when used to test milk samples 18-24 days post service could be used to predict the onset of oestrus. Both oestrus detection rates and accuracy showed considerable improvements. Trial 2 demonstrated that similar improvements in accuracy and detection rates could be achieved by alternate day sampling. Oestrus detection remains a problem in many large dairy herds using artificial insemination and these trials demonstrate a place for oestrus prediction using E.I.A. It was encouraging to see the improvements occurring in these herds in which oestrus detection was probably worse than average thus demonstrating that the technique could be used in herds of below average management ability. The accurancy of the visual assessment leads the way to the development of an on farm test using a qualitative assessment.

References

1. Boyd, H. (1984). Proceedings of BVA/BSAP Conference. Dairy Cow Fertility. Published by the B.V.A. 2. Foulkes, Cookson and Sauer (1982). 3. Eddy, R.G. (1980). FRCVS Thesis. 4. Stimpson, P. (1984). Paper presented to the 1984 Spring meeting at the Harbour Adams College of Agriculture.

Titers for BVD, IBR, PI_3, and BRSV in Dairy Cattle. What Do They Tell Us?

Samuel Hutchins 3rd, *D.V.M.*
Box 218
So. Barre, VT 05670

Blood samples from 160 dairy animals in 15 client herds were tested for titers to Bovine Virus Diarrhea (BVD), Infectious Bovine Rhinotracheitis (IBR), Parainfluenza 3 (PI_3), and Bovine Respiratory Syncytial Virus (BRSV). Sampling occurred from September through December, 1984. The results are summarized by disease and by vaccination status. Data from other surveys in the same geographical area are included in the 9-18 month age group summary.

Client Herds:

The management and vaccination history was known by the author in all client herds. The client herds included open and closed herds of 40-150 cows housed in stanchion, comfort stall and free stall barns.

Two herds with negative titers for IBR and BVD and no history of vaccination for these diseases were vaccinated for IBR, PI_3, and BVD after the initial sampling and then retested. They are included in both the non-vaccinate and vaccinate summaries. (Table 5)

Survey Design:

A minimum of ten animals in each herd were sampled including one 3 month calf, one yearling, two 1st calf heifers, two 2nd calf heifers, two 5-6 year old cows, and two aged cows.

Sampling:

10 cc of venus blood was drawn into a red top vaccutainer tube. The blood was allowed to clot and 2 cc of serum was transferred to another tube. The serum was chilled or frozen and sent to the Diagnostic Laboratory at the University of Minnesota.

Serological Testing:

Microtiter serum neutralization (SN) tests were performed for IBR, BVD, and BRSV. PI_3 titers were measured by a hemaglutination inhibition (HI) test. Testing was performed using serial dilutions from 2-2048.

BVD Titers:

Closed vs open herds: 30-40% of the animals in 5 closed herds had titers ranging from 2-512. All animals (22) in two open herds had titers ranging from 8-2048 with a titer of 256, the most common finding. Clinical evidence of BVD infection was not present in any of these herds.

Killed vaccine: Table 1 summarizes titers from 5 herds where killed BVD vaccine was used. The titers following initial vaccinations were lower than the literature suggests.[1] The yearly booster injection appears to raise the titer significantly.

MLV vaccine: In one herd, MLV BVD vaccine (Resbo[8a]) was given yearly to all animals 2-6 weeks post-calving. This is a closed herd and no other viral vaccines are given at any age. Titers (19) ranged from 16-256 with titers of 128 and 256 the most common finding.

These titers may reflect natural exposure to BVD instead of vaccination titers when serological results from non-vaccinated animals in the herd are considered (Table 2).

Serological testing was funded by Norden Laboratories, Lincoln, Nebraska. The author thanks Dr. Douglas Armstrong for technical assistance and many colleagues for conducting some of the surveys.

(a) MLV IBR, PI_3, BVD plus Leptoferm 5, Norden Laboratories, Lincoln, NE.

TABLE 1. BVD Titers With Killed BVD Vaccine.

	No.	Range	Most Common
2 Initial Injections, Sampling 2 weeks later	16	0-128	8-32
Yearly Booster, Sampling 1-2 months later	11	8-256	128-256
Booster vaccine, Sampling 1 year later	5	32-64	32-64

TABLE 2. BVD Titers In Non-Vaccinated Cattle In a MLV Vaccinated Herd.

Non-Vac. Heifers [x]		Calves from Non-Vac. Heifers [y]		Calves from Vac. Cows [z]	
Age	Titer	Age	Titer	Age	Titer
3 yr.	256	5 wk.	1024	6 wk.	128
3 yr.	4	6 wk.	64	8 wk.	32
1 yr.	128	8 wk.	16	8 wk.	256
1 yr.	256	10 wk.	2048		

[x] Probably post infection titers. The 4 titer increased to 64 1 yr. post vac.

[y] Two calves with high titers indicate exposure to BVD virus either in last trimester of dams pregnancy or just after birth.

[z] These probably are colostral titers, possibly boostered by natural exposure.

BVD infection may be present in this herd in the calf raising area or in the heifer raising unit. Clinical BVD is not a problem in this herd.

IBR Titers

No vaccination: 3 herds had never been vaccinated for IBR. In one open herd, titers (14) ranged from 0-32 with 4 and 8 the most common finding. Two closed herds had negative titers for all animals tested (19).

Vaccination: Table 3 summarizes the titers for the IBR vaccinates.

(a) *Nasogen[b]:* These titers were higher than was expected. Nutritional status directly effects IBR titers[2] and these dairy herds had above average production. IBR infection was not present clinically and non-vaccinates in these herds did not have IBR titers.

Significantly more negative titers occurred following Nasogen administered by the herdsman than when the vaccination was performed by a veterinarian. In so far as could be determined, the herdsman followed proper preparation and administration of the vaccine.

(b) *Kill vaccine:* This vaccine produced IBR SN titers in the expected range.

(c) *MLV intramuscular vaccine:* This data is from only one herd. The titers were one dilution lower than Nasogen and killed vaccine.

(d) TSV_2[c]: This temperature sensitive vaccine only replicates in the mucosal cells of the turbinates[3] [4] and production of humural antibodies is low. The SN test is not the test to use to measure antibody production from this vaccine. The placque-reduction test or virus isolation are better procedures.

TABLE 3. IBR Titers by Vaccine.

Vaccine	No. Animals	Range	Most Common
Nasogen	62	0-64	4-16
Killed Vaccine	23	0-32	4-16
MLV IM Vaccine	8	2-16	4-8
TSV	16	0-4	0

IBR titers in calves: Table 4 shows that colostral IBR titers in dairy calves disappear early. This suggests that calves should be vaccinated for IBR at an early age.

PI_3 titers: In this and other surveys conducted in the Northeast in 1984, almost all animals have HI titers for PI_3 regardless of vaccination status. PI_3 was included with all IBR vaccines used in the herds surveyed. PI_3 titers ranged from 0-320 with 20-80 the most common finding. Two herds in which heifers only were surveyed, PI_3 titers were negative in all animals. (See Table 6)

TABLE 4. IBR Titers in Dairy Calves.

	No.	Range	Most Common
6 wks.	5	0-32	2-8
2-3 mo.	15	0-2	0
1 yr.	14	0-4	0

BRSV Titers:

BRSV vaccine became available in July, 1984. No vaccine was used in the herds sampled. 37% of the cattle sampled and 73% of the client herds had SN titers for BRSV. The titers ranged from 0-32 with 4-16 the most common finding. This data suggests that BRSV is present in dairy herds in the Northeast. Serological testing is continuing to determine if BRSV is a factor in respiratory disease outbreaks in this area.

BRSV titers may be influenced by the environment of the cattle at the time of sampling. In 4 tie-stall herds, only 3 of 19 animals had positive titers for BRSV when these cattle were sampled on pasture in September, 1984. After the cattle had been confined to the barn for at least a month, 18 of 20 additional cattle in these herds had BRSV titers.

(b) MLV IBR, PI_3 nasal vaccine, Cooper Animal Health, Inc., Kansas City, MO.

(c) MLV IBR, PI_3 nasal vaccine, Norden Laboratories, Lincoln, NE.

TABLE 5. Client Herd Summary: Titer/No. Tested.

	BVD [x]		IBR [x]		PI_3 [x]		BRSV	
Vaccinates								
Animals	46/49	94%	83/110 [y]	75%	110/110	100%	0/0	0%
Herds	6/6	100%	14/14	100%	14/14	100%	0/0	0%
Non-vaccinates								
	BVD [x]		**IBR [x]**		**PI_3 [x]**		**BRSV**	
Animals	41/111	37%	14/50	28%	64/65	98%	59/160	37%
Herds	7/11	64%	1/3	33%	3/3	100%	11/15	73%
All Animals								
	BVD [x]		**IBR [x]**		**PI_3 [x]**		**BRSV**	
Animals	87/160	54%	97/160 [y]	61%	174/175	99%	89/160	37%
Herds	13/17	76%	15/17	88%	17/17	100%	11/15	73%

[x] Two herds represented pre and post vaccination.
[y] No. of animals with titers is low due to inclusion of TSV_2 vaccinated animals. See section on IBR.

Summary of Client Herds

BVD: 12 of 15 herds tested had cattle with BVD titers. Titers were present in 37% of the non-vaccinated cattle and 94% of the vaccinates.

IBR: 75% of the vaccinated cattle had SN titers for IBR. This percent is low due to the inclusion of TSV_2 vaccinates which produce little systemic antibody. One of three non-vaccinated herds had IBR SN titers in all cattle tested (open herd) indicating exposure to IBR virus. Non-vaccinated cattle in vaccinated herds had negative SN titers suggesting that the IBR titers were due to vaccine.

PI_3: 99% of all cattle sampled in the client herds had HI titers for PI_3 regardless of vaccination status.

BRSV: 73% of the herds and 37% of all cattle tested had BRSV SN titers. BRSV titers suggested natural exposure to BRSV since BRSV vaccine was not used in any herds.

Titers in Yearlings

Table 6 compares data on cattle 9-18 months of age with cattle > 2 years of age. All cattle were from the Northeast. Vaccination status was not known.

TABLE 6. Titers in Yearlings: combined Survey Data.

	BVD	IBR	PI3	RBSV
19 Herds 72/9-18 months	46%	6%	67%	22%
17 Herds 140/2 years +	58%	72%	100%	44%

BVD. The percent of yearlings with BVD titers is almost as high as for older cattle. Colostral titers usually are gone by 9 months; therefore, these titers are either from vaccination or natural exposure.

IBR: Only 6% of the yearlings had IBR titers in an area where IBR vaccination is a general practice. This suggests a low incidence of natural IBR exposure and adult vaccination practices. These yearlings appear vulnerable to IBR infection.

PI_3: Two of 19 herds had 19 out of 21 yearlings with negative titers for PI_3. This was not a common finding but significantly effects the data presented.

BRSV: 22% of the yearlings had titers for BRSV vs 44% of the adults. This suggests natural BRSV virus exposure occurred, since vaccine was not used on these cattle.

References

1. Schipper, A. et al: Comparison of Attenuated and Inactivated Bovine Viral diarrhea (BVD) Vaccines. *Veterinary Medicine,* Feb. 1984; p. 247. 2. Miller, E. Phillip, D.V.M.: Personal Communication, 1984. 3. Gerber, Jay D. et al; Local and System Cellular and Antibody Immune Responses of Cattle to Infectious Bovine Rhinotracheitis Virus Vaccines Administered Intranasally or Intramuscularly. *Journal of Veterinary Research,* May 1978; p. 753. 4. Kucera, Carrell J.; Evaluation of the Safety and Efficacy of an Intranasal Vaccine Containing a Temperature-Sensitive Strain of Infectious Bovine Rhinotracheitis Virus. *American Journal of Veterinary Research,* Vol. 39, #4, April 1978: p. 607.