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**Disertación del Prof. Fred Enright  
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Baton Rouge - LA - USA  
-Invitado-**

**Practical approaches for the control  
and eradication of bovine brucellosis**

**Conceptos prácticos para el control y  
erradicación de la Brucelosis bovina**



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### **Artículo N° 17 del Estatuto de la Academia**

«La Academia no se solidariza con las ideas vertidas por sus miembros en los actos que ésta realice salvo pronunciamiento expreso al respecto que cuente con el voto unánime de los académicos presentes en la sesión respectiva.»

**Disertación del Dr. Fred Enright DVM, Ph.D. Profesor and Head of Veterinary Science, Louisiana State University, Baton Rouge, USA.**

**Practical Approaches for the Control and Eradication of Bovine Brucellosis. \***

**Mr. President,  
Colleagues.**

**Ladies and Gentlemen:**

I am honored and pleased to be received by the Academia Nacional de Agronomía y Veterinaria of Argentina. For this honor, I extend my sincere thanks.

**Outline:**

\* A short history of the Brucellosis problems in the coastal marshes of south-west Louisiana.

\* A summary of results of the field studies on the control of brucellosis in the marsh herds.

\* The U.S. Brucellosis Program in the mid 1970s: A program in turmoil.

\* Questions for Argentina's animal health officials, beef and dairy producers and veterinarians.

\* Scientific factors and a disease control program: prevalence, reservoirs and transmission. A very long incubation period makes the control of brucellosis difficult.

\* Which cows are susceptible? Which are resistant?.

\* Surveillance: who looks, where do you look, and how will you look for the disease?

\* A practical plan for brucellosis control.

**Brucellosis and the marsh herds:**

Beef production represents the primary agricultural activity of the people living in the sparsely populated marsh lands of southwestern Louisiana. Vast areas of both fresh and salt water marshes are used to over winter Brahman cross cattle. In the spring of each year the cattle are gathered from the marshes with horsemen, dogs, and helicopters. They are then driven to higher (better drained) pastures, where they are counted, identified, vaccinated, and treated for parasites. This process is repeated about 6 months later when the cattle are driven back to the marshes. Calves ready for market and culled cows are either sold in the spring or in the fall of the year. Replacement heifers are generated from within the herd or they may be purchased from a neighboring herd. Non-indigenous

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cattle, particularly those with less than 50% Brahman blood, perform poorly in the marsh environment. When not engaged in working their cattle, the producers earn their incomes in the oil and natural gas business (drilling, processing, and off-shore supply) or by seasonal trapping, alligator hunting, guiding waterfowl hunters and by leasing land to waterfowl hunters.

Over 560 inhabitants in this coastal area and virtually all of their cattle were killed by the storm surge of Hurricane Audrey in June of 1957. Following this tragedy the survivors began the tasks of rebuilding their homes, communities and cattle herds. Large numbers of sexually mature cattle were purchased from Brucella infected herds throughout the state and from neighboring states. By 1968 limited area testing indicated that a large number (over 50%) of the marsh herds were infected with brucellosis. At this time, very little was being done to control brucellosis in these herds. Only a few of the producers were vaccinating their calves with Strain 19 vaccine. Enough testing and slaughter of reactor cows was done to convince the herd owners that this method was not eliminating brucellosis from their herds. They were very sure, however, that testing and slaughter was taking cows from their herds which could not be easily replaced. Their standard joke about the brucellosis program was that it was going to eliminate the "bangs" from southwest Louisiana by eliminating all of the cows.

Ten years later, the situation was even worse. Estimates placed the number of brucellosis infected herds at greater than 60%. Producers were fearful that cattle from Louisiana would be banned from all markets other than for immediate slaughter. Producers

whose income depended on the sale of calves for finishing operations in the midwest and west stood to lose millions of dollars.

I was asked to work with State and Federal health officials to develop a plan which would control brucellosis and meet with the approval of the state's cattle producers. At this time Dr. Paul Nicoletti had published the results of a study which used a reduced dose of Strain 19 vaccine in adult cattle in several brucellosis infected Florida dairies. Dr. Nicoletti thought that adult vaccination reduced transmission of brucellosis in these herds by as much as 90%. Our brucellosis control task force felt that adult vaccination with strain-19 vaccine would also work as well in Louisiana's infected herds. Members of the task force began by holding educational meetings on brucellosis throughout the State. Usually the first meeting with cattle producers was devoted to listening to their concerns about this disease, the National Program and their fears of going out of business. At a second and sometime third meeting we were able to explain important aspects of the disease to the producers and present a plan to control transmission of the disease and to eventually eliminate the disease from their herds. Because the disease prevalence was highest in the marsh herds, it was determined that we would initiate our plan in those herds. Herd owners in the marsh felt that the National Program depended too much on rules and regulations. The program lacked flexibility. It was geared to brucellosis control in single owner herds under intensive management: People charged with enforcement and interpretation of the regulations did not understand cow/calf production as carried out in the marsh herds. One "herd"

could number over 2,000 animals have 10 owners share 20,000 acres of marsh and 2,000 to 3,000 acres of summer pasture. In many instances the owners only saw their cattle twice in a year. The owners could not retest their cattle while in the marsh for 6 months and frequent retesting during the hot and humid summer months was a hardship on both cattle and their owners. As mentioned earlier, heifers were not available to replace productive brucellosis reactors taken from their herds. The cattle producers were most frustrated because USDA program officials would not even listen to their concerns.

We were eventually able to identify 10 herd owners willing to allow their herd to be used for demonstration herds for the new brucellosis control plan. These owners agreed to keep their fellow producers aware of what we were doing and what progress we were making. If we were successful, these 10 producers would work to have all of the producers in the two marsh parishes pass a referendum to use our plan to eliminate brucellosis from all of their herds.

When we began the plan in 1980, 60% of the marsh herds were under quarantine for brucellosis. In these herds, the average prevalence of infection was 8%. By the end of 1982, area testing in the marsh herds was 90% completed and 95% of the herds were adult vaccinated. These two parishes were among the first in the state to be free of brucellosis.

#### **A summary of the field studies to control brucellosis in the marsh herds.**

Our plan had two parts. In Plan A herds all of the original reactor (OR) cattle (positive on the card test)

were immediately slaughtered and the whole herd (all adult cows and all female calves) were subcutaneously vaccinated with Strain-19 vaccine. The adult cattle were given a reduced dose of the vaccine ( $3.0 \times 10^9$  cfu); the calves were given the standard calf dose ( $1.5 \times 10^{10}$  cfu). The cattle were retested when possible (at least once per year, usually twice per year) and any new reactors (NR) identified were immediately sent to slaughter. Disease transmission was based on attack rates (new reactors within the interval between tests). Following adult vaccination with strain 19 reactor status was based on a positive rivanol precipitation test (1:50 or above) or on a positive complement fixation test (1:41 or above).

In the other plan, the Plan B herds, the cattle were treated the same, except that original reactors and any new reactors identified following vaccination were allowed to remain in the herds as long as they remained in good condition and produced a calf.

In Table 1, a summary of Plan A herd 2 can be seen. You will note that 13 reactors of 226 cattle were originally detected and removed from the herd and that the number new reactors declined over the next 23 months.

Now, please examine the summary of Plan B herd 2 in Table 2. Of 82 cattle initially tested 35 original reactors were found. Most of these cattle remained in the herd over the next two years. In the first 6 month interval following vaccination, 2 new reactors were identified and none were detected over the next 18 months.

Table 3, is a summary of all Plan A and Plan B herds. The attack rates of 4.8% in the Plan A herds is not significantly different from the attack rate of 3.6% in the Plan B herds.

As noted earlier, this simple

demonstration of brucellosis control convinced the herd owners to actively begin a program to first control and then eliminate brucellosis from their herds.

### **The U.S. Brucellosis Program in mid-1970s. A program in turmoil.**

A program or policy which does not have the confidence of those it is supposed to benefit will fail... What went wrong? On paper the National Brucellosis Program was scientifically sound, yet, by the mid 1970's cattle producers through their state and national organizations and with the added pressure of their state's congressional delegation forced the USDA to completely review the National Brucellosis Program while a National Academy of Science panel reviewed the current scientific knowledge related to brucellosis pathogenesis, immunology, and epidemiology. The scientific review identified areas where additional information was necessary but determined that enough was known to control and eliminate the disease from U.S. cattle herds. The brucellosis program review determined that the existing program needed added flexibility, that individual herd plans developed by a trained epidemiologist working with the herd owner were more effective than lock step testing and slaughter. The program review also clearly indicated that producer education was necessary, if the program was to be accepted by cattlemen.

USDA animal health officials made mistakes in using the national prevalence rates for the disease to determine that Strain-19 vaccination should be less stressed as a tool to help control the disease. They listened to brucellosis free States and ignored the still infected southeastern States.

When faced with the realization that brucellosis was actually increasing in southern herds they were reluctant to change their reliance on test and slaughter which had worked in the Midwestern and northeastern states. Unlike the Midwestern and northeastern herds, the southern herds were larger and less intensively managed. In the end, a scientifically sound but flexible control and eradication program was developed. As of last month, there were 5 infected herds in the U.S. It has taken the U.S. over 60 years to get to this point. Argentina has a great advantage as it initiates its brucellosis program. It does not have to repeat the mistakes of others. Brucellosis is a difficult disease to control in the best of circumstances, a flawed program guarantees unnecessary delays and even failure.

### **Questions for Argentina:**

Are beef and dairy producers, animal health regulatory officials, scientists, and veterinarians ready to cooperate to control and eliminate this disease? The tools necessary to do this job are here. It will be expensive and lengthy but with cooperation it will work. Producers, citizens, and elected officials must be educated. They must be aware of the public health issues and economic benefits of brucellosis eradication.

### **Scientific factors and a disease control program: prevalence, reservoirs and transmission:**

In order to control a disease one must know: where the infection exists; what are the reservoirs of infection; and how does the infected animal pass the disease on to other animals.

As pointed out above knowing the overall prevalence of brucellosis for Argentina can be misleading. Herds in some regions of the country are going to be more likely to be infected than herds elsewhere. These problem areas must be identified and control efforts in these areas must be aggressively pursued. While other domestic animals and even wildlife can become infected with brucellosis, they play little role in transmission of the disease to other cattle.

Finding the infected cow is then the most important factor in stopping the disease. Finally, transmission of the disease must be understood in order to limit its spread. We must immediately concentrate our efforts to limit the contact of pregnant infected or exposed cows with pregnant susceptible cattle. As an example, the transmission of brucellosis in many California dairies was stopped by the use of maternity pens. In many beef operations it is possible to separate cows ready to calve from the rest of the herd. Some even go so far as to separate first calf heifers from other mature pregnant cattle. Why worry about first calf heifers? In many chronically infected herds the first calf heifers represent the animal which will most often abort a brucella infected fetus or calf. The key is to remember that this disease is invariably spread at the time of abortion or birth. We must also remember that between 5% to 20% of all first calf heifers born to brucellosis positive cows may have been congenitally infected. This means that the incubation period for the disease may be as long as two to three years in these heifers.

#### **Which cows are susceptible? Which are resistant?**

In order for a disease to be

transmitted, a susceptible animal must be exposed to sufficient numbers of the agent to establish a new infection. The genetics of the host's innate and acquired immune responses will determine if an individual cow is likely to become infected after exposure to Bruceella abortus. Approximately 18% to 20% of the general population of cattle are resistant to infection. This resistance is determined by only one or two genes and the trait is inherited in a simple dominant pattern. On the other hand, an equal number of cows are very susceptible to the infection. We must attempt to induce acquired immunity to brucellosis in the remaining 60% of the cattle population. To do this we depend on vaccines. Currently, there are two attenuated live vaccines, Strain 19 vaccine and Strain RB-51 vaccine, which can accomplish this task. Each vaccine has advantages and disadvantages. Strain 19 may give a longer duration of protection than RB51, while RB51 is safer for use in adults or pregnant cows and it will not cause vaccinated cattle to develop positive diagnostic serology as strain-19 will often do. Vaccination plays an important role in slowing down the transmission of brucellosis in an infected herd. It, however, is very important to remember that vaccination alone will not eradicate brucellosis. Ultimately, infected cattle must be removed from the herd to accomplish the goal of eradication.

#### **Surveillance: who looks, where do they look, and what methods will be used to look for the disease.**

Continuous and broad based surveillance is necessary to first locate the disease and second to monitor the movement of disease from one herd to

another. Owners or herd managers who report abortions to their veterinarian or to diagnostic laboratories represent a direct form of surveillance. Likewise, a veterinarian may report an abortion or seek a diagnostic work-up on an abortion case which may be due to brucellosis. Indirect surveillance may take the form of serodiagnosis of the disease from cattle at markets or at slaughter facilities, or from scheduled herd tests, or milk tests. Both forms of surveillance are important because each is dependent on sample collection from the widest variety of livestock production activities. We have learned some valuable lessons in surveillance for brucellosis in the U.S. The first lesson is if you don't look for the disease you will not find it. During the late 1960, and early 1970s the USDA was not finding brucellosis in southern herds because they were not looking for it.

In the U.S., for instance, if a producer only sells calves his infected herd could go undetected for years because we were only looking for reactor cows at sale barns or at slaughter facilities. In this case, a producers concern over abortions within his herd may represent the only way to know that his herd is infected. Another very important lesson learned is that a producer whose herd was once infected with brucellosis is much more likely to have his herd reinfected, than the herd of a producer whose herd has never been infected. The rule is that one looks for brucellosis where it has existed in the past. Any number of serological tests are adequate to detect infections. In many countries livestock abortions must be reported by the herd owner and by the veterinarian working with that herd.

### **The features of a practical and effective brucellosis control program.**

Shortly after my arrival in Argentina, Dr. Bernardo Carrillo asked me what I would need to control and eliminate bovine brucellosis from a country. My answer was quick. I would need: 1) several good diagnostic tests; 2) a safe and effective vaccine; and 3) the complete cooperation of educated producers, a trained epidemiologist and veterinary practitioners. All three of these requirements exist now in Argentina. Before I end this presentation, I would like to list some specific components of a brucellosis control and eradication plan and the final conclusions.

A sound program should have:

1. Education-directed to producers and veterinarians; it should deal with the biology of the disease, risk-factors, control, diagnostics, and vaccination.
2. Quarantine; The intervals of quarantine should be based on the biology of the bacteria and the host. In some case the period can be relatively short (i.e.: 120 days) or it may be very long (it may require that all exposed animals successfully complete a gestation prior to the quarantine being lifted).
3. Test and slaughter; Must be used when it will be most effective without destroying the production potential of a herd. It works best in smaller herds which are managed intensely. Test and slaughter will seldom work in a large herd without a vaccination program.



4. Depopulation; Very effective in the last stages of an eradication program (however it requires funding).

5. Owner compensation; Needs adequate funding, it increases the cooperation of producers.

6. Vaccination; Both calf hood and whole herd (adult vaccination) is very effective in slowing transmission of the disease within the herd and the transmission between herds. It alone will not eliminate the disease.

7. Herd management plans; Workable plans developed by the owner and a trained epidemiologist.

8. Flexibility; The program should be adaptable to management methods.

9. Rules and regulations; The application of the rules and regulations must be scientifically sound.

I have presented what I think is important in a brucellosis control and eradication program. My advice is to learn from both the failures and successes of others. Do not repeat the

mistakes and modify successful approaches to meet your own special requirements.

#### **As a final conclusions we can say:**

1. Adult vaccination and a flexible schedule for retesting herds were successful in eliminating brucellosis from heavily infected marsh herds in southwest Louisiana.

2. A control and eradication program for brucellosis must be based on sound science and must be supported by livestock producers, veterinarians, and animal health officials. Without their support and cooperation the best of control programs will fail.

3. Argentina's brucellosis control program has the advantage of new diagnostic methods and a new vaccine which does not interfere with diagnostic test. The program in Argentina should adopt and modify the successful components of programs in countries which have eliminated the disease and take care not to repeat the mistakes made by other countries in eliminating this disease.

Once again I would like to thank you all for your attention.

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**Table 1. Summary of Brucellosis Tests on Herd 2 of the Plan A Program**

Date	Cows Tested	Negative	OR*	NR** (12)	NR (3)	NR (8)	Initial Prevalence (percent)	Attack Rate (percent)
07/80	226	213	13	--	--	--	4.0	--
07/81	220	202	--	18	--	--	--	8.1
10/81	207	204	--	--	3	--	--	1.4
06/82	205	204	--	--	--	1	--	0.5

\* OR = original reactors.  
 \*\* NR = new reactors (test intervals in months.)

**Table 2. Summary of Brucellosis Tests on Herd 2 of the Plan B Program**

Date	Cows Tested	Negative	OR*	NR <sub>1</sub> **	NR <sub>2</sub>	NR <sub>3</sub>	NR <sub>4</sub>	Prevalence (percent)	Attack Rate 6 month (percent)
11/80	82	47	35	--	--	--	--	42.6	--
05/81	79	45	32	2	--	--	--	43.0	4.3
11/81	89	57	30	2	0	--	--	36.0	0.0
05/82	86	55	29	2	0	0	--	36.0	0.0
11/82	77	48	28	1	0	0	0	37.6	0.0

\* OR = original reactors.  
 \*\* NR = new reactors (subscript denotes successive 6 month intervals).

**Table 3. Summary of Brucellosis Tests on Plan A and Plan B Herds**

	Number of Cattle	OR*	NR**	Prevalence (percent)	Attack Rate 1 1/2 to 2 yrs (percent)
5 Plan A Herds	1,986	107	91	5.4	4.8 <sup>§</sup>
4 Plan B Herds	942	129	29	13.7	3.6 <sup>†</sup>

\* OR = original reactors.  
 \*\* NR = new reactors.  
<sup>§</sup> Attack rate for a 17 to 29 month interval.  
<sup>†</sup> Attack rate for a 24 month interval.



Marshes in the State of Louisiana



A sight of the Louisiana marshes



A sight of the Louisiana marshes



Animals in the marshes seen from the road



Healthy bovine without brucellosis