

B R U C E L L O S I S

(Undulant Fever)

Brucellosis Vaccination

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Prepared by

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It is not the purpose of this paper to impart a full understanding of the theory of immunity, and its application to all phases of brucellosis control. It is the hope, however, that this presentation of essential facts is done with sufficient clarity to enable the reader interested to approach the problem of Brucellosis vaccination without prejudice and to understand the dangers, limitations, and value of the practice. It is certain that before one can evaluate Brucella vaccination of cattle that these basic facts be understood.

Some of the terms used in this paper are hereby defined:

1. Brucellosis - Infected with bacteria of the Brucella genus. (In cattle Bang's disease or contagious abortion.)
2. Resistant - The ability to resist infection.
3. Immunity - A state of resistance resulting from recovery from disease, or resulting from the injection of vaccine.
4. Agglutinins - Substances in the blood capable of clumping (agglutinating) bacteria. (Agglutinins are formed as the result of infection, exposure or the injection of vaccine.)
5. Agglutination titer - Amount of agglutinins present in the blood. (This is the basis of the agglutination test.)

Data which have accumulated during the last 50 years have established the fact that it is possible for cattle to often acquire immunity to Brucella infection (1). This does not mean, however, that it is possible to establish in cattle a lifelong immunity at will, or without danger of permanent infection. In this manner Brucellosis differs from several diseases for which it is possible to easily and safely establish a solid and lasting immunity. Without an appreciation of this difference the limitations of the effective use of Brucella vaccine are apt to be overlooked.

* The numbers in parenthesis refer to the references listed on page 5.

It has been known for many years that calves are capable of resisting infection and that it is possible to raise Brucella-free animals from infected dams. It is also known that the calf does not acquire resistance to infection as the result of ingesting Brucella (1). Calves from non-infected dams, and not receiving milk from infected cows, appear to be just as resistant to infection up to a certain age as those from infected dams (1). This resistance to infection usually disappears at the time of pregnancy. It is thought that this is why first pregnancy so frequently marks the beginning of a Brucellosis or "abortion storm."

A small percentage of calves do not have this natural resistance, but may become infected early in life and may remain infected to maturity (1).

It has been repeatedly demonstrated that a considerable percentage of nonpregnant mature heifers and cows also possess a high degree of resistance (1), but if exposed to massive doses of Brucella develop a high agglutination titer (1). This agglutination titer may rapidly decline (1, 3, 4). If such animals are exposed to infection after becoming pregnant, they may resist infection as a result of some immunity acquired from the previous exposure (1).

It has been observed in some herds that have been infected for years, and to which there have been no outside replacements, that the incidence of disease decreases. It is reasonable to assume that many of the cows had developed immunity as the result of exposure (1).

It should be understood that there is a difference between exposure and actual infection. Even when some animals are injected with large doses of Brucella they may not become infected.

A small percentage of animals that become infected naturally, later become non-reactors (1). This percentage is so small, however, that in an eradication program it is practical to disregard that factor.

It is impossible with our present knowledge to determine immunity in cattle except by determining their resistance to natural or artificial infection (1).

Vaccines have been used in an attempt to take advantage of the immunity developed as the result of artificial exposure.

For many years prior to the advent of USBAI Brucella strain 19, other Brucella vaccines were on the market and were extensively used in some sections of the country. Relatively little of these vaccines was used in Oregon, however, since early experiments (1919) at the Experiment Station had demonstrated the effectiveness of sanitary measures, including testing and segregation or elimination of reacting animals as a basis of control.

While the early vaccines proved of value in producing some degree of immunity in a considerable percentage of animals and diminished the incidence of actual abortion, evidence accumulated that their use served to promote the spread and incidence of the disease and in no manner aided in the elimination of the disease, thus resulting in no permanent good. In other words, too many animals became infected instead of becoming immune.

When it became clear that these early vaccines were obnoxious, license for their manufacture and sale was discontinued by the B.A.I. Meanwhile investigators started searching for strains of Brucella which were capable of inciting immunity and still sufficiently nonpathogenic as not to produce the typical disease. Different strains were selected by several investigators for experimental use. In one instance a strain incapable of producing agglutinins was used in trials covering a period of several years and involving several thousand animals (1). This strain was discarded because it failed to produce sufficient immunity (1). It can be readily seen that such a strain, if it induced sufficient immunity, could be used in conjunction with the test and control program. From the many strains investigated

by the B.A.I., strain 19 was finally selected (1925) because it appeared, to investigators involved, to be capable of inciting a considerable degree of immunity but was less capable of producing disease than most field strains. Strain 19 vaccines were licensed for manufacture and sale in 1932.

Strain 19 has now been under investigation for twenty years, during which period some of its characteristics have been reported upon by several workers. These reports would appear to justify the following conclusions:

1. "—when it is used on calves between the ages of 4 to 8 months, a high degree of active immunity is produced against natural brucellosis infection during the first pregnancy, that active immunity remains even during the second and third pregnancy, that the organism contained in the vaccine used on calves does not establish itself in the animal body to produce a carrier state, that calves and young heifers show an agglutination titer for only a few months after vaccination." (1)
2. The immunity produced lessens in degree in a considerable percentage of animals with increasing age (4, 3). In one experimental herd of 35 calves 22 or 60% became reactors before the end of the third gestation, when exposed to natural infections (1). None of these animals aborted (1).
3. It produces a permanent reaction in a small percentage of calves (5).
4. When used in pregnant cows it is capable of producing typical brucellosis with abortion (3) and the discharge of organisms in a high percentage of animals (6).
5. It is capable of producing permanent infection in cattle when taken in by way of the digestive tract (7).
6. When used in nonpregnant mature cows it will lessen the percentage of abortions in some herds if these animals are subsequently exposed to infection (1, 3).
7. When injected into mature cows it produces a reaction of long duration, thus nullifying future blood testing of these animals (7,8). Approximately 50 percent will remain positive to the agglutination test two years after vaccination (8).
8. It is capable of producing typical Brucellosis (undulant fever) in man (9).

It can be readily seen that strain 19 is far from being a perfect vaccine and that only the optimistic or uninformed can look for a high degree of efficiency in its use, except when used under the most carefully selected and supervised circumstances. It must be remembered, however, that it has

never been advocated by the B.A.I. as anything but an aid in the eradication of the disease, and then only under such circumstances where the partial and temporary immunity resulting from its use might be instrumental in reducing infection in badly infected herds. The recommendation of the Bureau of Animal Industry should not be confused with representations of the manufacturers of vaccines.

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