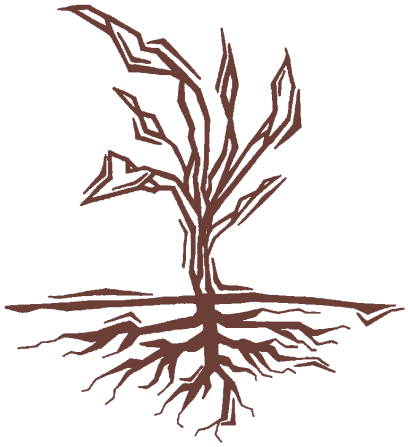

SOIL

Update on Fertilizer Suggestions as Applied to Swine Effluent Utilization

no. 0.566

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Quick Facts...

Soil NH_4-N should not be credited when using Colorado State's fertilizer suggestions.

Application of effluent to rangeland should be based on NO_3-N and organic matter levels in the top foot of soil.

Deep sampling should be used as a feedback loop to ensure that calculated agronomic rates are accurate.

This fact sheet seeks to clarify some misunderstandings that have developed as a result of the application of Colorado State University's fertilizer suggestions to swine effluent disposal. The Colorado Department of Public Health and Environment Water Quality Control Commission regulation No. 61, Colorado Discharge Permit System Regulations, in section 61.13 for Housed Commercial Swine Feeding Operations (HCSFOs) describes the development of swine waste management plans and refers to Colorado State University Cooperative Extension's published fertilizer suggestions as the basis for agronomic rate determination (section 4.e.ii).

Corn and Sorghum Suggestions

The corn algorithm that Colorado State uses was developed by the University of Nebraska using over 100 site-years of data including some historically manured sites. We validated the algorithm for application to Colorado crops with over 50 site-years of testing. The Nebraska data included soil samples to a 4 foot depth, and the algorithm is designed to include a range of 2 to 4 feet of NO_3-N data. If 4 feet of NO_3-N data are used, they should be averaged (weighted by depth increment as shown in Colorado State University Cooperative Extension fact sheet 0.538, *Fertilizing Corn*) and inserted into the algorithm where it says [8 x average ppm NO_3-N in the soil]. The NO_3-N from 3 to 4 foot depths should not be subtracted as an "other N credit," and doing so is not consistent with CSU's calibrated fertilizer algorithm approach. This is also clearly stated in the recently revised University of Nebraska Nebguide G74-174-A, *Fertilizer Suggestions for Corn*.

It is important to realize that this is a calibrated algorithm, not a mass balance equation. Specifically, an NH_4-N credit should not be included as an "other N credit." The University of Nebraska measured NH_4-N in all of their soil samples, but found that including NH_4-N in the algorithm actually made the correlations worse. The NO_3-N concentration is used as an index for N availability in this algorithm. Therefore, crediting NH_4-N as an "other credit" amounts to double crediting and is not consistent with CSU's calibrated fertilizer algorithm approach.

The comments made in the previous two paragraphs pertaining to corn are also applicable to the sorghum algorithms in fact sheet 0.540, *Fertilizing Grain and Forage Sorghums*.

Alfalfa Suggestions

Our recommendations for effluent application to alfalfa as described in fact sheet 0.565, *Update on Manure and Effluent Recommendations,* suggest that producers apply effluent based on a percentage of N removal (as a function of

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soil texture). After calculating the appropriate N removal value, we recommend crediting organic matter in the top foot and NO_3-N down to 4 feet. Although we have no replicated research plot data to verify this recommendation, it is justifiable from an environmental standpoint. Due to the ephemeral nature of NH_4-N, we recommend against crediting NH_4-N. We recommend dividing by a fertilizer use efficiency of 66 percent, on the assumption that mineral N in effluent behaves similarly to mineral N in commercial fertilizer. Care should be taken to avoid overapplication of effluent to alfalfa to prevent possible nitrate toxicity to livestock (see fact sheet 1.610, *Nitrate Poisoning*).

Table 1. Nitrogen Recommendations (lbs N/acre) for Rangeland.

NO_3-N (ppm)	OM ≤ 1.0%	OM from 1.1-2.0%	OM > 2.0%
0-6	40	20	0
7-12	20	0	0
>12	0	0	0

No additional N credits should be added or subtracted when using this table.

Rangeland Suggestions

Colorado State University's N recommendation for native grass and improved range grass remain as described in CSU's Guide to Fertilizer Recommendations in Colorado (XCM-37 published in 1985, and no longer in print). Measure soil NO_3-N and organic matter (OM) levels in a 0 to 1 foot soil sample, and then refer to Table 1 to determine the N application rate.

All Other Table-based Fertilizer Suggestions

For table-based fertilizer suggestions, such as wheat, millet, and other crops, do not credit additional soil N such as NO_3-N below the suggested sampling depth or soil NH_4-N at any depth. These tables are based on calibrated fertilizer response under average agronomic conditions across Colorado using the top 2 feet of soil as an index of total root zone availability. Therefore, it is improper to mix the indexing approach used in those tables with a mass balance approach by crediting deeper soil N levels.

Suggestions for Crops Not Included in CSU's Fertilizer Suggestions

When swine effluent is applied to crops that are not included in published CSU fertilizer suggestions, we recommend that the fertilizer recommendations of our colleagues at other land-grant universities in neighboring states be used.

Conclusions

Colorado State has defined the "other appropriate N credits in the root zone" as described in regulation 61.13.4.e.ii.A. The other N credits as defined in numerous fact sheets are credits for previous manure applications, legumes, and nitrate in irrigation water. "Other N credits" as defined by CSU in the fertilizer suggestions fact sheets do not include soil NO_3-N crediting below the depths specified or soil NH_4-N at any depth.

All site-specific conditions can not be adequately addressed in tables or algorithms. The deep sampling (monitoring) should be used as a feedback loop to ensure that the calculated "agronomic rates" accurately reflect crop uptake and the actual site-specific agronomic rate. Deep sampling should not be used for calculation of agronomic rates.

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