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IS THERE A ROLE FOR NUTRITIONISTS IN ENVIRONMENTAL PLANNING AND MANAGEMENT FOR FEEDYARDS?^{1, 2}

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Introduction

The effects of beef cattle feedyards on ground water, surface water, air quality, wildlife, and the general environment is a growing concern among many groups. The recently released USDA-EPA Draft Unified National Strategy for Animal Feeding Operations (**Unified Strategy**, USDA-EPA, 1998), new EPA air quality regulations on PM-10 and -2.5 particulates (EPA, 1997), current plans to rewrite the 1974 Effluent Limitations Guidelines and to revise air quality standards for grain elevators and feedmills (Grelinger, 1997; Midwest Research Institute, 1998), discussions to pass legislation to eliminate open lagoons, and state/local regulations that limit or prohibit the construction of "large animal operations" are just a few examples of that concern. Most High Plains feedyards have a good record of compliance with current environmental regulations; however, it is very probable that regulations will change and become even stricter in the future. Unfortunately, it is likely that many of these regulations will be based on politics, rather than on sound science (personnel comment by EPA employee, 1998).

Consulting nutritionists play an important and vital role in the cattle feeding industry. However, with new, ever-stricter environmental regulations, that role may need to change to meet the needs of the client. In the future, the consulting nutritionist may need to be involved in environmental compliance for feedyards. Relevant questions related to this future role are: 1) do consultants want this responsibility; 2) what role can consultants fill; and 3) what benefits can they receive?

Do Consultants Want a Role?

In attempt to answer the first question we did a "nonscientific survey" of 20 nutritional consultants that are members of the Plains Nutrition Council (PNC). We scanned the membership directory of the American Society of Animal Science and recorded the "discipline areas" listed by each consultant. The results are presented in Table 1. Although a wide variety of disciplines were reported by the consultants, none reported in the Waste Management discipline. It should be noted, however, that a number of consultants expressed an interest in

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the areas of food safety and quality control, that are major concerns to the cattle feeding industry. This indicates that many consultants are willing to make the extra effort to "fill the gaps" and to do their best to solve problems important to the industry and to their clients.

In reality, nutritionists can be considered "manure chemists." In oversimplified terms, the major improvements in beef cattle nutrition over the past 50 years have been accomplished by decreasing the quantity of manure produced (i.e., increasing digestibility). So, in one sense, nutritionists have always been involved with waste management.

The Unified Strategy discusses terms such as "feed management for water quality." As noted by Alex Avery, "The statement 'feed management for water quality' changes the whole goal of the animal feeding operation. Having the most minimal nutrient impact becomes the new goal of feeding" (Avery, 1998). Thus, the nutritionist's role and perspective may need to change in the future to meet environmental regulations.

Possible Roles of Nutritionists

Information sources. Less than 2% of the American public is involved in production agriculture. The vast majority of the public is scientifically and agriculturally illiterate. In a 1990 Gallup poll, 49% of Americans did not know that bread was made from wheat. As regulation increases, nutritionists can serve as knowledgeable information sources that defend and promote agriculture, and correct misinformation that is given to the public. By working with cattle feeders and other groups in a proactive manner, it is possible to limit adverse effects that regulations may have on the beef industry. Because "perception is reality" for many consumers, it is important that accurate information be provided to the public as well as to cattle feeders, feedyard managers, and feedyard owners.

Paper work. Under the new proposed water quality regulations, many smaller feedlots, previously not regulated, will be urged to voluntarily develop site-specific "technically sound and economically feasible Comprehensive Nutrient Management Plans (CNMPs)." In addition, many larger feedyards in areas of the country where regulation has been lax, will be required to write or revise CNMPs by the year 2001 (or 2008). The objectives of these CNMPs, as stated in the Unified Strategy, are to "minimize impact on water quality and public health." As noted in the Unified Strategy, "CNMPs should address at a minimum, **feed management**, manure handling and storage, land application of manure, land management, record keeping, and management of other utilization options." The plans must also address risks from other pollutants such as pathogens and must include a schedule to implement the management practices identified in the CNMP. "CNMPs should encourage and facilitate technical innovation and new approaches to manure and nutrient management. Development and implementation of CNMPs are the ultimate responsibility of the 'feedyard' operator with assistance as needed from certified industry staff, government agency specialists, **private consultants**, and other qualified vendors."

Table 1. Discipline Areas Reported by 20 Plains Nutrition Council Consulting Nutritionists in the 1998 Membership Directory of the American Society of Animal Science

Discipline area	Percent reporting
Ruminant nutrition	100
Production and management	75
Forages	25
Animal behavior	20
Food Safety	20
Growth and development	20
Quality control/food safety	20
Other	10
Meat and muscle biology	5
Processing and engineering	5
Regulatory issues/legislation	5
Waste management	0

The Feed Management component of CNMPs states, "Where possible, animal diets and feed should be modified to reduce the quantities of nutrients in manure." Records must be maintained of nutrients entering and leaving the operation. Thus, the nutritionist can (or should) play a major role in writing nutrient management plans. Who better knows and understands the quality and quantity of nutrients entering the feedyard, as well as the losses of those nutrients?

Under the proposed regulations, individuals that assist animal feeding operations (AFOs) with Nutrient Management Plans must be trained and certified. The draft strategy estimates that 300,000 AFOs will voluntarily need to develop or revise CNMPs and that 15,000 to 20,000 operations will be considered new Confined Animal Feeding Operations (CAFOs) and be required to develop and implement CNMPs. Therefore, one strategic initiative of the Unified Plan is to increase the number of certified specialists to develop CNMPs. With minimal training, many consulting nutritionists could become listed as certified specialists.

Consulting nutritionists are typically intelligent, motivated individuals capable of doing more than just "nutrition." Even if they do not become a "certified specialist," they are capable of including management of manure, compost facilities, wastewater, and wildlife in their areas of expertise.

Adopting/Adapting new technologies. "New" nutritional strategies have the potential to decrease the effects of feedyards on the environment. Obviously, many of these have yet to be "proven" under real world conditions, some are potentially more expensive than common practices, they may require additional management or equipment (feed delivery, feed inventory, feed storage, multiple finishing diets, etc.), and many need additional research. These technologies may have positive effects on the environment by decreasing total nutrient excretion, or by altering the route of excretion. For example, it seems that shifting N excretion away from the urine and to the feces (i.e., decreased **apparent** digestibility) may decrease ammonia volatilization losses to the atmosphere. The following is a brief list of technologies that are currently available or may be available in the near future.

1. "Use of the NRC, 1996 protein system to decrease feeding of excess N." Formulating diets based on their content of Degraded Intake (**DIP**) and Undegraded Intake Protein (**UIP**), rather than on total crude protein, could potentially decrease N excretion and ammonia emissions from the feedlot surface.

2. "Limited feeding / slick bunk management." These technologies have the potential to decrease total nutrient inputs and thereby decrease nutrient excretion. To meet environmental standards, it may be necessary to limit intakes to a greater extent than currently practiced.

3. "Phase-feeding." The swine industry has routinely adjusted the nutrient content of finishing diets (i.e., phase feeding) to more specifically meet the nutrient requirements of animals as they grow - because nutrient requirements change with the physiological state of an animal. Dr. Mike Galyean gave an excellent review of phase-feeding at the 1998 PNC Spring Conference (Galyean, 1998) and noted that there are a number of obstacles to overcome in using phase feeding systems in commercial feedyards. For many years Dr. Rod Preston has proposed decreasing dietary protein concentrations of beef cattle finishing diets as time on feed increased and even total withdrawal of supplemental protein during the final 30 to 60 days on feed (Preston, 1982). Whether this is economically practical under current feeding and management situations is equivocal (Galyean, 1998).

Decreasing the quantity of protein in the diet may have adverse effects on animal performance. Another potential problem with phase feeding of protein in finishing diets is adverse effects on animal health (i.e., increased acidosis problems). However, it may be possible to decrease these adverse effects via the addition of neutralizing agents such as calcium- and magnesium-hydroxides (Boukila et al., 1995).

4. "Precision Feeding." The term "precision ag" is a hot topic today that is normally applied to crop and forage production. Can it apply to finishing beef cattle? In the 1984 Nutrient Requirements of Beef Cattle (NRC, 1984) the protein requirements presented in the tables were to meet the calculated requirements for 50 % of a given class of cattle. To meet the requirements of 84% of the cattle, the values needed to be multiplied by 1.14, and to meet the requirements for 100% of the cattle, the values needed to be multiplied by 1.28. Using the values from the 1984 NRC, we calculated animal performance and N excretion (Table 2) when pens of 100 steers

were fed diets formulated to meet the protein requirements of 50%, 84%, or 100% of the animals in the pen. In addition, assuming that animals could be sorted and individually fed based on their genetic potential for performance (obviously a pipe-dream today), overall pen performance and N excretion were calculated (i.e., precision feeding of the bottom-performing 50 steers, middle-34 steers, and best-performing 16 steers). Restricting the dietary protein concentration to meet the requirements of 50% of the cattle in the pen had adverse effects on animal performance and did not appreciably decrease total N excretion. Feeding to meet the requirements of 84% of the cattle rather than 100% had a modest negative effect on animal performance but an appreciable beneficial effect on N excretion. Precision feeding provided the best performance and lowest N excretion.

Table 2. Effects of feeding to meet the crude protein requirements of 50% (9.9% CP), 84% (11.3% CP), 100% (12.8% CP), or of performance groups (precision fed): 100 head of 880 lb., large frame steers

Item	50%	84%	100%	Precision
Ration cost, \$ / ton	108	110	112	109
N intake, lb/d	34.8	39.8	45.1	37.4
N excreted, lb/d	27.9	31.9	36.1	29.9
ADG, lb	2.73	3.39	3.52	3.52
Feed/gain	8.00	6.49	6.25	6.25
Cost of gain, \$/cwt	43.20	35.70	35.00	34.06
Days to 1280 lb	146	118	114	114
N excreted, lb/pen	4,073	3,764	4,115	3,409

5. "Altering animal behavior." Animal behaviors may actually affect the environment. For example, dust events in feedyards usually occur in the late afternoon. A major factor involved with these dust events may be increased animal agonistic activity relating to the lack of feed (Wiggers et al., 1998; Morrow-Tesch et al., 1997 & personnel communication). It has been suggested that modifications of feeding programs could possibly alter animal behavior and decrease any adverse effects on air quality.

6. "Diet formulation." Owens et al. (1994), noted that many commercial trace mineral premixes, when formulated in typical finishing diets, did not meet the animals' requirements for at least one trace mineral. The percentages of the supplements that met requirements were as follows: Cu - 39%, Se - 46%, I & Mn - 54%, Zn - 70%. Galyean (1996) reported that to improve carcass quality and hoof health, a number of consultants provided Zn in finishing diets at concentrations as high as two to 10 times the NRC (1984) requirement. Copper supplementation was often two to four times NRC recommendations. The dietary mineral of

major concern, from an environmental stand point, is phosphorus. Erickson et al. (1998) noted that performance by yearling steers was not adversely affected by feeding diets with P concentrations as low as 0.14%. Thus, it may be possible to decrease the quantities of some minerals in finishing diets without adversely affecting animal performance.

7. "Increase Nutrient Recycling." We recently reported that oscillating dietary protein concentrations between low and high concentrations at 48-hour intervals could potentially increase N retention, possibly by increasing N recycling within the gut (Cole, 1999). More data are needed, and there are a number of management obstacles that need to be overcome before this procedure could be used by the industry. Such procedures may also work for several minerals, especially those that can enter the rumen via the saliva. However, the use of these procedures may be restricted to "limit-feeding" situations. Other procedures may become available that increase nutrient recycling and thereby decrease nutrient inputs and outputs.

Balancing cost of gain and performance with environmental/waste management concerns. In order to meet some future environmental regulations, it is possible that animal performance and cost of gain will have to be sacrificed. For example, concentrations of some dietary nutrients such as N, P and some trace minerals may need to be decreased to reduce their concentration in manure and feedlot runoff. More expensive sources of nutrients (i.e., organic trace minerals, etc.) that may be more bioavailable might have to replace cheaper nutrient sources. "Safety margins" in diet formulation may have to be decreased. The nutritionist will have to balance these factors to determine the optimum point from an economical, liability (i.e., risk), and ecological stand point.

In the classic publication "Feeds and Feeding" (Morrison, 1961) an entire chapter was devoted to the manurial value of feeding stuffs. Morrison wrote "In purchasing feeds, one should consider not only their feeding value but also their worth as fertilizers. ... To determine which feeds are the cheapest ..., one should deduct the manurial value per ton from the gross price." Today the objectives may be different but the results are similar. In formulating diets it may be necessary to evaluate the effects of those feeds on costs of waste management and manure disposal and include those costs as a portion of the diet costs. For example, if manure must be applied to land based on its P content, rather than its N content (a highly probable event in the near future), feedyard manure with a high P content will become less valuable and more difficult to sell (or give away) than manure with a low P content.

Benefits to the Consultant

New regulations are a potential opportunity to consulting nutritionists. Under the proposed Unified Strategy regulations, an estimated 100,000 + small cattle feedlots and several hundred larger operations that did not previously come under regulation, will either be required to or asked to voluntarily submit CNMPs to EPA by December 2002 (or 2008 for small operations). These cattle feeding operations will need expert help and guidance in formulating these plans. The Unified Strategy notes that operators use "qualified specialists from the public and private sectors to assist in development and implementation of CNMPs." With budget and personnel cuts within agencies such as USDA-NRCS, it is very likely that there will not be

sufficient numbers of "public" sector employees to do the job. Therefore, private sector specialists, that are trained and certified, will be needed to do the job.

Conclusion

In a recent Feedstuffs article, Karl Hess and Frank Bryant of Sustainable Environmental Solutions, Inc., an agricultural environmental consulting firm in Lenexa, KS, wrote "The public is demanding that everyone - and that includes agriculture - be held accountable for their impact on the environment. This means big changes for American agriculture - changes in how it produces its commodities and changes in forces that influence its markets. ... Agricultural producers who resist change face a big and growing problem. ... It may not seem fair or right to make agriculture pay such a high price for America's new environmental conscience - especially after 100 years of being the world's breadbasket - but there is a lot in life that's not fair or right, and the trick is how to accept what is now inevitable" (Hess and Bryant, 1998). Dr. John Sweeten states the situation in a similar manner: "The public will never be satisfied with CAFOs. As yesterday's and today's questions are answered, the public will demand answers to new questions. Prepare for it, and become a part of the debate."

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