Livestock and Poultry Environmental Stewardship (LPES) curriculum

CAFO Fact Sheet series

Fact Sheet #25: Making Decisions About Application Rates

By Jessica Davis, Colorado State University

Introduction

The new U.S. Environmental Protection Agency (EPA) regulation for concentrated animal feeding operations (CAFOs) requires CAFO operators to develop and implement a Nutrient Management Plan to be granted a National Pollutant Discharge Elimination System (NPDES) permit. For more information, see *CAFO Fact Sheet #20: What is Required in a Nutrient Management Plan?* In addition, the Effluent Limitation Guidelines for large CAFOs require that manure, litter, and process wastewater (hereafter called "manure") be applied using rates and methods that

- "Ensure appropriate agricultural utilization of nutrients."
- "Minimize phosphorus and nitrogen transport from the
- field to surface waters."

Thus, the goal is to apply manure at rates that meet crop needs while avoiding overapplications that could lead to water quality impairment. Rates that meet these two goals are often called "agronomic rates." The focus of this fact sheet is the basis for agronomic rate determination and other decisions that affect that rate, such as whether to apply on a nitrogen (N) or a phosphorus (P) basis or whether to apply annually or in multi-year applications. Finally, the impact of your choices about application rates on the agricultural storm water exemption and the setback requirements will be addressed.

Agronomic Rate Determination

To calculate an agronomic rate, it is necessary to know the crop nutrient requirement as well as the nutrient availability from the manure and other nutrient sources. You will need the following information to calculate an agronomic rate:

- Realistic yield goals
- Soil sample analysis and fertilizer recommendations
- Crop rotation history

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Agronomic Rate Determination (continued)

- Manure and biosolids application history
- Fertilizer applications planned
- Manure nutrient content
- Mineralization and volatilization estimates
- Irrigation water application amounts and nitrate concentration (if applicable to your region)
- Tabular values of crop nutrient removal (in some cases)

Realistic yield goals are essential to the determination of crop nutrient requirements. Yield goals should reflect the yield history of a given field, or if that information is not available, yields from neighboring farms or county records. In combination with yield goals, fertilizer recommendations or crop nutrient requirements applicable to your region will be needed to calculate your crop's nutrient needs.

Next, you need to know the amount of nutrient already available to the crop. The key to this determination is soil sampling and testing using recommended methods (required by EPA at least once every five years to correspond with the permit cycle for CAFOs). Without a current soil analysis, a producer cannot know current nutrient levels present in the soil. Soil sampling frequency, depth, and analytical requirements vary from state to state; therefore, it is critical to be aware of specific state requirements. In addition to the nutrient levels in the soil, it is important to credit other nutrient sources including previous legume crops, crop residues, previous biosolids or manure applications, fertilizer application, and irrigation water if it is enriched with nitrate. Crediting methods also vary by state. Depending on how the soil test recommendations are presented, these credits may need to be deducted from the fertilizer recommendations before determining a manure application rate.

Finally, to use manure to meet the remaining crop nutrient needs, it is essential to know the nutrient content of the manure you are using. Due to the variation in manure nutrient content with different animal types, feed and water management, manure collection and storage practices, and climate, EPA requires that large CAFO operators sample manure annually and have it analyzed for N and P. Many states require ammonium as part of the manure analysis as well.

In addition to the total N and P levels in manure, you will also need estimates of volatilization and mineralization rates for your soil, management practices, and climatic conditions. These estimates and how they are used vary by state; contact your state environmental agency, extension office, or Natural Resources Conservation Service (NRCS) for details. Not all of the N in manure is immediately available for plants. Manure has both organic and inorganic N fractions. A significant portion of the inorganic N is urea, which is subject to volatilization loss if applied and left on the soil surface. Therefore, the net availability of manure N for crop use is commonly adjusted downward if manure is not immediately incorporated. Availability of the organic N in manure depends on microbial mineralization to convert it to inorganic, plant-available forms. Both volatilization and mineralization are very dependent on climate, and therefore, their estimates vary by region.

Most states have state-specific guidelines for the agronomic rate calculations due to variability in manure-handling practices and soil and climatic differences. Therefore, it is critical to get this information from your local extension or NRCS offices.

Choosing an N or P Basis for Application Rates

The new EPA regulation requires that each field that receives manure be evaluated using a risk assessment method to determine the extent of risk of P (and N) loss from the field. In general, if the P runoff risk is high, then manure must either be applied at P-based agronomic rates or not be applied at all. If the P runoff risk is low, then manure can be applied at N-based agronomic rates. The risk assessment methods and their interpretations vary by state. Some states allow for single year N-based application rates, with P managed by frequency of application when P loss risk is high. The regulation describes three different risk assessment methods and refers to the USDA-NRCS Nutrient Management Conservation Practice Standard, Code 590, for further description. Some

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states have chosen one of these tools for their risk assessment, and others leave this decision open. Consult with your local NRCS office to determine the specific options available in your state.

Phosphorus (P) Index

The P Index varies from state to state, but the concept remains the same. It considers both source factors (such as soil test P level and P application rates and methods) and transport factors (such as erosion, runoff, leaching, and distance to a water body) to evaluate the risk of P loss from the application site. In other words, if soil test P is high, but runoff potential is low, the P Index will probably be moderate. Generally, both the source and the transport factors have to be high to have a high P loss risk. Many state P Indices allow producers to reduce their P Index by changing the manure application method or implementing certain best management practices.

Soil P Threshold Level

In states that choose this method, a soil test P level (and type of extraction) will be defined. When that threshold level is exceeded, manure application must either stop, application frequency must be reduced, or application must be made at P-based rates. This method is simple but does not consider transport or provide the flexibility that the P Index provides.

Soil Test P Level

This approach uses the standard fertilizer recommendation tables available from each state's Cooperative Extension office for manure application. When the P recommendation is zero, either manure application is not allowed at all or P can only be applied at rates that replace crop removal.

Choosing Whether to Apply Annually or in Rotation

The new EPA regulation allows for multi-year P applications on fields that do not have a high potential for P runoff to surface water. Therefore, a risk assessment method as described in the previous section must be used first to determine whether this option is available for each of your fields. This allowance came about due to the practical difficulties in applying manure (especially poultry manure) at P-based rates with standard manure spreading equipment, the higher cost involved in spreading lower rates over greater acreages, and the potential reduction in environmental impact from periodic vs. annual applications.

A multi-year approach allows a single application to meet several years of a P requirement as long as the manure application rate does not exceed the N-based agronomic rate during the year of application. The multi-year P requirement may be calculated using P fertilizer recommendations or crop P removal estimates. If a producer chooses this approach on a particular field, that field must be managed over the longer term to balance manure P applications with crop P removal.

Agricultural Storm Water Exemption

EPA's new regulation clarifies the agricultural storm water exemption by stating that when there is a manure discharge from land application areas, it will be considered an agricultural storm water discharge ***if*** the manure was applied at a site-specific agronomic rate. If a producer chooses to apply manure at rates above agronomic rates, then that producer could lose this agricultural storm water exemption. For more information, see *CAFO Fact Sheet #21: What is the Agricultural Storm Water Exemption?*

Manure Application Setbacks

The new EPA regulation requires that large CAFO operators "maintain a setback area within 100 feet of any down-gradient surface waters, open tile line intake structures, sinkholes, agricultural well heads, or other conduits to surface waters where manure, litter, and other process wastewaters are not applied." Alternatives to this setback are described in detail in *Fact Sheet #22: Land Application Setback and Buffer Requirements for NPDES Permitted Large CAFOs*. In addition, some states have developed alternative setbacks for manure application. Contact your state regulatory agency for specific information.

One alternative to the setback may be to inject manure below the soil surface as a way of reducing nutrient runoff and protecting surface water. If a

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producer chooses this alternative, it is important to be aware that choosing to inject manure will probably reduce the agronomic rate for that field due to reduced volatilization losses (in states that consider volatilization in agronomic rate determination).

State (or Species)-Specific Information

The new EPA regulation allows a fair amount of flexibility among states, to accommodate differences in production practices and climates. It is critical to get the specific information for your state before making decisions about manure application rates.

Summary

The new EPA regulation requires a field-by-field, site-specific assessment of the risk of nutrient loss to water bodies prior to deciding whether manure application to that field should be based on N or P requirements. Become familiar with the agricultural storm water exemption and required land application setbacks for your state before calculating manure application rates for your fields.

Definition of Terms

Agronomic rate–Application rates that meet crop needs without leading to water quality impairment due to overapplication

Mineralization–Microbial conversion of organic nutrients into inorganic, plant-available forms

Phosphorus Index–A field-specific risk assessment tool that uses source and transport factors to evaluate the risk of P loss from a field

Volatilization–Loss of ammonia gas from the soil into the air

Yield goal–The realistic, expected crop yield based on field-specific, historical averages

Author

Jessica Davis, a Professor and Extension Soil Specialist at Colorado State University, can be reached at Jessica.Davis@Colostate.edu.

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For More Information

Environmental Regulations Related Resources

EPA CAFO Phone Line–202-564-0766

http://www.epa.gov/npdes/caforule/–To obtain copy of regulations

http://www.epa.gov/npdes/afo/statecontacts/–To obtain state environmental agency contacts

http://www.epa.gov/agriculture/animals.html/–To obtain compliance assistance information from EPA

http://cfpub.epa.gov/npdes/contacts.cfm?program_id=7&type=REGION/–To obtain EPA Region Animal Feeding Operation contacts

Land-Grant University Resources

The local contact for your land-grant university Cooperative Extension program is listed in the phone book under "Cooperative Extension" or "*(county name)* County Cooperative Extension."

http://www.reeusda.gov/1700/statepartners/usa.htm/–To obtain state Cooperative Extension contacts

http://www.lpes.org/–To view the Livestock and Poultry Environmental Stewardship (LPES) curriculum resources

USDA Farm Bill Resources

To obtain more information about the Farm Bill 2002, see the USDA-NRCS website at http://www.nrcs.usda.gov/programs/farmbill/2002/. You can also contact your local USDA Service Center, listed in the phone book under "U.S. Department of Agriculture," or your local conservation district.

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MWPS (MidWest Plan Service), headquartered at Iowa State University, is the primary distributor of LPES curriculum materials. To order the materials online, access their website at <http://www.mwpshq.org> and visit the catalog section.

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