THE EFFECT OF IBR/PI3 AND *PASTEURELLA* VACCINATION ON THE MORTALITY RATE OF HIGH PERCENTAGE EAST FRIESIAN LAMBS

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Background

The United States does not have a history of sheep dairying, and, as a consequence, much effort has been devoted to the importation of European dairy sheep breeds such as the East Friesian. Previous research at the Spooner Agricultural Research Station has shown that milk production, lactation length, ewe prolificacy, and lamb growth rates of domestic breeds such as the Dorset, Rambouillet, and Polypay are improved when these breeds are crossed with the East Friesian (Thomas et al., 1998 and 2000). However, at this same location we have reported a significant and undesirable positive relationship between percentage of East Friesian breeding and lamb mortality (Thomas et al., 1999 and 2000). In the 1999 lamb crop, lambs of over 50% East Friesian breeding had a mortality rate of 28% compared to mortality rates ranging from 12% to 4% for groups of lambs with from 50% to 0% East Friesian breeding (Thomas et al., 1999 and 2000). In the 2000 lamb crop, lambs with the highest proportion of East Friesian breeding (over 75% East Friesian breeding) had a 48% mortality rate; the highest rate for any breed group (Thomas and Berger, unpublished data).

Increased mortality of high percentage East Friesian has been reported previously. Katsaounis and Zygoyiannis (1986) reported especially poor viability of East Friesian sheep in Greece. They imported a total of 52 ewes, 10 rams and 18 lambs of East Friesian breeding in the three years of 1956, 1960, and 1965. They were run on their experimental farm along with sheep of two local dairy breeds. Of these imported animals, all the lambs died within two months, and all the adults had died by 1970. Of the East Friesian lambs born in the flock in Greece, 38.3% were stillborn or not viable at birth, 29.6% died before the age of two months, and of those weaned, 69.2% died before one year of age. Ewes of 1/2 East Friesian breeding lived for a respectable 5.1 years (similar to the local breeds). However, ewes of higher percentages of East Friesian breeding had very short lifespans: 3/4 East Friesian = 2.6 years, 7/8 East Friesian = 2.7 years, 15/16 East Friesian = 2.5 years, 31/32 East Friesian = 2.5 years, and pure East Friesian = 2.0 years. The most common cause of death among lambs was pneumonia with a high incidence of Maedi (OPP-like disease) in adult ewes.

Ricordeau and Flamant (1969) also reported an increased death loss to respiratory disease of East Friesian-cross lambs in France. In different years and with percentages of East Friesian breeding varying from 50% to 87.5%, they reported a 2.2% to 22.2% increased death loss in East Friesian-cross lambs from pasteurellosis and pneumonia compared to Préalpes du Sud lambs.

We were aware of previous problems with high mortality of East Friesian lambs in Mediterranean countries but thought this may have been due to the fact that the environment in these countries is considerably different from the northern European environment where the East Friesian breed was developed. Since the environment in northern Wisconsin is more similar to the environment of northern Europe than is the Mediterranean region, we expected less mortality problems here. This was not the case.

Over 63% of lamb death losses in 1999 were attributed to pneumonia (Thomas et al., 1999 and 2000). Lambs typically presented a marked respiratory disease and died within 2 to 3 days of clinical onset. Histopathology revealed classic findings of bronchopneumonia, and in some cases, focal abscessation. Bacteriological culture revealed *Pasteurella haemolytica and multocida.*

While it was desirable to discover that the East Friesian breed may have increased susceptibility to respiratory disease in the temperate environment of northern Wisconsin, it is now necessary to determine if there are health programs that can prevent this disease. Dairy sheep producers in North America have few breed options. The only other dairy sheep breed available to North American dairy sheep producers is the French Lacaune. The Lacaune is available in only limited numbers, and a comprehensive comparison of the Lacaune and East Friesian breeds has not been completed.

The objective of the present experiment is to evaluate the efficacy of vaccinating the ewes and/or their lambs with one or two commercial vaccines on the incidence of lamb mortality.

Materials and Methods

Animals. The study was conducted with the 2001 lamb crop from the dairy flock at the Spooner Agricultural Research Station. Ewes and lambs were various percentages of East Friesian, Lacaune, Dorset, Rambouillet, and/or Polypay breeding. Many animals also contained a very small percentage of Targhee and Finnsheep or Romanov breeding. Proportion of East Friesian breeding in the lambs varied from 0% to over 94%. Lambing occurred from February 6 through May 21, 2001. A total of 527 lambs were born. Lambs were either raised on milk replacer from shortly after birth or by their dams in drylot until weaned at approximately 30 days of age. Prior to weaning, lambs had free access to a high energy creep diet. After weaning, lambs were fed high energy diets in drylot until marketed or selected as a replacement.

Treatments. Prior to lambing, ewes were randomly assigned to one of two gestational treatments within ewe age and proportion of East Friesian breeding (Figure 1): approximately 1/3 of the ewes were vaccinated with 2 ml of a bacterial toxoid preparation of *Pasteurella haemolytica/ multocida* (Presponse HM®, Fort Dodge Animal Health, Inc.) at 8 and 4 wk prior to parturition; the other 2/3 of the ewes were not vaccinated. At lambing, all lambs born to an individual ewe received one of two birth treatments (Figure 1): within ewe vaccination treatments, approximately 1/3 of the lambs were vaccinated with 0.5 ml of a modified live preparation of IBR and

PI_3 viruses (TSV-2®, SmithKline Beecham Animal Health) in each nares, the other 2/3 of the lambs received no intranasal vaccine. At weaning, slightly less than 1/2 of the lambs within each 'ewe vaccination/lamb birth vaccination' group were vaccinated with 2 ml of a bacterial toxoid preparation of *Pasteurella haemolytica/multocida* (Presponse HM®), and slightly more than 1/2 of the lambs were not vaccinated (Figure 1).

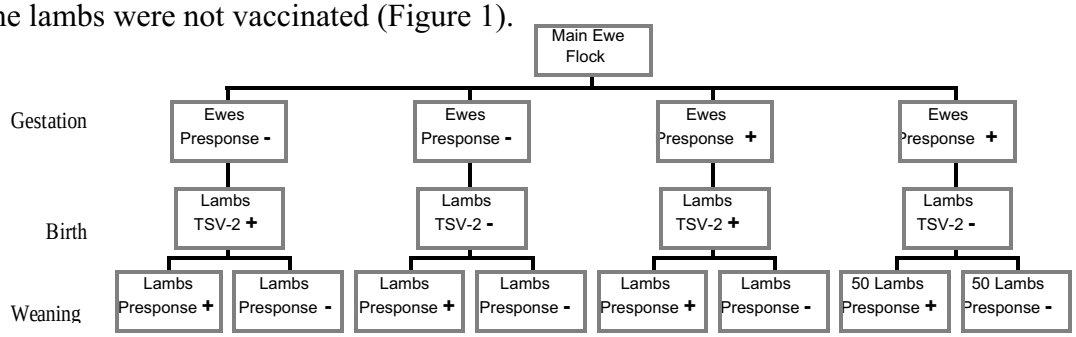

Figure 1. Experimental treatment combinations for the dairy ewe flock and their lambs at the Spooner Agricultural Research Station during the gestation/lactation 2000-2001. Presponse = bacterial toxoid preparation of *Pasteurella haemolytica/multocida.* TSV-2 = modified live preparation of IBR and PI_3 viruses.

Mortalities. Lamb mortality was determined from birth until approximately 7 months of age, but no mortalities occurred after August 20, 2001. Lambs that were born dead or that died within 1 day of birth were deleted from the study. Of the 527 lambs born, 499 were living 1 day after birth. Eighteen of the 499 lambs (3.6%) died prior to weaning. Of the 481 lambs weaned, 37 lambs (7.7%) died postweaning. Of the 527 lambs born, 83 died by August 20, 2001 for an overall mortality rate of 15.7%. Of the 499 lambs alive 1 day after birth, 55 died (11.0%). Of these 55 dead lambs, 27 died from pneumonia (7 preweaning and 20 postweaning) and 28 died from other causes (11 preweaning and 17 postweaning).

Statistical analyses. Data were analyzed with the General Linear Models Procedure of SAS. Lambs were recorded a 1 if they survived and a 0 if they died. The model for data set with all lambs treated at birth included the effects of proportion of East Friesian breeding (0-49%, 50-74%, or 75-100%), dam age (1 year or 2 years and older), lamb sex (male, female), ewe vaccination (yes or no), lamb birth vaccination (yes or no), and significant two-way interactions. The same model was used for the data set with all lambs surviving to weaning with the addition of lamb weaning vaccination (yes or no). Birth type of lamb (single or multiple) initially was fit to each model. Since birth type was never significant and there were few single-born lambs, birth type was deleted from both models. The numbers of lambs in each data set are presented in Tables 1 and 2.

Table 1. Number of lambs treated at birth by breed group and ewe vaccination treatment

% East Friesian breeding of lamb	Ewe vaccination treatment				Total by breed group
	No Pasteurella		Pasteurella		
	Lamb vaccination treatment at birth				
	No IBR/PI_3	IBR/PI_3	No IBR/PI_3	IBR/PI_3	
0 – 49 %	129	83	63	43	318
50 – 74 %	41	15	15	11	82
75 – 100 %	43	24	20	12	99
Total by vaccination	213	122	98	66	499

Table 2. Number of lambs treated at weaning by ewe vaccination and lamb birth vaccination treatments

Lamb weaning vaccination	Ewe vaccination treatment				Total by weaning trt.
	No Pasteurella		Pasteurella		
	Lamb vaccination treatment at birth				
	No IBR/PI_3	IBR/PI_3	No IBR/PI_3	IBR/PI_3	
No Pasteurella	122	61	47	34	264
Pasteurella	85	56	47	29	217
Total by birth trt.	207	117	94	63	481

Results

Preweaning mortality. The effects of several factors on preweaning survival of lambs treated at birth are presented in Table 3. No factors influenced preweaning lamb survival including ewe vaccination with Pasteurella and lamb vaccination at birth with IBR/PI_3. There were three significant two-way interactions among the factors, but in all cases every sub-group of lambs had a preweaning survival rate of 90% or greater. Biological reasons for the existence of the interactions were not evident.

Table 3. Preweaning lamb survival (%) of lambs alive at birth as affected by various factors

Factor	No. of lambs	Mean ± standard error
% East Friesian breeding:		
0 – 49 %	318	93.4 ± 1.2
50 – 74 %	82	97.2 ± 2.3
75 – 100 %	99	94.8 ± 2.0
Dam age:		
1 year	224	94.7 ± 1.5
2 or more years	275	95.5 ± 1.7
Lamb sex		
Female	260	94.5 ± 1.4
Male	239	95.8 ± 1.4
Ewe vaccination		
No Pasteurella	335	95.5 ± 1.3
Pasteurella	164	94.8 ± 1.6
Lamb vaccination at birth		
No IBR/PI_3	311	94.8 ± 1.4
IBR/PI_3	188	95.5 ± 1.7

It is very difficult to show an effect of vaccination when non-vaccinated animals had a survival rate of 95%. It is possible that the present of vaccinated ewes and lambs reduced the incidence of infectious agents to the point where non-vaccinated animals were not exposed to high enough levels to cause disease.

Postweaning mortality. Lambs that survived weaning were either vaccinated or not vaccinated for Pasteurella. Presented in Table 4 are the effects of various factors on postweaning lamb survival. Lambs from 1-year-old dams had lower ($P < .05$) postweaning survival than lambs from dams 2 years of age and older, and male lambs had lower ($P < .05$) postweaning lamb survival than female lambs. Vaccination of ewes with Pasteurella and lambs at birth with IBR/PI_3 had no significant effect on postweaning lamb survival.

Table 4. Postweaning lamb survival (%) of lambs alive at weaning as affected by various factors

Factor	No. of lambs	Mean ± standard error
Dam age:		
1 year	214	84.6 ± 2.1 [b]
2 or more years	267	96.2 ± 2.1 [a]
Lamb sex		
Female	249	92.9 ± 2.0 [a]
Male	232	88.0 ± 2.0 [b]
Ewe vaccination		
No Pasteurella	324	90.3 ± 1.8
Pasteurella	157	90.5 ± 2.3
Lamb vaccination at birth		
No IBR/PI_3	301	89.3 ± 1.9
IBR/PI_3	180	91.6 ± 2.3

[a,b] Means within a factor without a common superscript are different (P < .05).

There was a significant interaction between proportion of East Friesian breeding and lamb Pasteurella vaccination at weaning on postweaning lamb survival. Among the two breed groups with the lowest proportion of East Friesian breeding, there were no significant differences for postweaning survival between vaccinated and non-vaccinated lambs. However, within the group of lambs of 75% or greater East Friesian breeding, vaccinated lambs had a greater (P < .05) postweaning survival than did non-vaccinated lambs (94.4 vs. 79.6 %).

It appears that lambs in 2001 were under greater risk of death postweaning than preweaning because twice as many lambs died after weaning as before (of lambs living more than 1 day). It also appears that the lambs of very high percentage East Friesian breeding are at greater risk of death postweaning than lambs of a lower percentage East Friesian breeding. These data suggest that during periods of greater risk and with genotypes of greater risk, vaccination of lambs for Pasteurella may result in reduced lamb mortality. Since the number of lambs of high percentage East Friesian breeding included in this study was relatively small, further work should be done with larger numbers of animals to clarify this situation.

Table 5. Interaction between lamb breeding and lamb Pasteurella vaccination at weaning on postweaning lamb survival

% East Friesian breeding of lamb	Lamb Pasteurella vaccination treatment			
	No Pasteurella		Pasteurella	
	No.	Mean ± se, %	No.	Mean ± se, %
0 – 49 %	165	90.5 ± 2.2 [a]	140	92.8 ± 2.4 [a]
50 – 74 %	59	98.0 ± 3.6 [a]	22	87.3 ± 5.7 [a,b]
75 – 100 %	40	79.6 ± 4.3 [b]	55	94.4 ± 3.6 [a]

[a,b] Means without a common superscript are different (P < .05).

References

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