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## Manure Use Planning: An Evaluation of a Producer Training Program

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**Abstract:** A training program for producers in manure use planning was evaluated. The potential for runoff nutrient loss to surface water can be reduced and the value of manure increased through better planning of manure use. Training was conducted throughout Nebraska in 2002 and 2003. Livestock producers who attended evaluated the event at the end of the last class. The need for and impact of the training was greater for continuing operational and maintenance skills of manure utilization that are regularly needed for strategic planning skills. We recommend that training focus primarily on operational and maintenance skills.

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# Background

Many animal-feeding operations (AFOs) above 300 animal units throughout the United States must have a permit to operate a livestock waste control facility. In Nebraska, producers need to comply with Nebraska Title 130, "Rules and Regulations Pertaining to Livestock Waste Control" (NDEQ, 2000). In applying for the permit, a manure utilization plan must be submitted that typically involves manure application on agricultural land.

The manure utilization plan must give estimates of the annual amounts of manure nitrogen (N) and phosphorus (P) produced, N losses during storage, and N remaining in the field after land application. Manure P produced and manure N remaining after application losses are used in estimating land required for manure application. Annual manure applications cannot exceed the "agronomic rates for nitrogen" (NDEQ, 2000). If sufficient land is not available to receive the manure, the AFO must have manure application agreements with other landowners, arrangements to sell the manure, or arrangements for alternative use of the manure. The plan must also address:

- Manure and soil testing,
- Calibration of application equipment, and
- Response to emergencies.

The plan must contain inventories of manure application equipment and of land available for application, with maps of application areas. The producer needs to keep annual records for 5 years on:

- The determination of manure application rates,
- Soil and manure analyses,
- Manure and fertilizer application, and
- A cropping season summary.

The development and implementation of these plans require that producers understand the concepts underlying these plans and that they master certain procedures and skills needed for implementation.

# Methodology

The University of Nebraska Cooperative Extension implemented a program to enhance the capacity for AFOs to safeguard water quality while improving agronomic efficiency in the utilization of manure. Specifically, the program focused on AFO capacity for the development and implementation of manure nutrient utilization plans. Planning tools were developed, including:

- Spreadsheet programs for estimating land requirement (Nutrient Inventory), farm nutrient use efficiency (Whole Farm Nutrient Balance), and manure application rates (Manure Use Plan) developed by Koelsch (2002), and
- A manure land application workbook (Koelsch, Shapiro, & DeLoughery, 2003; Shapiro DeLoughery, Koelsch, Kucera, & Wortmann, 2003).

Twenty-two Extension specialists and educators located throughout Nebraska formed five regional teams to provide training and technical support for producers.

Nine training events were conducted in 2002 and 2003 to enable producers to better understand the concepts underlying manure use planning and to enhance their skills in developing and implementing the plans. Each

training event consisted of three afternoon meetings spaced 1 week apart. Each session lasted for 3 hours, giving a total of 9 hours for instruction and practical exercises. The three-meeting arrangement allowed producers the opportunity to apply the concepts and tools in planning for their AFO before moving on to other subject matter. The intended learning outcomes were to gain the understanding and skills to:

- Calculate manure N and P available after storage losses,
- Estimate total land requirements for manure application,
- Calculate manure N available to the crop,
- Calculate crop N need,
- Develop a nutrient management plan,
- Write an annual manure application plan,
- Identify key records needed to maintain a permit, and
- Prepare maps of the application fields that show setbacks and environmentally sensitive areas.

The expectation was that upon completion of the training, most participating producers would understand the primary requirements for preparing a permit application or recognize the expectations for implementing an existing permit.

Participants were asked to complete questionnaires at the end of the training to evaluate the achievement of the learning outcomes. The questionnaires were modified in 2003 but with some overlap with the 2002 questionnaires. Completed questionnaires were submitted by 143 of 161 participants.

## **Findings**

### **Characteristics of the Animal Feeding Operations**

Most of the respondents (54%) fed beef cattle, another 37% had swine operations, while the remainder had dairy or poultry operations (Table 1). This follows the type of manure applied by 2002 respondents, with:

- 52% spreading solid manure from box type spreaders, generally scraped from feedlots,
- 25% applying slurries or liquids with tank spreaders, and
- 13% applying effluent through sprinkler irrigation systems.

The average estimated land area used for application of manure was 1054 acres per AFO and often inadequate to avoid excessive soil P build-up.

**Table 1.**  
 Characteristics of the Animal Feeding Operations Represented <sup>1</sup>

| <b>Livestock Type</b>  | <b>Number of Responses, 2003</b> | <b>Mean One-Time Capacity of Animal Feeding Operation</b> |
|--|----------------------------------|---|
| Beef cattle  | 43                               | 8,789   |
| Mature dairy cows  | 5                                | 463   |
| Replacement dairy cows   | 1                                | 300   |
| Swine (feeders, finishers, breeding)                                 | 24                               | 2,771   |
| Nursery pigs   | 6                                | 1233  |
| Poultry - turkeys  | 1                                | 260,000   |
|  |                                  |   |
| Mean land area used for manure application                           | 66 <sup>2</sup>                  | 1054 acres  |
| <b>Waste Control Facility Permit Status (Percent of Respondents)</b> |                                  |   |
|  | <b>2002</b>                      | <b>2003</b>   |
| Have permit  | 81                               | 78  |
| Permit pending   | 7                                | 16  |
| Do not have  | 12                               | 11  |

|   |     |     |
|---|-----|-----|
| Participants that farm  | 100 | 95  |
| Number of producer participants (total)   | 54  | 107 |
| <sup>1</sup> Information collected at the beginning of the training event.<br><sup>2</sup> Some producers did not respond to this question and some operations had two livestock types. |     |     |

Most AFOs (79%) represented in these training events already had a permit to operate a livestock waste control facility. Some of the AFOs were exempted from permitting, so lack of a permit did not indicate non-compliance with regulations.

At the beginning of the 2002 training events, the participants were asked about their practices. Their responses indicated more use of best management practices than is typical for AFOs (Table 2). For example, Richert, Tokach, Goodband, and Nelssen (1995) found that only 10.6% of Kansas swine producers tested manure for N and P, compared to the 73% reported in Table 2. However, use of best management practices may have been over-estimated as indicated by subsequent responses, where 53% admitted that they did not have a good estimate of their manure application rates, and 56 and 72%, respectively, did not have an estimate of the amount of N and P supplied to their crops from manure.

**Table 2.**Use of Best Management Practices Prior to Training (44 to 45 Responses, 2002) <sup>1</sup>

| <b>Use of Specific Practices</b>   | <b>Yes (%)</b> |
|--|----------------|
| Do you calibrate your manure application equipment?                        | 55             |
| Have you analyzed manure in the last 3 years?                              | 73             |
| Do you calculate a N or P rate for manure application?                     | 61             |
| Do you deep sample for soil nitrate credit?                                | 61             |
| Do you sample for soil P credit?   | 80             |
| Do you consider soil P levels when choosing manure application sites?      | 68             |
| Do you incorporate manure within 24 hours of application?                  | 45             |
| Do you maintain a written plan for manure application?                     | 49             |
| Do you maintain a record of past manure applications?                      | 73             |
| Do you use soil conservation measures at manure application sites?         | 89             |
| <sup>1</sup> Information collected at the beginning of the training event. |                |