

O

odor and Nutrient Management



Manure management plan changes

by Jeremy Klatt, Nutrient Specialist, Iowa Department of Natural Resources

Several changes were made in the Department of Natural Resources (DNR) rules for manure management plans (MMPs). These changes were effective August 25, 2004, for confinement feeding operations that are required to file MMPs with the DNR. The changes include some additional requirements for nitrogen based manure application and for recordkeeping. Also, after October 25, 2004 those producers who have not submitted an original MMP to the DNR, will need to incorporate the phosphorus index into their next plan submittal.

Revised requirements:

Producers will no longer be allowed to apply nitrogen (N) at one-and-one-half times the N rate when soil tests

indicate that low or very low soil phosphorus (P) or potassium is present. If an MMP has already been developed for this fall using the one-and-one-half times N rate, those rates can be used for fall manure application provided the phosphorus or potassium concentrations are below optimum levels. However, MMPs must be updated before submitting the 2005 annual update to the DNR to reflect this rule change. Producers are asked to indicate this change on the MMP update short form.

Recordkeeping

Starting August 25, 2004, producers must keep records of several new items in addition



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to the records that are already required. These new items are:

- Optimum yield for the planned crop
- Types of nitrogen credits and amounts
- Remaining crop nitrogen needed
- Nitrogen content and first year nitrogen availability of the manure
- Maximum allowable manure application rate.

Producers will still be required to keep records of the date, location, rate and method of manure application.

Also effective August 25, 2004, producers must keep their current MMP within 30 miles of the production site. Finally, don't throw out those old application records because effective August 25, 2006, producers will be required to

have five years of records on file instead of three.

Producers will need to record the following items in addition to the above recordkeeping requirements when the P index is required:

P content of the manure

If P-based rates are used, indicate the crop rotation that the rate is based on and the P removal of that rotation

The DNR has developed a new recordkeeping form that producers may use. This form is available at www.iowadnr.com on the DNR's animal feeding operations page.

The manure management plan rules can also be found on DNR's animal feeding operations page.

ISU College of Agriculture active in air quality research and extension

by Gerald Miller, Associate Dean-Extension Programs and Outreach, Director-Agriculture and Natural Resources Extension

One of the most debated and divisive issues facing Iowans today is what should be done about odor and gas emissions from livestock operations. Experience suggests that the best way to reach common ground is to work together. That's what we in the Iowa State University (ISU) College of Agriculture are doing, both within the College and in partnership with the agriculture industry and government.

Researchers within the College of Agriculture continue to look for ways to reduce odor and gas emissions from livestock operations. ISU Extension specialists work with producers as this research leads to new knowledge. Funding from farm and commodity groups, industry and state and federal government agencies has been vital to these efforts.

In 2003-2004, 24 externally funded projects—ongoing, recently initiated or recently completed—addressed research and extension issues on air quality/odor, animal waste and manure management. The projects are conducted by scientists in the colleges of Agriculture, Veterinary Medicine and Engineering, as well as by ISU Extension.

Three new projects received funding this year. In March 2004, the U.S. Department of Agriculture announced \$5.1 million had been awarded to 11 institutions for air-quality

research. ISU received nearly \$1.4 million of the total and was the only institution to receive more than one award. One project will study the benefits of trees, shrubs and other perennial plants as buffers to reduce odors around poultry and egg production facilities. Another will investigate odor dispersion from swine facilities. A third will investigate dietary strategies to reduce emissions from animal feeding operations.

Another exciting effort at ISU is the opening this fall of a new lab that will allow our researchers to study the impact of diet and animal manure management practices on air emissions. Animals of all species can be fed individually or in groups, with emission measurements collected the same way. It's the only facility of its kind in the world. Money and in-kind contributions totaling \$700,000 came from the ISU College of Agriculture and the Department of Animal Science.

Iowa State University's research work is being used to help inform public debate on the air quality issue. During the 2004 Iowa legislative session, ISU administrators and scientists provided testimony and analysis to lawmakers on proposed air quality legislation. At each opportunity, it was made clear ISU supports air-quality standards based on the most current science, while protecting public health.

As new emissions data emerged from research studies and from measurements by state agencies, ISU provided new scientific information, analysis and testimony to the Iowa Department of Natural Resources (DNR) and the Environmental Protection Commission (EPC). Most recently, a statement was prepared for the July 19, 2004, meeting of the EPC where a new standard for hydrogen sulfide emissions was proposed.

The commission voted to approve a new benchmark standard for hydrogen sulfide emissions from animal feeding operations. The new standard is 30 parts per billion (ppb) for one hour as a health effects value. Operations exceeding this standard more than seven times in a year would violate the health effects standard (HES). If the HES is violated, the rule says the DNR can develop plans and programs to reduce hydrogen sulfide emissions.

College officials attended the July 19 EPC meeting and provided scientific input. The key point made by ISU representatives at this and other such opportunities is that we strongly encourage following federal guidelines for ambient air quality levels published by the Agency for Toxic Substances and Disease Registry (ATSDR). The mission of the ATSDR, an agency of the U.S. Department of Health and Human Services, is to serve the public by

using science-based information and taking responsible public health actions.

ATSDR lists 70 ppb as the maximum level of hydrogen sulfide for an acute continuous exposure that would last from one to 14 days. It places the intermediate continuous exposure maximum at 30 ppb for anywhere from 14 to 364 days.

ISU scientists believe the 30 ppb level is clearly more appropriate than the 15 ppb exposure level previously recommended by DNR and the EPC. But it's still lower than the ATSDR recommendation and far removed from the levels being found during ongoing monitoring by ISU researchers and DNR personnel. Nevertheless, ISU expressed support for the 30 ppb standard for hydrogen sulfide, which was in line with prior testimony. A copy of the comments submitted by the College can be found on ISU's Air Quality and Animal Agriculture page at <http://www.extension.iastate.edu/airquality/>.

This article provides a very brief review of some of the College activities related to air quality. A comprehensive review is online at <http://www.extension.iastate.edu/airquality/reports/isuaqsummary.pdf>. This four-page review makes it easy to see that working together, we're making important progress.

Integrating manure application and tillage management

by Mark Licht and Mahdi Al-Kaisi, Department of Agronomy

As fall approaches and harvest begins, it is a good time to think about manure application and tillage management. Manure is a vital nutrient source, but the application of manure can cause environmental problems, if not applied

properly. One of those environmental problems is soil erosion. Manure application equipment typically used by producers and custom applicators in Iowa reduces surface residue to levels that no longer protect the soil from erosion,

regardless of the tillage program being followed. Therefore, producers need to review their conservation plans and evaluate how manure application fits into that plan.

Manure application is generally not considered a tillage operation even though it acts as one by incorporating surface residue. When planning manure application, conservation plans should be used to determine the amount of residue cover that is needed. To determine how much residue will be left or predict soil erosion after manure application, tillage operation, or tillage program there are several models available to consider. Go to <http://extension.agron.iastate.edu/soilmgmt> to further explore suitable manure application, tillage management, and residue management best management practices.



Manure application into cornstalk residue.

Adoption of best management practices throughout an operation include taking into account both manure application and tillage management. Best management practices that integrate manure application into a tillage management system will leave residue on the soil surface for effective soil erosion control. In addition to improving residue management, soil quality will be improved resulting in less nutrient leaching and runoff.



ISU staff measuring residue after manure application at a field day event.

Iowa plan for open feedlots beef producers should prepare for compliance

by Rachel E. Martin, Iowa Beef Center

Three years ago, the Iowa Department of Natural Resources (DNR), Iowa Cattlemen's Association, National Resource Conservation Service, and Environmental Protection Agency (EPA) created the Iowa Plan for Open Feedlots, which intends to bring Iowa cattle producers into compliance with the Clean Water Act by 2006.

For information regarding the Iowa Plan for Open Feedlots can be found on the IMMAG Web page at: <http://extension.agron.iastate.edu/immag/openfeedlot/plan.html>



Solids settling basin on feedlot with less than 1,000 animal units.

Components of the Iowa Plan for Open Feedlots are:

1. Feedlots of 1000-head capacity and greater were allowed to register by December 31, 2001 in order to become part of the program and receive protection from EPA visits.
2. An in-house environmental assessment is conducted by Iowa DNR to determine the environmental risk associated with each lot. Lots are ranked as high, medium, or low environmental risk.
3. An on-site visit is conducted by Iowa DNR to review the in-house assessment and discuss compliance options and a compliance schedule for the feedlot.
4. The feedlot follows the compliance schedule to install manure control structures, with all feedlots in compliance by 2006.

According to a recent assessment by the EPA, much work remains to be done in order to get all registered facilities into compliance. As a result, the Iowa DNR is stepping up efforts to assist producers in becoming compliant. All feedlots of 1000-head capacity and greater have been, or will be, visited for their on-site assessment by the end of this summer.

Following the on-site visit, the following timeline for submittal of information is applied to the large-capacity feedlots:



This feedlot has more than 1,000 animal units and is required to capture all manure.

- **45 days** to designate a licensed professional engineer registered in Iowa or NRCS personnel (an engineer is only required if a construction permit will be necessary)
- **six months** to submit a plan of action
- **12 months** to have the feedlot in compliance, or moving toward compliance using a phased approach
- failure to submit the required information by the appropriate deadline will result in a notice of violation
- failure to submit the required information within **45 days** of the notice of violation will result in an administrative order, which may include a penalty.

What's on the horizon for smaller feedlots?

CAFO Implications

According to Gene Tinker, Iowa DNR's Animal Feeding Operations Coordinator, open lots with less than 1000-head capacity won't need to have a nutrient management plan, since CAFO (concentrated animal feeding operations) regulations are restricted mostly to confinement operations. However, Tinker does stress that all operations will need to settle solids. The Iowa DNR is in the process of visiting these smaller operations, which number in the thousands.

A plan for settling solids will need to involve a good plan for removing effluent off the solid-settling system. Tinker cautions producers to be aware that if their plan involves draining effluent directly into a water of the state, that automatically designates the feedlot operation as a CAFO, and therefore concrete basins will be necessary.

Assistance is available

Feedlot owners and managers should be in touch with the Iowa DNR throughout this progression, and can also use ISU Extension ag engineers and beef field specialists throughout the compliance process. For more information, visit the Iowa Beef Center Web site at www.iowabeefcenter.org or call (515) 294-BEEF.

Part 2: Nutrient recovery options

by Wendy Powers, associate professor of animal science, Robert Burns, associate professor of agriculture and biosystems engineering

While the primary method of manure management in the United States is temporary storage followed by land application as crop fertilizer, there is increasing interest in recovering energy and nutrients from manures prior to land application. Insufficient nutrient assimilation capacity in nearby crop land, or interest in adding value to manure beyond the fertilizer value, are among the reasons that alternative management strategies may be sought. Producers who consider alternative manure uses will find many options available.

This is the second of a two-part series that describes several nutrient recovery processes. Each process is explained and

primary issues that a producer should consider with each process are discussed. Opportunities and approaches that enhance the ability to recover nutrients will continue to gain popularity as the need to move nutrients offsite, in order to avoid over-application of nutrients to cropland, heightens. In the first part, we addressed solids separation and flocculation and precipitation as methods of nutrient recovery. This section will cover composting and aquaculture.

Composting

Composting can be used to process manures into a stabilized organic material (compost) that can be land applied in place of



Composting beef feedlot manure.

manure. Because compost has been stabilized by aerobic decomposition it does not have odors and can be used in locations where manure use would be objectionable. If an appropriate market exists, composting manure can be used as a value-added product.

A significant amount of dried manure, composted manure, composted solids separated from manure, or some combination of these is bagged and sold as organic fertilizer. For example in California, a dairy cooperative was set up to move manure off of large, intensive drylot dairies located in an urban area. The cooperative picks up the manure from the farm, takes it to a central location where it is processed, bagged, and marketed.

Composting is a logical way to process wet manure solids (but not slurries unless the slurry can be added to drier materials) when animal producers must create a product that easily moves off-farm and is stable enough so that suburban users or agricultural users near urban centers will want to use it. Composting requires routine management of the piles in order to ensure complete and timely processing. Therefore, operations usually consider the process if marketable products that will help them remove excess nutrients, especially phosphorous (P), from the farm can be generated even if income does not equal processing and handling costs.

Advantages include: aerobic composting reduces volume and converts biodegradable materials into stable, low-odor end products; thermophilic temperatures of 130° F to 160° F, achieved in this process, kill most weed seeds

and pathogens. If moisture content is too high, anaerobic conditions develop and odorous compounds can be produced. Obviously, high quality compost has much greater value in horticultural and urban markets than simply assessing nitrogen (N), P, and potassium (K) value. In addition, the capital investment for manure composting can be considerably less than other options provided that equipment to turn the compost is already available on the farm. While P and K remain in the finished product, and must be managed appropriately, much of the N is volatilized, potentially creating a challenge in the face of air quality regulations. Typically a material such as wood shavings, sawdust or some other carbon source is needed to successfully compost animal manures. The bulk material needed to improve carbon/nitrogen ratio (C/N ratio) must be locally available for the process to be reasonably cost-effective.

Composting is a very well developed technology with thousands of full-scale installations using animal manures worldwide. The success of a composting system relies heavily on ensuring adequate labor is allocated to system management.

Aquaculture products

Manure can be used to provide the nutrients required to produce aquatic plants and animals. The nutrients in manure are converted into another product that the farm can sell using this integrated approach. Some aquatic plants have the potential to be used as livestock feed as well as a feedstuff for fish and other aquatic species.

Manure nutrients can be used to produce aquatic plants, fish and other aquatic invertebrates. Typically plants such as algae and duckweed are produced and then either harvested and sold as a feedstuff for fish production, or used on-site as a nutrient source to produce fish, baitfish, crawfish or other marketable aquatic invertebrates in integrated production systems. Swine manures have been used as a nutrient source for fish production in Asia for hundreds of years. While significant research has been conducted on integrated manure wastewater treatment systems that include the production of aquatic plants and animals, no full-scale integrated aquaculture systems have been implemented, commercially, in the United States.

Some aquatic plants have the potential to

be used as livestock and poultry feed as well as a feed for fish and other aquatic species. Because aquatic duckweed plants have a fast biomass production rate and contain relatively high nitrogen content (i.e., high protein content) there is recent interest in the U.S. in evaluating the potential of duckweed production as a means of treating swine manure. Use of algae or duckweed production as a waste treatment process works off the principle that nutrients from manure are recycled during the production of plant biomass. The biomass, then, can be harvested and used as a feed source in animal production. Duckweed can be produced in a grid-system that contains the duckweed mat in order to facilitate harvesting. Belt dewatering systems have shown promise for harvesting algae.

The recovery of nutrients as an additional farm product requires integrating two or more production systems and marketing additional

products. Considerable dilution of excreted manure is required before use as a nutrient source in an aquaculture system. To be economically competitive, aquaculture systems require a warm climate with a long growing season. For these reasons, the greatest interest in the U.S. has occurred in southern regions where lagoon systems predominate and temperatures are warm. The primary market, to date, for aquatic plants, such as duckweed, has been fish farming which is relatively high-value when compared to livestock feed.

Summary

When selecting a nutrient recovery option, producers need to consider the extent of nutrient recovery needed and weigh that against not only the economics but, also, the intensity of management needed to employ a strategy successfully.



DNR establishes technical workgroups

by Bryan Bunton, Iowa Department of Natural Resources

In an effort to understand complex technical issues involved in air quality associated with animal feeding operations, the Iowa Department of Natural Resources (DNR) established three technical workgroups in the areas of best management practices, ambient air modeling methodology, and air emissions characterization. The workgroups started meeting in February 2004. The mission of the technical workgroups is to determine air emissions characterization tools and techniques, ambient air modeling methodologies, and best management practices that can be used to estimate and mitigate air quality effects that may occur as a result of air emissions from animal feeding operations, and to provide this information to the public.

For the workgroups, DNR solicited participation from organizations with working knowledge of agricultural practices and technical expertise. Workgroup participants include U.S. Environmental Protection Agency, Iowa State University, University of Iowa, Iowa Department of Public Health, Iowa Department of Economic Development,

National Soil Tilth Laboratory, Iowa Citizens for Community Improvement, Iowa State Association of Counties, Izaak Walton League, Iowa Air Emissions Assistance Program, the Iowa Chapter of Sierra Club, and DNR. Agricultural commodity groups and industrial associations also were invited to participate, but declined.

The charge of the best management practices workgroup is to identify practices to mitigate emissions, determine the effectiveness of the practices, and consider additional parameters such as associated cost, availability, and potential environmental impacts. The group is focusing on practices that reduce hydrogen sulfide, ammonia, dust and odor. The emissions characterization workgroup is determining the source of pollutants, determine which source(s) contribute the most to the atmosphere, and find emissions factors that accurately characterize emissions. Hydrogen sulfide, ammonia, dust, methane and odor are all being considered. The modeling workgroup is determining which models, if any, could accurately predict air pollutant concentrations downwind from an animal feeding operation

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and to consider the cost, user skill, and equipment needed to run such a model.

Since a critical component to the workgroup activities is to provide information to the public, the DNR plans to issue a comprehensive final report in December, 2004. The report will contain relevant information as

well as outline any conclusions and recommendations reached by the three groups. For additional information on the technical workgroups, please visit the DNR Air Quality Bureau's animal feeding operations Web page located at

<http://www.iowadnr.com/air/afo/afo.html>

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