AN EVALUATION OF IMMUNE RESPONSE IN WEANLING AGE BEEF CALVES GIVEN BOOSTER VACCINATIONS AT SELECTED INTERVALS

I.A. Schipper, D.G. Landblom, J.L. Nelson and H.M. Smith

OBJECTIVES:

The primary objective when using vaccines is to prevent infectious disease. This objective is too frequently not obtained because of incorrect administration of the biological product. Investigations at this station to identify the method that would generate the most immune response revealed that very minimal, or no antibody production was produced following a single vaccination; and that regardless of the type of vaccine used (modified live or inactivated) two vaccinations were required to produce maximum blood serum levels of antibodies (Schipper et al, 1984). It was also found that when weaning and vaccination occurs simultaneously, antibody titer is decreased and that a more rapid decay of antibody titer occurs. When the previous work being discussed was done, and interval of three weeks was used between the initial and booster vaccinations. The purpose of this present investigation is to identify the interval between the initial and booster vaccinations that will promote maximum antibody response among weanling age beef calves.

PROCEDURE:

Calves weighing approximately 450-550 pounds of multiple breeds and of both sexes were utilized in this investigation. The biological agent used was an inactivated trivalent (Infectious Bovine Rhinotrachetis – IBR, Bovine Virus Diarrhea – BVD, and Para Influenza – 3-PI-3) vaccine administered according to the manufacturers recommendations. In the vaccination protocol 46 calves served as controls and were intermingled with the treated groups but received no vaccine. One group of 39 calves received a single administration (5 ml) of the trivalent vaccine when the experiment began. Three other treatment groups comprised of 38 to 40 calves each were given an initial vaccination of the trivalent vaccine and were then given booster vaccinations at either one, two or three week intervals.

All calves were bled on vaccination day, on the day that booster vaccinations were given and six weeks following the initial vaccination. Blood serum was obtained, frozen and forwarded to the Veterinary Diagnostic Laboratory, NDSU where it was titered for antibodies to IBR, BVD and PI-3 viruses present in the trivalent vaccine.

RESULTS:

IBR

Over the six week period of this investigation, control calves did not exhibit major changes in blood serum antibody levels. All calves, regardless of the frequency or interval that a booster vaccination was administered exhibited a definite blood serum titer decay. The greatest antibody titer response was detected in those calves given a booster vaccination two weeks following the initial vaccination. (Figure 1)

BVD

Calves in the control group exhibited a slight increase in blood serum antibody titer between the three and six weeks period of the investigation. A similar slight increase occurred in varying degrees between the three and six week period for those calves given an initial vaccination only and those given booster vaccinations at one and two weeks after the initial challenge. A major increase in blood serum titer was observed for those calves given a booster vaccination three weeks following the initial vaccination. (Figure 2)

PI-3

The controls exhibited a steady increase in blood serum titer over the six week period investigated. Administering a booster vaccination two weeks following the initial challenge generated the greatest increase in blood serum titer to PI-3. With the exception of the control group of calves, all calf groups exhibited a similar increase in serum antibody titer following the three week period of the investigation. (Figure 3)

Comparison of Immune Response for IBR, BVD, and PI-3 Antigens

Figure 4 provides a comparison of blood serum antibody response for each disease antigen in the trivalent viral vaccine when administered initially followed by a second administration at three weeks. The IBR vaccine provided the least antibody response and an antibody decay between the third and sixth week of the study. Greatest antibody response was detected by those calves receiving the PI-3 antigen following the three week booster vaccination.

DISCUSSION:

IBR

Response among calves given the IBR (Herpes virus) antigen was substantially less than that observed among calves receiving either BVD or PI-3 vaccine. Also these data clearly indicate that IBR blood serum antibody decay occurs soon after maximum post-vaccination titers are observed.

The blood serum titer decay observed is characteristic for nearly all Herpes viruses and has led to the suggestion that continuous multi-vaccinations must be utilized to maintain a maximum level of antibody for protection from Herpes virus diseases. While this would maintain maximum antibody levels, it is an impractical approach.

BVD

The results relating to the immune response among calves vaccinated with BVD virus indicates that there is little protection provided animals vaccinated only once, or receiving a second administration at one or two weeks following initial vaccination. When comparing BVD and IBR antibody titers, BVD exhibited a greater antigenic activity. It is apparent from these data that those animals receiving a second vaccination three weeks after the initial vaccination for BVD would have the greatest opportunity to develop maximum protection against BVD virus.

Blood serum titers to BVD were detected at the time initial vaccinations were made, indicating that calves in this investigation had experienced natural infections to BVD virus and had developed some immunity before the vaccination sequence began.

PI-3

A steady increase in blood serum titer to PI-3 virus was detected in the control animals indicating that PI-3 virus was present in the calves in advance of the vaccination program. It would also appear that the stress of handling and crowding resulted in a rapid and extensive spread of the PI-3 virus among all animals involved. This would result in a consistent titer increase among vaccinated and unvaccinated calves. Results obtained for PI-3 virus demonstrate that it is a virus that spreads rapidly throughout all calves brought together and that by the end of the six week study period all calf groups had developed strong antibody titers.

SUMMARY:

To obtain maximum antibody levels to the three viral strains tested would require administering an initial vaccination to IBR and PI-3 followed by a booster vaccination two weeks later. And in the case of BVD virus, maximum antibody production would be obtained by giving an initial vaccination for BVD followed by a booster vaccination at three weeks. While this would provide the best protection it is impractical to handle cows and their calves so often. The best alternative is to use a trivalent vaccine (IBR, BVD and PI-3) giving an initial vaccination and following it with a booster vaccination two weeks later.

If one is to establish and maintain maximum blood antibody titers to IBR virus it will be necessary to follow one initial vaccination with IBR vaccine with routine booster vaccinations at six week intervals, which is impractical.

The PI-3 virus is everywhere in the young calf and when they are subjected to the stress of vaccination, handling and crowding there is an extensive spread of this viral agent. The infection under stressful conditions results in the establishment of high blood serum antibody titers by six weeks following the initiation of the stressful period.

REFERENCES:

Schipper, I.A., D.G. Landblom, J.L. Nelson, V. Anderson, R. Danielson and T. Stromberg. 1984 Optimum Vaccination Time for Feeder Calves. North Dakota Agr. Expt. Sta., Dickinson Branch, 34th Livestock Research Roundup, pp. 38.

Figure 1: IBR Vaccination.

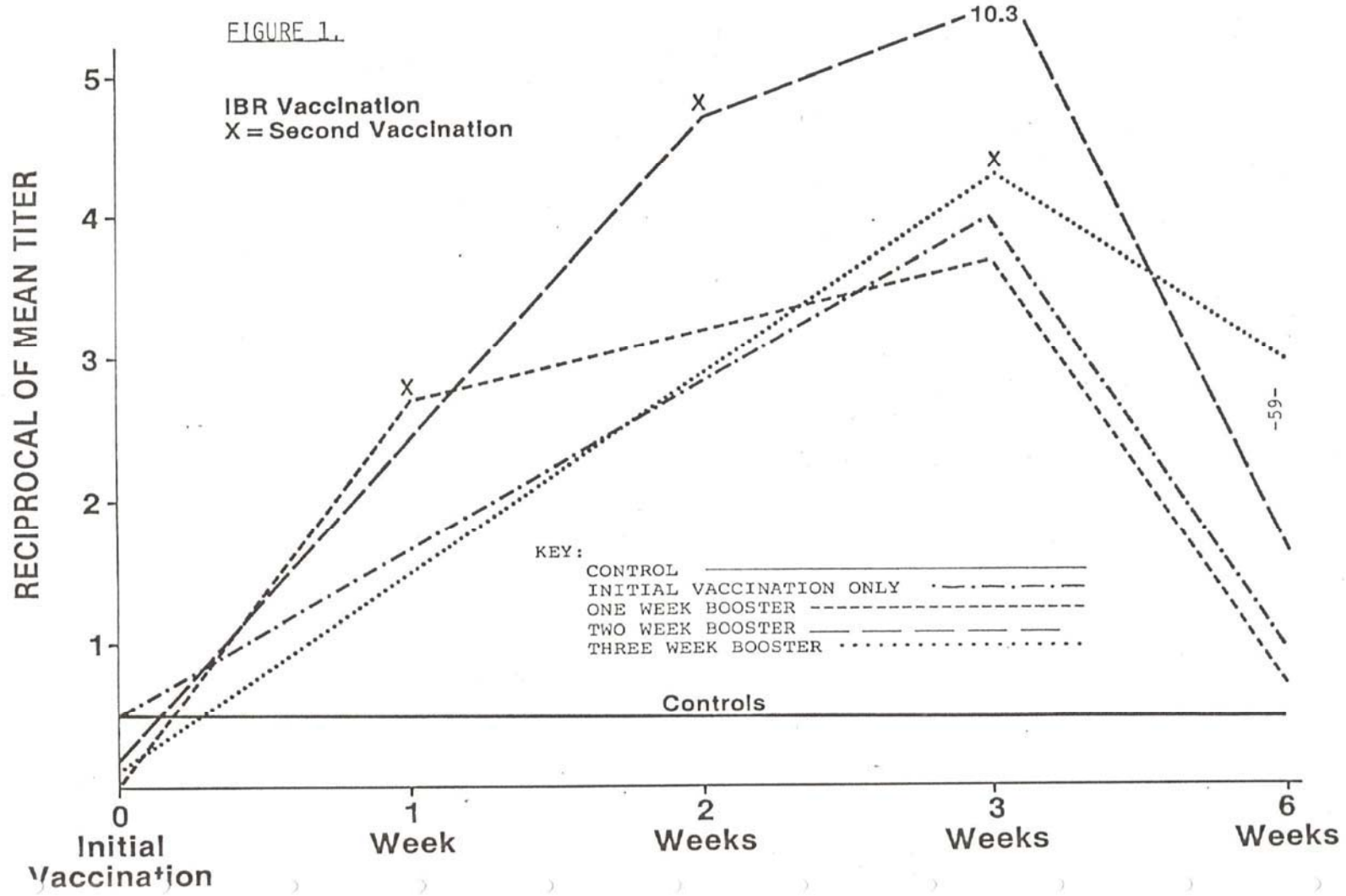

Figure 2: BVD Vaccination.

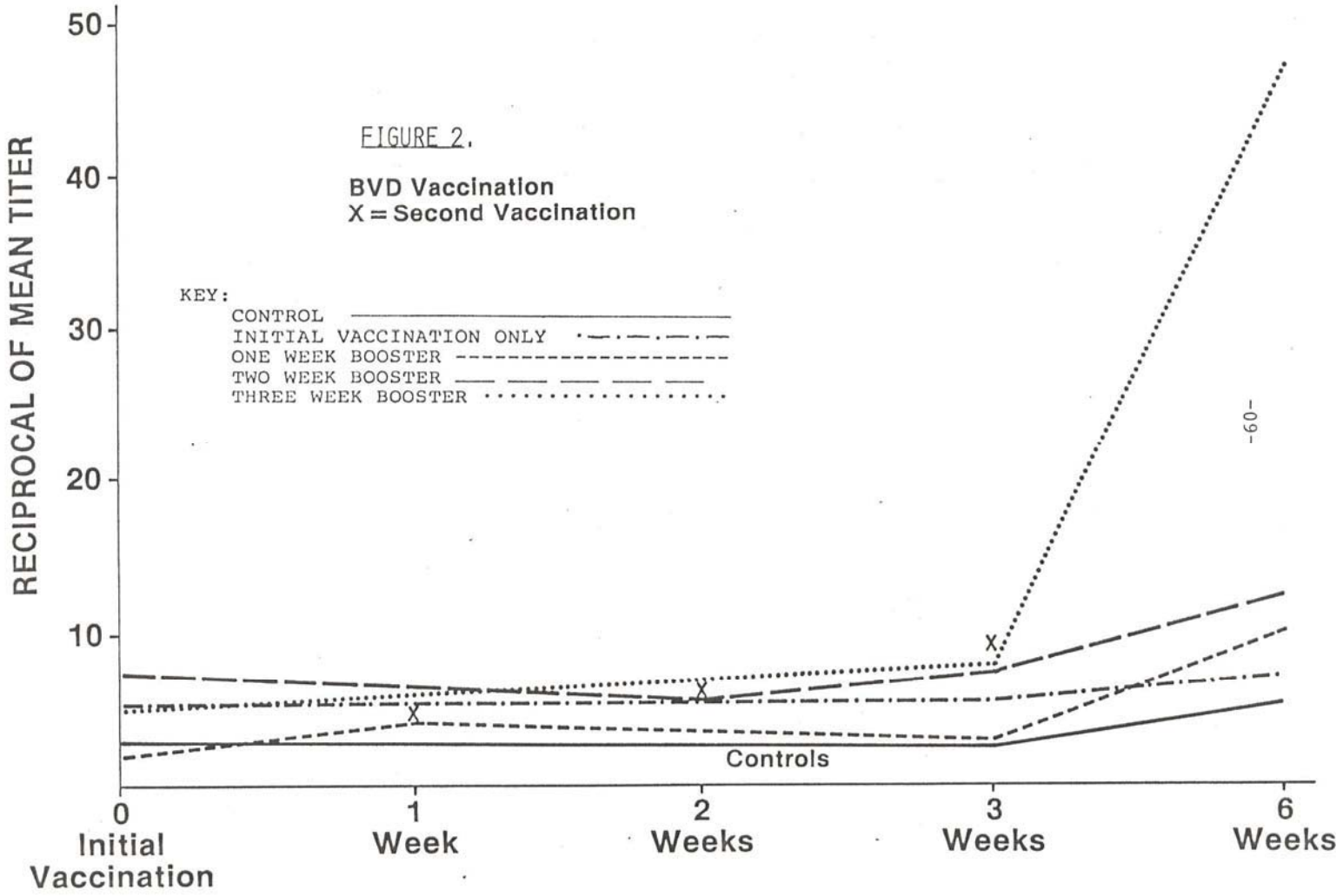

Figure 3: PI-3 Vaccination.

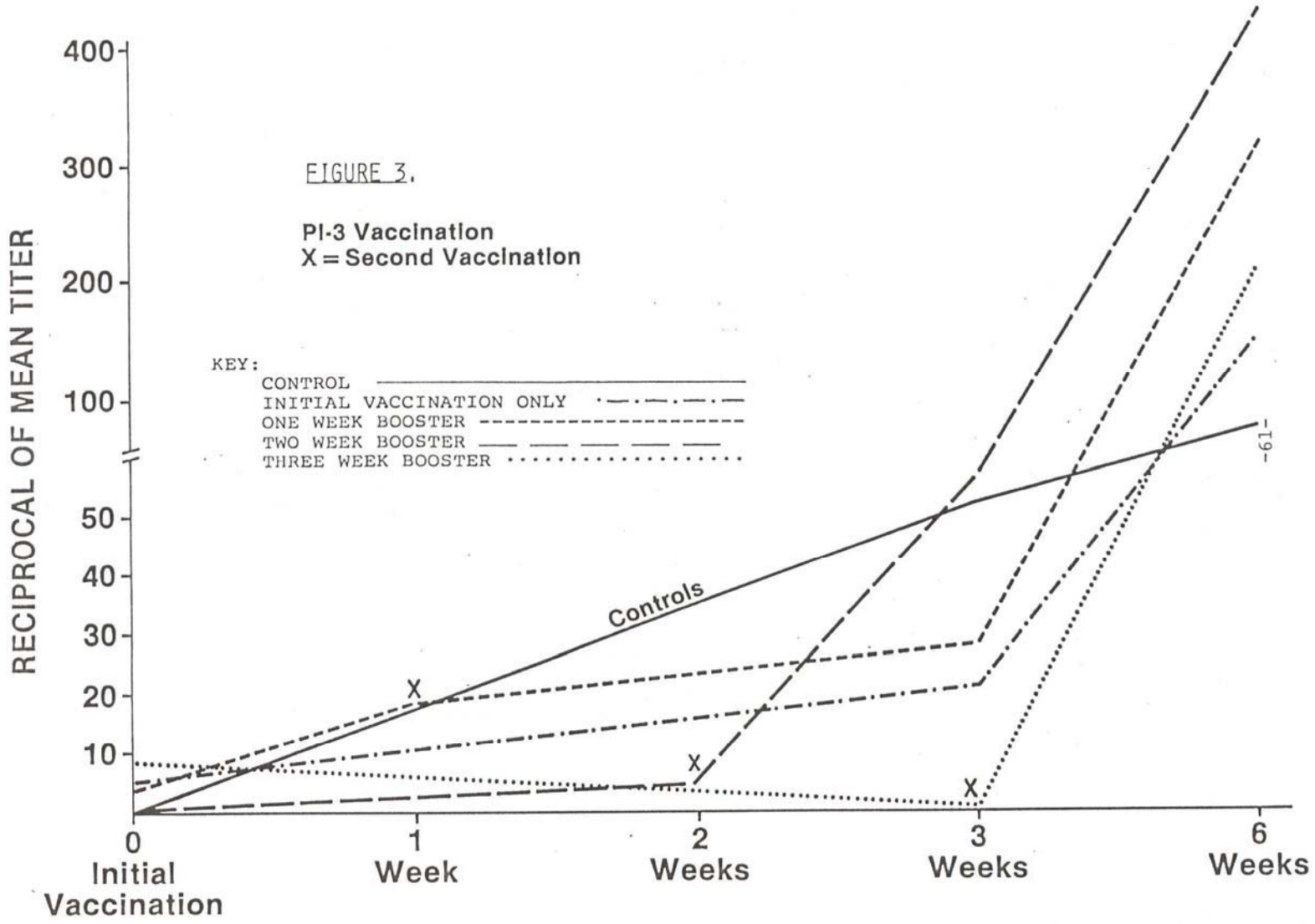

Figure 4: Comparison of Immune Response for IBR, BVD, and PI-3 Vaccines