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Nutrient management is of increasing concern as legislation is developed to govern the amount of excess nutrients, such as nitrogen and phosphorus, in the environment. Feed formulation is a criti-

cal control point for nutrient management.

This last summer, I had the opportunity to observe how Dutch nutritionists formulate feed to confront the problem of nutrient management. Coupled with our research on nonlinear programming, which deals with nutrient variability in feed ingredients, a managed approach to feed formulation can be implemented to reduce the amounts of excess nutrients going into the environment.

## Taking A Lesson From The Dutch

A typical Dutch approach to feed formulation for nutrient management is to set maximums on protein and total phosphorus to reduce environmental excesses and to set minimums on digestible amino acids and available phosphorus to meet the nutrient requirements of the animal. The result strikes a balance between reducing waste nutrients to the environment and meeting the nutrient requirements of the animal.

Penn State research has shown stochastic nonlinear programming accurately guarantees nutrient levels while reducing variability and excess nutrients (Roush et al., 1996, J. Appl. Poultry Research 5:16). As a part of our study, Fushan Zhang, a Ph.D candidate

in Animal Science and Operations Research, formulated rations by stochastic programming and linear programming. These rations were compared for their ability to meet nutrient requirements at the same requested level of probability while minimizing excess nutrients.

In the first series of rations, linear and stochastic programmed rations (LP50 and SP50) were compared at a requested maximum level of 21% with a 50% probability of meeting the nutrient requirement. A second series of rations, which included a margin of safety for protein (LP69 and SP69), were formulated for a maximum of 21% protein and a requested 69% probability. A third series of rations (LP69-AA and SP69-AA) were formulated with a 69% margin of safety for both protein and amino acids, at a requested maximum crude protein level of 21% and minimum on digestible amino acids (methionine, total sulfur amino acids, lysine, threonine and tryptophan).

The stochastic ration had reduced levels of amino acids. The difference in crude protein for both SP69 versus LP69 and LP69-AA versus SP69-AA was .2 percentage points. SP69-AA as com-

pared to LP69-AA, had lower calculated levels for digestible amino acids including methionine, total sulfur amino acids, lysine, threonine and tryptophan for a difference of .016, .010, .012, .038, and .005 percentage points, respectively.

As expected from earlier research, there was no difference in the cost of the rations at a requested probability of 50%. At a requested probability of 69%, there was a lowering of cost in favor of stochastic formulated rations for both the protein and the protein/amino acid formulations.

The nutrient and cost differences between stochastic and linear programmed rations were small as compared to linear programming. However, it must be kept in mind that when rations are formulated, recipes of ingredient amounts are produced. That is, discrete or fixed amounts of ingredients mixed at the feed mill. So the differences are real and consistent between the two approaches to ration formulation.

This formulation research suggests that the Dutch approach of minimizing total nutrients while maximizing digestible nutrients in conjunction with a nonlinear program would, over time, consistently reduce excess nutrients in the environment.

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## Dairy Calf Nutrition and Management Workshop

WESTMINSTER, Md. - A Satellite Teleconference and Workshop will be offered two evenings on Calf Nutrition and Management, April 21 & 28, 1998, from 7:30 p.m. to 9 p.m. at Carroll Community College, Room 157.

Topics covered on April 21 include physiology and digestion; colostrum; calf survival; colostrum; quality; liquid feed alternatives; milk replacers.

On April 28, topics include dry feed selection; rumen development; health concerns; preweaned calf; transition during weaning; nutrition; transition during weaning; management practices; and calf growth.

Cost for the workshop is \$10 per person, which will include a packet of printed workshop materials. Preregistration and payment is requested by April 20. Checks should be made payable to Carroll County EAC and mailed to Carroll County Extension Service, Calf Workshop, 700 Agriculture Center, Westminster, MD 21157-5700.

For more information call (410) 848-4611.

The Satellite Teleconference and Workshop is sponsored by Penn State College of Agricultural Service's Cooperative Extension

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