

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Range Beef Cow Symposium

Animal Science Department

December 1999

Vaccines and Dewormers – Do We Need Them All?

Dale M. Grotelueschen

University of Nebraska - Lincoln

Follow this and additional works at: <http://digitalcommons.unl.edu/rangebeefcowsymp>



Part of the [Animal Sciences Commons](#)

Grotelueschen, Dale M., "Vaccines and Dewormers – Do We Need Them All?" (1999). *Range Beef Cow Symposium*. 124.
<http://digitalcommons.unl.edu/rangebeefcowsymp/124>

This Article is brought to you for free and open access by the Animal Science Department at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Range Beef Cow Symposium by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

VACCINES AND DEWORMERS - DO WE NEED THEM ALL?

Dale M. Grotelueschen, DVM, MS
Veterinary Extension & Diagnostics
University of Nebraska
Panhandle Research & Extension Center
Scottsbluff, Nebraska

Consumers are the ultimate beneficiaries of improved animal health. Costs and potential benefits from use of vaccines and dewormers affect returns to individual producers or operations as well as the beef industry as a whole. Vaccines that positively influence average daily gain, improve carcass quality, lower costs of production and improve efficiency, and that reduce treatments, decreasing reliance on antibiotics, and that decrease treatment costs contribute to success of the beef industry.

Consideration for use by individual operations often involves shorter time perspectives, especially if cattle are marketed or if products administered affect only production systems on the premises. When marketing prior to slaughter, owners must strive to market increased value of animals. Thus, ability to market becomes crucial if animals have added value when transferred to other segments of the industry. Understanding of the value of animal health and of various health practices is critical. Recent studies by Odde et al., of Superior Livestock Video Auction and Northern Plains Livestock Auction Markets confirms additional monetary value of calves with health programs, especially specific prior vaccinations and weaning.

Animal health improvements in the beef industry are affected by management practices and decisions beginning at birth and extending to slaughter. Considerations for use of animal health products are part of those. Decisions about vaccine and dewormer use, though made by beef producers, affect most parts of the beef industry complex in some way. Objective decision-making processes for incorporation or deletion of specific vaccines and dewormers in health programs can be extremely difficult. Even though a large amount of information is available, seemingly it often does not address questions of beef production units and sometimes appears to be incomplete or contradictory. According to Animal Health Institute (AHI) estimates, investment by animal owners in animal health products increased by 18% to an estimated \$4.3 billion in 1998. Biologicals sales for livestock and pet vaccines increased 19% to \$550 million in 1998. However, and in return, \$464 million was spent in research and development for animal health products and \$121 million was spent for research and development on biologicals by AHI member companies.

Enhancement of animal health through prevention of infectious disease focuses on 3 biosecurity principles: prevention of introduction of infectious agents, minimizing exposure risk to existing infectious agents, and increasing immunity to those existing agents. Vaccines focus on improvement of immunity in individual animals as well as populations of animals. Value of field-induced immunity, that is, immunity from natural exposure and infection should not be underestimated.

Immunologists have stated the science of immunology is in its infancy. Significant technological advancements in vaccines are being marketed and research and development investments offer further promise. An example is a new experimental oral IBR vaccine that is showing potential. The beef industry needs to participate in determining how to best apply newer tools.

Multifactorial Nature of Disease

Vaccines are used to induce resistance to specific disease-causing organisms. Some vaccines target specific disease-causing agents where presence of that specific agent in an individual or herd will result in a high probability of disease. Examples include brucellosis and trichomoniasis. In most other cases, potential disease causing agents are already present in herds. Presence of these organisms does not result in disease without influence from other risk factors. For example, rotavirus is present in most cow herds but does not cause calf diarrhea without adequate exposure or presence of calves with less than adequate colostrum immunity. BVD virus antibodies have been found in 50-90% of cattle. However, disease has not been detected nearly with that frequency.

Bovine respiratory disease (BRD) requires stressors, viral exposure, and then bacterial disease for clinically apparent disease to occur. BRD is caused by various combinations of infectious agents. Viral vaccines exist for BRSV, IBR, BVD, and PI3 and bacterial vaccines to combat *Pasteurella haemolytica*, *Pasteurella multocida*, and *Hemophilus somnus* are marketed for BRD control. Most or all of these infectious agents are found commonly in the upper respiratory tracts of animals not found to be clinically ill. Most disease is produced when these agents invade the lower airways, resulting in lung infections that greatly compromise the animal's ability to function. Other agents such as rhinovirus, adenovirus, respiratory coronavirus, and mycoplasma can contribute to BRD infection. Additionally, management, including commingling of animals from different sources, transportation stress, weaning stress, and inadequate nutrition are examples of risk factors predisposing animals to BRD. Presence of excessive exposure by presence of persistent BVD carriers has prompted one author to state that no commercial vaccines will be effective in such herds. Specific vaccines are a management tool and cannot be expected to prevent all disease in the face of excessive exposure and immune compromising situations.

Parasite transmission is also affected by many variables, including climate, management practices, level of nutrition, and cattle genetics. The greatest likelihood of clinical disease and economic losses occurs when the seasonal parasitic challenge is accompanied by nutritional and climatic stress. Stocker calves and replacement heifers are at greatest risk for experiencing losses in productivity and clinical disease from parasitism. Due to extreme variability, it is difficult to identify all situations where economic returns exceed the cost of treatment.

In regard to deworming of incoming feedlot cattle, cattle do not acquire internal parasite loads in the feedlot so the practice focuses on exposure to parasites prior to arrival. Assessment of risk of animals having parasite loads that will significantly reduce productivity is difficult. Fecal egg counts are likely the best tool, despite some serious shortcomings. Cattle origin is used

to assess risk but lacks accuracy.

Husbandry and Management

A number of management factors are more important than vaccines or dewormers for maintaining or improving health. However, discussions about vaccine and dewormers often overshadow important topics such as nutrition, weaning management, colostrum management, and animal handling. Vaccination and deworming are only tools to deal with health issues. Risk reduction through husbandry and management must be used to reduce reliance on these and at the same time enhance likelihood of their success. Planned biosecurity is a part of sound management.

Prudent Use of Vaccines and Dewormers

Label directions and prescribed uses of vaccines and dewormers have been developed through research. Compromises generally decrease likelihood of effectiveness. Examples include use of only 1 dose of a killed vaccine when 2 are directed at prescribed intervals. Ideally, uses that do not follow directions should be eliminated since effectiveness has been lost or greatly reduced. Injection of vaccines into immune-compromised cattle reduces effectiveness even if everything else has been done correctly. Deworming at less than optimum times results in less than desirable results.

Proper handling and administration of vaccines and dewormers is critical if any benefits are possible. Temperature control, avoidance of sunlight, dosage, route of administration, avoidance of chemical disinfectants with live vaccines, and other factors all reduce possible effectiveness.

Clinical Efficacy and Controlled Challenge Studies

The ultimate test of vaccines and dewormers is the production of measurable differences in field situations. Hundreds of clinical field trials have been conducted by investigators in attempts to provide documentation of clinical efficacy. Perino and Hunsacker reviewed 521 published field trials with an objective to review field efficacy of BRD vaccines in North American beef cattle, based on research that uses scientifically valid methods with clinically relevant outcomes reported in peer-reviewed publications. Published papers were reviewed to ensure the methods were sound, including use of a valid control group, randomization of treatments, blinding of evaluators, and adequate statistical power. Their selective criteria eliminated all but 22 of the field trials. Of these, 9 reported positive vaccine effect and 13 reported neutral or negative effects. For 14 BRSV clinical vaccine trials, 4 showed positive results (including 1 positive for calves and neutral for yearlings) and 10 showed neutral results. For IBR, 1 trial reported positive results and 1 reported neutral. For *Hemophilus somnus*, 1 trial was neutral to negative, 1 was neutral, and 1 had positive results. For 10 Pasteurella vaccine clinical trials, 5 reported positive results and 5 reported neutral results. No reliable reports of field trials for BVD and PI3 viruses remained in the final 22 published experiments.

The authors state that to be reliable, studies must: include a valid control group, use an externally relevant population, use a clinically reasonable treatment regime, use random treatment assignment, blind assessors to treatment assignment, use a field challenge in an externally relevant production setting, ensure adequate followup, have adequate statistical power to detect treatment effects, control for confounding variables, use appropriate statistical evaluation to determine if differences are real, measure clinically relevant outcomes to determine if differences are important. It is evident that conducting valid field studies is extremely difficult. In spite of this, future investigators must design and conduct trials that meet stringent criteria, as discussed by the authors. They did not suggest abandonment of vaccination for BRD but rather suggested we may be making less than optimal recommendations of vaccine use because of a lack of clinically relevant information. Clinical trials in general are plagued by lack of adequate control needed for collection of reliable data, presence of confounders, decisions as to which measurements of outcome are correct, and also the multifactorial nature of the diseases vaccinated against and which are being measured.

A checklist for assessing clinical research trials including vaccines has been suggested by Ribble: 1) Has the vaccine been laboratory and field-tested in randomized controlled clinical trials? If so, how many trials, and in each case; 2) Were the control groups concurrent or historical? 3) How were the trial animals challenged? 4) Was the measure of outcome meaningful? 5) Were the biology and epidemiology of the disease considered? 6) Was the vaccine assigned randomly? 7) Were blinding techniques used to reduce bias? 8) What other important biases are evident? 9) How likely was the result of a chance finding? 10) What are the differences between the trial animals and the animals you are considering? Are these differences important with respect to the vaccine?

The Academy of Veterinary Consultants recently sponsored a session focused on literature reviews of specific vaccine types by invited experts. Summary statements from those presentations included for IBR virus vaccines, seroconversion is induced in naive cattle, it decreases or eliminates clinical signs in the face of experimental challenge, clinical efficacy used in the way we use them in feedyards is somewhat undefined, and when used in the cow they appear to give her at least partial ability to protect the fetus from IBR challenge. For BVD type 2 vaccines, there is evidence from stringent challenge models that Type 1 vaccines can protect animals very well from a very virulent Type 2 challenge. For BRSV vaccines, it appears that all modified live vaccines currently available reduce pulmonary and clinical disease. There are experimental models that demonstrate this activity against severe challenge. For pasteurella vaccines, there are many factors to consider when interpreting field trial results, including previous exposure, stressor type and intensity, presence of co-infecting viruses, age differences, nutritional differences, genetic differences, and the study design. There are many factors that influence whether an animal gets sick with pasteurellosis so managing this disease is similar to managing all the factors that suppress and enhance immune function. Vaccine may stimulate immunity that might overcome exposure levels in some animals. Pasteurella vaccines are worth giving.

Confer and Fulton evaluated Pasteurella and Hemophilus vaccines. Their summary states that excellent progress has been made in *P haemolytica* vaccine technology in recent years and

that several commercially available vaccines have potential to reduce losses to pasteurella pneumonia. *Pasteurella multocida* vaccine technology is not as advanced as is *P haemolytica* and efficacy has not been as well examined. Newer understanding of potential immunogens related to *Hemophilus somnus* has not been incorporated into biologicals and efficacy of current vaccines against respiratory diseases has not been firmly established.

Justification for use of leptospira vaccine in the majority of beef herds is lacking based on reported incidence and currently available information on vaccine efficacy, according to Perino and Rupp. They suggest trichomonas vaccine may be recommended for controlling disease in infected or high risk herds; although they also suggest more studies are needed to address efficacy and economic value. Data suggest effectiveness of Campylobacter (vibrio) vaccines, according to the authors. However, timing of administration in relation to breeding season is critical to possible efficacy.

Vaccine studies conducted under controlled conditions are required for regulatory approval of new vaccines. A predescribed measurable response is needed. Biologicals production companies also conduct similar experiments on their products to provide more information about appropriate use. Independent researchers also perform controlled challenge studies. For example, Brock et al., recently published results of a trial demonstrating the effects of modified live BVD vaccine toward prevention of persistently infected calves. Results of that study indicated there was significant protective effect because there were fewer persistently infected calves produced compared to calves of unvaccinated control animals. Protection was not complete however, since some persistently infected calves were born in the vaccinate group.

Field research suggests some vaccines have direct potential for benefit to the industry. Recent data suggest that cattle with lung lesions present at slaughter have reduced average daily gains. The ages or time of the production cycle in which they appear is not known. Furthermore, cattle with lung lesions at slaughter have reduced carcass value. There is no field trial data currently published documenting a benefit of vaccination in reducing lung lesions. Controlled studies of *Pasteurella haemolytica* vaccines have demonstrated reduced lung lesions and clinical illness scores compared to nonvaccinated controls.

Characteristics of an ideal cattle dewormer include: a wide margin of safety, compatibility with other compounds, a broad range of activity with ability to kill mature and immature forms of parasites, ease of administration to large groups of animals, and a positive economic return resulting from use.

Efficacy of various dewormer products is very good and is well documented. Anthelmintics vary in their affects on certain parasite species, time of action, and other characteristics so producers should be sure use of the compound under consideration will achieve desired results.

Authors state that the goal of internal parasite control should be reduction of pasture contaminations. The major determinant for using dewormers in cow/calf operations is calf weaning weight. Results of 16 studies where cows only were dewormed ranged from 0 to 52

pounds weaning weight advantage for untreated calves from treated cows. Results of 36 studies where both cows and calves were dewormed ranged from a negative 5.5 to 55 pounds weaning weight advantage for the treated group at weaning. Recent reports from the northwest U.S. and Canada show positive benefits for deworming incoming feedlot cattle.

Economic return is much more difficult to document. Extreme variability in management, cattle, nutrition, climate, and environment have likely resulted in the production of very few good documentations of economic merit.

Conclusions

Vaccines and dewormers are tools for use in the total management scheme. Proper use is necessary for success. Controlled challenge studies show effectiveness while field efficacy studies, which are greatly lacking in number, often show mixed results. Measurement of effectiveness and economic return within herds is most often not possible. Some vaccines can be eliminated in herds due to absence or very low risk of exposure. Management to reduce risk of disease can be reason for reduced vaccine and dewormer use.

Literature Cited

- Bryant, L.K., L. J. Perino, D. Griffin, et al. 1999. A method of recording pulmonary lesions of beef calves at slaughter, and the association of lesions with average daily gain. *The Bovine Practitioner* 33(2):163-173.
- Bumgarner, S.C., M.A. Brauer, R.M. Corwin, et al. 1986. Strategic deworming for spring-calving beef cow/calf herds. *JAVMA* 189(4):427-431.
- Confer, A.W. and R.W. Fulton. 1995. Evaluation of *pasteurella* and *hemophilus* vaccines. Proc. Amer. Assn. of Bovine Practitioners 27th Ann. Conv., Pittsburgh, PA, Sept. 22-25, 1994., pp.136-141.
- Cortese, V.S. K.H. West, L.E. Hassard, et al. 1998. Clinical and immunologic responses of vaccinated and unvaccinated calves to infection with a virulent type-2 isolate of bovine viral diarrhea virus. *JAVMA* 213(9):1312-1319.
- Cortese, V.S., D.L. Grooms, J. Ellis, et al. 1998. Protection of pregnant cattle and their fetuses against infection with bovine viral diarrhea virus type 1 by use of a modified-live virus vaccine. *Am. J. of Vet. Res.* 59(11):1409-1413.
- Ellis, J. 1998. BRSV vaccines: A literature review. *Acad. of Vet. Consultants.* 56(3):1-4.
- Ellis, J. 1998. BVD2 vaccines: A literature review. *Acad. of Vet. Consultants.* 56(3):11-14.
- Feedstuffs Staff Editor. 1999. Animal health product sales, research spending rise in 1998. *Feedstuffs* 71(28):1,2.
- Gardner, B.A., H.G. Dolezal, L.K. Bryant, et al. 1998. Health of finishing steers: effects on performance, carcass traits and meat tenderness. In 1998 Oklahoma St. Univ. Ani. Sci. Research Report, pp. 37-45.
- Gardner, B.A., H.G. Dolezal, N. Owens, et al. 1998. Impact of health on profitability of feedlot steers. In Oklahoma State Univ. Ani. Sci. Research Report, pp. 102-108.
- Hansen, D.E., R. Syvrud, D. Armstrong. 1992. Effectiveness of a bovine respiratory syncytial virus vaccine in reducing the risk of respiratory disease. *Agri-Practice* 13(6):19-22.

- King, M.E., T.E. Wittum, K.G. Odde. 1996. The effect of value-added health programs on the price of beef calves sold through seven Superior Livestock video auctions in 1995. CSU Beef Program Report, pp. 167-173.
- King, M.E., T.E. Wittum, K.G. Odde. 1997. The effect of value-added health programs on the price of beef calves sold through nine Superior Livestock video auctions in 1996. CSU Beef Program Report, pp. 159-165.
- King, M.E., T.E. Wittum, K.G. Odde. 1998. The effect of value-added health programs on the price and no-sale rate of beef calves sold through 10 superior Livestock video auctions in 1997. CSU Beef Program Report, pp. 85-93.
- Loan, R.W., H. Tung, J.B. Payne. 1998. Comparative efficacy and duration of immunity of commercial *pasteurella haemolytica* vaccines. The Bovine Practitioner 32(1):18-21.
- Odde, K. 1999. Effect of vaccination programs on the sale price of beef calves-Superior Livestock Video Auctions-1998. Pfizer Animal Health.
- Odde, K. 1999. Effect of vaccination programs on the sale price of beef calves-Northern Plains Livestock Auction markets-Fall 1998. Pfizer Animal Health.
- Perino, L. 1998. IBR vaccines: A literature review. Acad. of Vet. Consultants. 56(3):5-10.
- Perino, L.J., B.D. Hunsaker. 1997. A review of bovine respiratory disease vaccine field efficacy. The Bovine Practitioner.31(1):59-66.
- Perino, L.J., G.P. Rupp. 1994. Immunization of the beef cow and its influence on fetal and neonatal calf health. In: Vet. Clinics of No. Am: Food Animal Practice. W.B. Saunders Co., Philadelphia, PA. 10(1):15-34.
- Reinemeyer, C.R. 1997. The economics of parasite control for beef cattle. Proc. 30th Ann. Conv. of the Amer. Assn. of Bovine Practitioners. Montreal, Quebec, Canada. Sept. 1997, pp 117-123.
- Reinemeyer, C.R. 1998. Common misconceptions about internal parasite control. Proceedings. Wild West Veterinary Conference, Reno, NV, Oct.11-15, pp.171-178.
- Ribble, C.S. 1992. Assessing vaccine efficacy in the feedlot. The Bovine Practitioner. 24:137-141.
- Roth, J. 1998. Pasteurella vaccines: A literature review. Acad. of Vet. Consultants. 56(3):14-19
- Schultz, R.D. 1994. Thoughts on current anthelmintic needs and usage. The Bovine Practitioner. 28:150-53.
- Schultz, R.D. 1998. Vaccines I would not use in my cattle. Proceedings, 31st Annual Convention of the Amer. Assn. of Bovine Practitioners, Spokane, WA, Sept. 24-16, pp. 119-120.
- Sears, J.E. 1997. The value of a health program to the rancher and feeder. In Proceedings. The Range Beef Cow Symposium, Dec. 9-11, Rapid City, SD, pp. 74-80.
- Smith, R.A. 1992. Making rational product choices. Proceedings, XVII World Buiatrics Congress, XXV Amer. Assn. of Bovine Practitioners Conf., St. Paul, MN, Aug. 31-Sept. 4, 1992, Vol. 2:315-19.
- Smith, R.A. 1998. Impact of disease on feedlot performance: A review. J. Anim. Sci.76:272-274.
- Stromberg, B.E. 1999. Economic evaluation of deworming strategies for cow-calf herds. Proceedings, 32nd Ann. Conv. of the Amer. Assn. of Bovine Practitioners, Nashville, TN, Sept. 1999, p. 260.
- Stromberg, B.E., T.L. Skogerboe, R.S. Rew. 1999. Economic evaluation of deworming strategies for cow-calf herds. Amer. Assn. of Bovine Practitioners. Poster Session, Sept. 1999.

- Waller, P.J. 1999. International approaches to the concept of integrated control of nematode parasites of livestock. *Int. J. Parasitology* 29(1):155-64.
- Williams, J.C. 1995. Endoparasites of cattle: diagnosis and assessment of infections and prevention and control from now to the foreseeable future. *Proceedings, 27th Ann. Conv. of the Amer. Assn. of Bovine Practitioners, Pittsburgh, PA, Sept. 22-25, 1994*, pp. 21-31.
- Wittum, T.E., N.E. Wollen, L.J. Perino, et al. 1996. Relationships among treatment for respiratory tract disease, pulmonary lesions evident at slaughter, and rate of weight gain in feedlot cattle. *JAVMA* 209(4):814-818.