diet dry matter from 0.2% (N.R.C.) to 0.3% or 0.35%. Other work suggests that changing the relative proportion of potassium and sodium in the diet may enhance magnesium absorption from the gut and therefore could possibly increase milk production.

11. Dry cow and heifer rations should contain near the N.R.C. recommendations of 0.8% potassium and 0.1 to 0.2% sodium. Higher levels suggested here for lactation rations could cause udder edema if fed to nonlactating animals about to refreshen.

Question: Are there any upper limits for potassium supplementation to receive a negative effect?

Answer: When we first started doing this work the higher levels of potassium got up around about 1.6, he started seeing a negative effect from it. The curve started coming back down. But that was with lower sodium levels, when the sodium was around .2, a little less than .2. When he raised his sodium up to .4 or .6 then I don't think he has reached an upper limit. He hasn't gone above a 1.6 or very close to that in his potassium.

Question: Did the chloride content of these diets remain constant?

Answer: Dr. Beede didn't figure the chloride content of the diet at all.

Question: What about the palatability of the higher levels of potassium?

Answer: At these levels it had no effect on feed intake at all, so I assume the palatability was acceptable.

Question: How do you tell how much potassium is available in dry feed such as alfalfa? It is high in potassium but it is not available to the cow.

Answer: They really don't have any really good way of measuring potassium availability in feeds at this time. Now we have some very specific methods for measuring calcium availability in feedstuffs and phosphorus availability in feedstuffs. Most people assume that since potassium is a water soluble ion, if it is in the feed it is available. Most nutritionists at this time are figuring that even with alfalfa, as far as I know, the quantity there is available to the cow, and they plug it into their formulas at 100%.

Campylobacter Fetus Bacterin

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CAMPLYLOBACTERIOSIS (Vibriosis) is a venereal disease of cattle caused by *Campylobacter* (Vibrio) *fetus* subsp. *fetus*. The infection, isolated to the genital tract, results in infertility and early embryonic death. Abortion occurs in a small percentage of cattle. The disease is transmitted by coitus under natural conditions and may also be spread by the use of contaminated semen in artificial insemination and by contaminated instruments.

The best method to bring the disease under control is to use artificical insemination. Semen for this purpose should either be from known uninfected bulls or treated with antibiotics.[1] When natural service is employed, as in large beef herds, vaccination is recommended.

Studies conducted at Beecham Laboratories and by others have demonstrated that vaccination can significantly increase pregnancy rates in the face of exposure to infection.[2 3 4]

Two factors influence the successful use of bacterins: 1) the potency of the bacterins; 2) proper administration of the product. All USDA licensed *Campylobacter fetus* bacterins must be demonstrated as safe, pure, potent and effective. However, these products vary in formulation. Three characteristics can affect the potency or effectiveness of Campylobacter bacterins. These are: 1) the quantity of the antigen they contain; 2) the quality of that antigen; and 3) the use of adjuvants.

There are many methods to quantitate the amount of antigen used in preparing a bacterin. The method of choice would be to measure the antigen which stimulates the productions of protective antibodies. With some organisms for which the pathogenicity is well defined, this is relatively easy. In Colibacillosis for example, antibodies against the *Escherichia coli* pili are protective, and tests have been developed to quantitate pili levels. It has been suggested that heat-labile gylcoproteins surface antigens (K antigens) are the protective antigens in bovine campylobacteriosis.[5 6] However, no test to quantitate these antigens has been published. A second method to measure antigen levels is measurement of total bacterial mass. Quantity of bacterial cells can be measured by one of several methods such as optical density, cell counts, protein nitrogen and dry or wet weight.

There are three major antigen groups associated with *Campylobacter fetus* subsp. *fetus*. The O or somatic heat stable antigens, the H or flaggelar antigens, and the K or heat labile surface antigens. As mentioned earlier, only the K antigens have been implicated in protection. Bacterins containing just the O or the O and H antigens were not protective, while bacterins containing O, H and K antigens were.[5]

At least 7 heat labile K antigens have been identified. Types 2 and 3 are most commonly associated with venereal disease.[7] More than one surface antigen may be associated with a particular *Campylobacter* strain. Antigenic shifts in vivo have been reported.[6] An efficacious Campylobacter bacterin should incorporate a range of the most common K antigens and be produced by a method which reduces the chances of antigenic shifting.

In addition to the appropriate concentration of the correct antigens, an efficacious bacterin needs to be adjuvanted. Two

types of adjuvants are available in USDA licensed campylobacter products, oil emulsions and aluminum hydroxide gels. In general, Freund's incomplete adjuvant (FICA) which is an Arlacel-water-in mineral oil stable emulsion will stimulate more persistent antibody levels than most (but not all) other adjuvants. However, FICA tends to cause a persistent granuloma at the injection site and be more viscous than aluminum hydroxide adjuvanted bacterins. Aluminum adjuvanted products using either alum or aluminum hydroxide can result in excellent immune stimulation. The quality of the adjuvant is critical: some are excellent and some essentially inactive depending upon the preparation and application. Variables such as absorbtive capacity and concentration are readily standardized to produce an efficacious and safe product.

In a study conducted at Beecham Laboratories, twenty virgin heifers were vaccinated with a USDA licensed aluminum hydroxide adjuvanted product (serial 7502) and twenty with an USDA licensed oil adjuvanted product (serial 545). Both products were administered in a single dose according to their label recommendations. An additional ten heifers were left unvaccinated as negative controls. Serum samples were collected from all cattle at the time of vaccination and 4, 8, 16 and 26 weeks post-vaccination and tested for *Campylobacter* agglutinating antibody titers.[4] The results are presented in the following table:

Campylobacter fetus Agglutinating Antibody Titers
(Reciprocal Titer, Strain 7128)

			Weeks Post Vac			
	Adjuvant	Pre-Vac	4	8	16	26
Series 7502	Al (OH)	≤16*	34	69	23	≤16
Series 545	Oil	≤16	19	38	20	≤16
Control	None	≤16	16	16	≤16	≤16

*Titers of ≤16 were considered non-specific.

During the critical time period, when cattle would normally be bred, the aluminum hydroxide product stimulated higher antibody titers than the oil adjuvanted product. By twenty-six weeks post vaccination antibody titers in all animals were essentially negative.

The results of this study demonstrate the second important factor in proper vaccination against Campylobacteriosis—proper administration. Cattle should be vaccinated 2-6 weeks prior to breeding, so that the period of peak antibody response corresponds to the time of breeding for optimum protection. In addition, it is essential to re-vaccinate approximately 3 weeks prior to subsequent breedings to insure maximum antibody levels at breeding.

In summary, vaccination with *Campylobacter fetus* has been shown to significantly increase fertility in infected herds. Efficacy of the products is influenced by many factors including antigen quality and quantity, adjuvants, and proper administration of the bacterins prior to breeding.

In the study reported, the $Al(OH)_3$ adsorbed bacterin stimulated significantly more rapid and higher antibody responses than the oil adjuvanted bacterin. Persistence of antibody was similar with both bacterins.

References

1. The Merck Veterinary Manual, Fifth Edition (Published by Merck and Co., Inc.) 1979:387. 2. Kendrick, J.W.: Williams, James; Crenshaw, George; Vestal, Thomas: Fertility and Immune Reactions of Heifers Vaccinated with an Adjuvanted Vibrio Fetus Vaccine. JAVMA, V. 158, No. 9 (May1, 1971):1531-1535. 3. Hoerlein, A.B. and Carrol, E.J.: Duration of Immunity to Bovine Genital Vibriosis. JAVMA, V. 156, No. 6 (March 15, 1970):775-778. 4. Beecham Laboratories, Data on File. 5. Border, Maryon M. and Firehammer, B.D.: Antigens of Campylobacter Fetus subsp. fetus Eliciting Vaccinal Immunity in Heifers. Am J Vet Res, V. 41, No. 5 (May, 1980):746-750. 6. Corbeil, L.B.; Schurig, G.G.; Duncan, J.R.; Wilkie, B.N.; and Winter A.J.: Immunity in the Female Bovine Reproductive Tract Based on the Response to "Campylobacter Fetus". The Ruminant Immune System, Edited by John E. Butler (Plenum Publishing Corporation, 1981):729-743. 7. Berg, R.I.; Jutila, J.W.; Firehammer, B.D.: A Revised Classification of Vibrio Fetus. Am J Vet Res, V. 32, No. 1 (January, 1971):11-22.

Question: (inaudible)
Answer: With one vaccination, right.
Question: (inaudible)
Answer: For the products licensed by the USDA, it is required that an antigen blockage study be conducted. These studies demonstrate that none of the components of the bacterins reduce a response to the other component. So if they are USDA licensed bacterins, they should be efficacious for all components. But again it is essential to keep in mind label recommendations with accordance to breeding times.
Question: (inaudible)
Answer: With all bacterins all animals seroconverted at 4 and 8 weeks post vaccination. There was no difference between the groups. The only difference we saw was by comparing geometric mean antibody titers at 8 weeks post vaccination.
Question: (inaudible)
Answer: They were all fairly consistent. I'm pretty sure they all seroconverted at greater than 16, but I would have to get the actual data to verify that.
Question: Have you done any work with bulls?
Answer: We have never done any work in our laboratory. There have been some studies reported that vaccination will cure infected bulls but we have never done any work with our product.

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by
Peg Beardsley
Buffalo Area Chamber of Commerce, Buffalo, NY

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