to force tillage tools into the soil. On umbilical applicators without tanks, when tanks are closer to empty, or if discs and knives are not rigidly fixed on the toolbar extra force may be required. Down force can be added through down pressure springs if they are available on implement shanks. If injection depth is still too light, additional ballast can be added to the implement.

Jeff Prier, Environmental Specialist Senior, Iowa Department of Natural Resources

1. What should livestock producers and commercial manure applicators in Iowa do to prepare for an early manure application season?
Check all your employees to ensure that they are properly certified. Check that proper signage has been placed on the equipment if it is hauling manure down a public road. Review the land application rules and regulations and proper driving/handling of equipment, spill response, and proper safety on the job. When arriving at the site, review any potential spill/land application issues that should be considered.

2. What separation distances do folks need to be aware of when applying manure?

It depends if it is liquid or dry manure and what environmental issues are by the application area. Liquid and dry manure not incorporated the day that is applied must meet a minimum setback of 50 feet to a water of the state provided the area between the water and the application area is in permanent vegetation. If there isn’t a 50 foot buffer, the setback would be 200 feet. There is no separation to buildings or public use areas for dry manure. On the other hand, liquid manure requires a 750 foot setback from buildings or public use areas unless it’s incorporated within 24 hours or directly injected. For more information on separation distances consult the DNR Fact Sheet 113 at: http://www.iowadnr.gov/Portals/idnr/uploads/afo/fs_sepdstb4.pdf.

Angela Rieck-Hinz, Extension Program Specialist, Iowa State University

1. What are some other issues to consider as we approach fall manure application season?

Livestock farmers and manure applicators should not only consider land application issues this fall, but management of manure on open lots, stockpiles and manure storage structures. This extended period of dry weather is a good opportunity to makes sure open lots are scraped and settling basins and holding ponds below feedlots have had manure, settled solids and effluent removed and land-applied or stockpiled. Make sure stockpiles are properly located to reduce impact of potential runoff if we do get rainfall.

Producers with liquid manure storage systems will want to take manure samples this year to determine nutrient concentration in those liquid storage systems. If animals were confined to a building, extra water sprinkling may have occurred to keep animals cool during our extreme summer temperatures. This could add more water to the pit diluting the manure concentration. On the other hand, any outdoor liquid storage could have experienced significant evaporation of liquid, possibly concentrating nutrients. Be sure to take manure nutrient samples this year and adjust your manure application rate accordingly. Keep records of manure samples from year to year to compare how weather conditions and management decisions affect current nutrient levels.

This article was compiled by Angela Rieck-Hinz, extension program specialist for Iowa State University Extension and Outreach and coordinator of the Iowa Manure Management Action Group (IMMAG). You can read more about manure management issues by visiting the IMMAG Web Page at: http://www.agronext.iastate.edu/immag/