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# LEPTOSPIRAL VACCINATION OF CATTLE EXPOSED TO INFECTED DEER

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**Abstract**

The incidence of leptospirosis due to *L. pomona* and *L. hardjo* in 900 cattle at the Dixon Springs Agricultural Center was evaluated annually by the microscopic agglutination test during a 15-year period.

The *L. pomona* reactor rate ranged from 5 percent in 1954 to 58 percent in 1955 during the period from 1953 to 1958 when the cattle were not vaccinated. Abortions were observed during 1955 and 1960.

The *L. pomona* reactor rate ranged from 15 percent to 28 percent between 1959 and 1964 when half of the cattle were vaccinated and declined to 0.5 percent to 5 percent when all of the cattle were vaccinated with *L. pomona* bacterin.

An infection of *L. pomona* vaccinated cows occurred in 1968 as indicated by a MA titer response of 1:100. No clinical signs were associated with the infection. The infection may have been caused by an endemic infection in a few carrier cattle or from infected wildlife. The skunk had previously been shown to be an active shedder.

The *L. hardjo* reactor rate ranged from 29 percent to 56 percent during the period from 1958 to 1966 when the cattle were not vaccinated and 33 percent during 1967 and 1968 when half of the cattle were vaccinated.

## Introduction

Leptospirosis has been recognized as a major disease of cattle in the United States during the past twenty years, since the availability of improved serologic and bacteriologic procedures for primary isolation of leptospires. A long-term vaccination study has been conducted with a large experiment station herd. The University of Illinois maintains approximately 900 cattle at Dixon Springs Agricultural Center (DSAC) in Pope County in southern Illinois. The University leases from the U.S. Forest Service about 5,000 acres of forest, pasture and crop land within the Shawnee National Forest for DSAC. Close proximity of forest and pasture provide ample opportunity for contact among cattle, abundant deer and wildlife in the area.

Annual serologic surveillance of the sera of the cattle by the microscopic agglutination (MA) test using several serotypes of leptospires has been conducted since 1953. Abortions associated with serologic evidence of *L. pomona* leptospirosis were observed in 1955 and 1960.

The purpose of this investigation was to use the MA test to determine the annual incidence of *L. pomona* and *L. hardjo* infections in the cattle at DSAC. Simultaneously an investigation of the incidence of leptospiral species in deer in the area was done (Andrews[1]). Comparative reactor rates were examined to determine if a relationship existed between leptospiral outbreaks in the cattle and deer. Another purpose was to determine if *L. pomona* and *L. hardjo* outbreaks could be controlled by vaccination with the specific leptospiral bacterins.

## Materials and Methods

### *DSAC Cattle*

The 400 cows were divided into 4 or 5 herds during the winter and for spring calving season. Further subdivision of cows and their calves into 18 to 20 herds was done for the pasture season. Individual herds were pastured in several locations during the summer.

All cattle were bled annually in late October and the sera separated for leptospiral microscopic agglutination testing. Leptospiral and other vaccinations were administered at this time.

### *Serologic Signs of Leptospirosis*

The microscopic agglutination - lysis (MA) test was conducted according to the procedure described by the Committee on Leptospirosis[4] of the 64th Annual United States Livestock Sanitary Association. All sera causing agglutination or lysis of 50 percent or more organisms in dilutions of 1:100 or greater were considered positive reactors in the microscopic agglutination (MA) test. The designation microscopic agglutination test is preferred to the former designation agglutination-lysis test.

### *Clinical Signs of Leptospirosis*

Abortions were observed in the cows in 1955 and 1960. Other clinical signs associated with leptospirosis were not observed.

### *Vaccination of Cattle*

Vaccination against *L. pomona* was done with a commercial* *Leptospira pomona* bacterin prepared from a killed whole culture adsorbed with aluminum hydroxide. Vaccine was injected subcutaneously in doses of 2 ml. or 5 ml. according to the manufacturer's directions.

Vaccine against *L. hardjo* bacterin was done with an experimental** *Leptospira hardjo* bacterin consisting of a whole culture, aluminum hydroxide adsorbed. Vaccine was injected subcutaneously in a dose of 5 ml.

## Results

The percentage of cattle reacting positively each year in the microscopic agglutination test with *L. pomona* cultures is presented in Table 1. The rise in the reactor rate from 5 percent in 1954 to 58 percent in 1955 was accompanied by abortions in the herd in 1955. Many of the cattle in 1955 had MA titers of 1:10,000 or higher, indicating serologic evidence of recent active leptospiral infection. The reduction in reactor rates in 1956, 1957 and 1958 to 37 percent, 29 percent and 13 percent, respectively, may reflect residual immunity in the herd resulting from active infection of animals in the 1955 outbreak.

*L. pomona* bacterin vaccination history of the herd is also presented in Table 1. From 1959 to 1964 half of the animals in the herds were vaccinated twice a year, in late spring and late October with commercial *L. pomona* bacterin. The other half of its animals were not vaccinated. The reactor rate was 16 percent in 1959, rose to 27 percent in 1960, during which year abortions were observed, remained stable at 28 percent and 27 percent in 1961 and 1962, and declined to 15 percent and 5 percent in 1963 and 1964, respectively.

Because of interest in the reactor rate decline between 1963 and 1964, one herd of forty-seven cows assembled for winter feeding and calving was retested in January, 1965. In November, 42 had been negative, 5 had been reactors. In January, only 25 were negative, 17 had converted from negative to reactors and the 5 previous reactors were still positive to the MA test. However, most titers were 1:100, much lower than experienced in previous outbreaks. After completion of the serologic tests, an isolation of *L. pomona* was made from the urine cultured from one bull. Having thus established the presence of a nidus of

*Fort Dodge Laboratories, Inc., Fort Dodge, Iowa.
**Affiliated Laboratories Corporation. A Subsidiary of Rohn and Haas Company, White Hall, Ill.

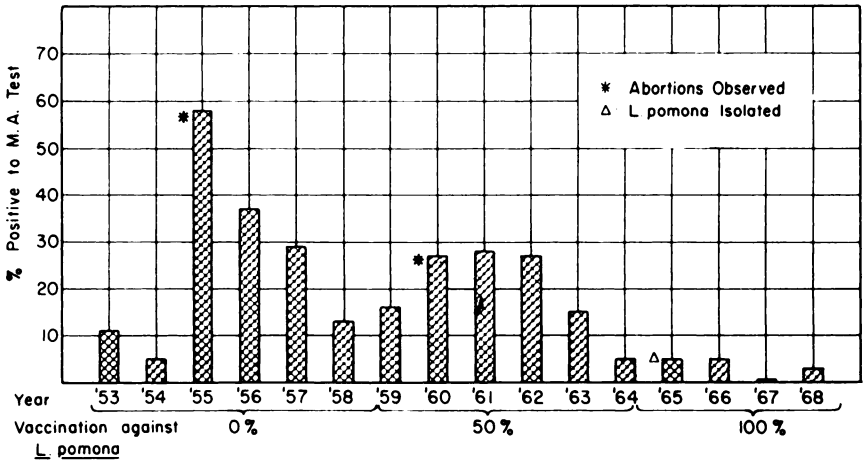


Table 1. Annual Reactor Rates to L. pomona and Vaccination History of Cattle in Dixon Springs Agricultural Center.

infection in this herd, annual vaccination of all of the cattle at DSAC with *L. pomona* bacterin was instituted.

Since annual vaccination of all cattle, the reactor rate was 5 percent in 1965 and 1966, 0.5 percent in 1967 and 3 percent in 1968.

The annual serologic titers of ten cows ranging from 5 to 12 years of age, pastured together in the summer of 1968, are presented in Table 2. Cow 3348 was first vaccinated in 1956, cow 4024 in 1958. Cow 3348 remained serologically negative until 1968. Cow 4024 had a titer of 1:100 in 1960 but was negative other years until 1968. The persistence of antibody titer several years after active infection was illustrated by cows 4298 and 3687. The presence of titers of 1:100 in 1968 in the seven vaccinated cows pastured together indicated a natural challenge to *L. pomona* during 1968. The persistent low titer in the serum of cow 4916 suggested the possibility that the animal might have been a renal shedder of *L. pomona*.

Another source of the natural challenge may have been *L. pomona* infected wildlife since Andrew and Ferris[2] repeatedly isolated *L. pomona* from skunks in the same area in 1962 and 1963 and the annual tests of deer killed in the Dixon Springs area indicated an endemic infection in deer.[1]

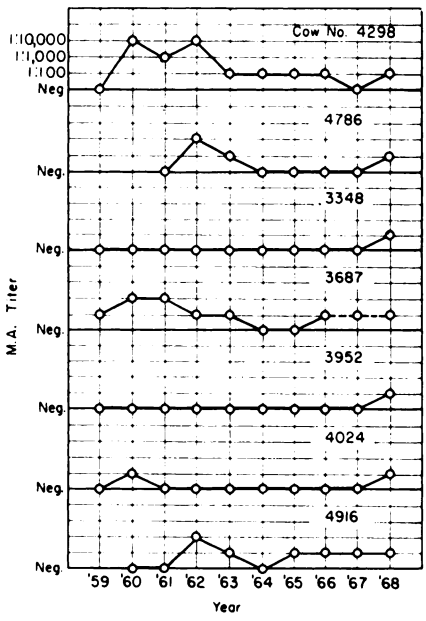


Table 2. Serologic Response of Vaccinated Cows to a Natural Challenge with L. pomona in 1968.

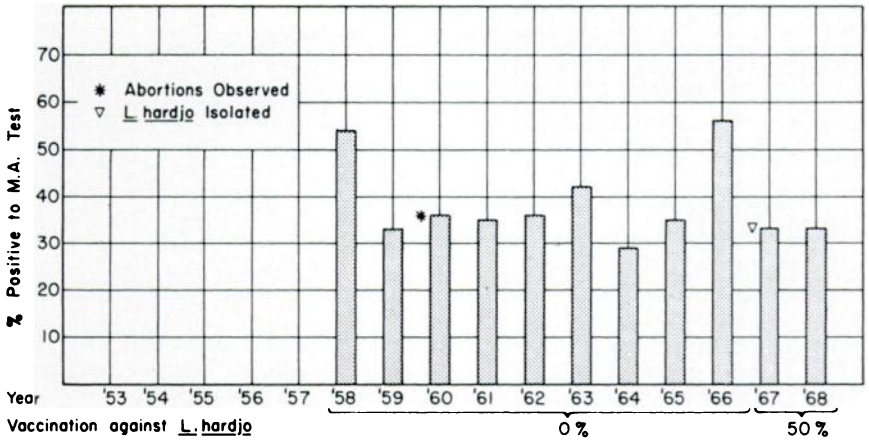


Table 3. Annual Reactor Rates to L. hardjo and Vaccination History of Cattle in Dixon Springs Agricultural Center Herd.

The percentage of cattle reacting positively each year from 1958 to 1968 in the microscopic agglutination test with *L. hardjo* cultures is presented in Table 3. The highest reactor rates were 54 percent, 42 percent and 56 percent in 1958, 1963 and 1966, respectively. The reactor rates for other years varied from 29 percent to 36 percent. The reactor rate in 1967 and 1968, when half of the herd was vaccinated with experimental *L. hardjo* bacterin, was 33 percent.

## Discussion

Annual serologic examination by the MA test of sera from cattle at DSAC and deer in adjacent areas of Pope County provide an index of the rate of infection with *L. pomona* and *L. hardjo*. The *L. pomona* outbreak in 1955 produced a reactor rate of 58 percent and clinical signs of abortion. Reactor cattle continue to be positive for several years and were apparently resistant to clinical disease. With annual calf replacements in the herd the number of *L. pomona* susceptible animals increased yearly resulting in new cycles of leptospiral infections. The cycles were not stopped by vaccination of half of the herd, but appear to have been suppressed by vaccination of all of the animals. The increase of reactors from 0.5 percent in 1967 to 3 percent in 1968 indicates that a nidus of *L. pomona* infection exists at DSAC. The low titers of 1:100 suggest a typical antibody response in vaccinated cattle to exposure to a leptospiral infection.[3]

The data of Andrews[1] on the *L. pomona* reactor rates in the deer suggest parallels with the reactor rate in unvaccinated cattle, but at a lower rate. The wide dispersal of deer may account for the lower reactor rate. The data in cattle suggest a nidus of infection with spread within the small herd group rather than widely disseminated infection among the several herd groups at DSAC.

At present, experimental *L. hardjo* bacterin is being evaluated in half of the cattle at DSAC. It is anticipated, the reactor rate to *L. hardjo* will be considerably reduced when the reacting animals lose their titers and resistance due vaccinations prevents new infections.

**Acknowledgements**

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