Summary of Studies Supporting USDA Product Licensure

Establishment Name	Zoetis Inc.
USDA Vet Biologics Establishment Number	190
Product Code	1750.00
True Name	Mycoplasma Bovis Vaccine, Avirulent Live Culture
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Not Listed - No distributor specified
Date of Compilation Summary	January 27, 2022

Disclaimer: Do not use the following studies to compare one product to another. Slight differences in study design and execution can render the comparisons meaningless.

<table>
<tr><td>Study Type</td><td>Efficacy</td></tr>
<tr><td>Pertaining to</td><td>Mycoplasma bovis</td></tr>
<tr><td>Study Purpose</td><td>Demonstrate efficacy against Mycoplasma bovis</td></tr>
<tr><td>Product Administration</td><td>Two doses administered subcutaneously 21 days apart</td></tr>
<tr><td>Study Animals</td><td>39 vaccinates (vaccinated group), 39 challenged controls (control group), and 5 non-challenged controls. Holstein/Holstein cross, 7 to 12-day-old calves, seronegative to Mycoplasma bovis (ELISA antibody titers <0.2).</td></tr>
<tr><td>Challenge Description</td><td>Mycoplasma bovis Kansas strain 110LA-5544 p4</td></tr>
<tr><td>Interval observed after challenge</td><td>Animals were observed daily following challenge for 28 days, lungs were examined at 28 days post-challenge.</td></tr>
<tr><td>Results</td><td>Five Number Summary of Percent of Total Lung with Lesions
<table>
<tr><th>Treatment</th><th>Total No.</th><th>Minimum</th><th>1st Quartile</th><th>Median</th><th>3rd Quartile</th><th>Maximum</th></tr>
<tr><td>Control Group</td><td>39</td><td>0.1</td><td>9.1</td><td>16.5</td><td>31.5</td><td>71.2</td></tr>
<tr><td>Vaccinated Group</td><td>39</td><td>0.0</td><td>0.8</td><td>4.3</td><td>10.2</td><td>39.5</td></tr>
</table>
Attached are raw data for percent of lung with lesion for individual animals.</td></tr>
<tr><td>USDA Approval Date</td><td>02/28/2019</td></tr>
</table>

Percent of Total Lung with Lesions per Animal								
Group	**ID**	**Percent of Lung with Lesions**	**Group**	**ID**	**Percent of Lung with Lesions**	**Group**	**ID**	**Percent of Lung with Lesion**
Control Group	5808	43	Vaccinated Group	5807	0	Non-Challenged Group	5810	1
	5815	14		5809	0		5811	0.76
	5816	4		5813	39		5876	0
	5817	19		5814	3		5900	0
	5818	19		5819	10		5916	0.21
	5820	20		5821	20			
	5823	13		5822	13			
	5828	35		5825	17			
	5834	16		5826	2			
	3835	11		5829	6			
	3836	9		5830	10			
	5837	32		5832	1			
	5839	7		5833	13			
	5843	7		5840	15			
	5846	12		5841	3			
	5848	33		8544	2			
	5850	9		5845	0			
	5851	0		5847	23			
	5854	2		5852	0			
	5878	29		5855	5			
	5879	14		5875	0			
	5880	11		5877	7			
	5881	42		5882	2			
	5883	71		5884	4			
	5885	25		5886	8			
	5887	17		5889	22			
	5888	5		5890	0			
	5891	25		5892	5			
	5893	5		5895	1			
	5894	21		5897	7			
	5896	20		5901	1			
	5898	48		5902	0			
	5903	31		5904	10			
	5905	56		5907	5			
	5908	6		5909	34			
	5912	48		5911	2			
	5913	3		5915	0			
	5919	12		5921	1			
	5925	40		5922	0			

Study Type	Safety
Pertaining to	*Mycoplasma bovis*
Study Purpose	To demonstrate safety under field conditions in calves.
Product Administration	Two doses administered subcutaneously (SC) 21 days apart.
Study Animals	A total of 1069 calves were enrolled at three distinct geographical locations. The locations and herds enrolled in the study represented a range of calf types (dairy and beef calves of varying sources, including those raised in high population densities, high stress situations and intensive calf raising facilities). The animals were distributed as follows: Controls, n =355, Vaccinated, n = 714. Calves were 8 days old of age or younger and defined as "young" or approximately 30 days and identified as "old".
Challenge Description	N/A
Interval observed after last treatment	Health observations were performed for all calves within 4 hours post-vaccination and daily until 35 days after the second vaccination. Visual assessment of injection site reactions was completed on days 7, 14 21 (first vaccination site) and on days 28, 35 and 42 (second vaccination site).
Results	Only antimicrobials that had no activity against *M. bovis* were allowed.

Number of Animals		**Animals with no AE* (%)**	**Animals with AE* (%)**
Enrolled	1069		
Controls	355	264 (74.4%)	91 (25.6%)
Vaccinated	714	551 (77.2%)	163 (22.8%)

*AE= Adverse Events

Injection Site Reactions
No injection site reactions were observed in the vaccinated animals.

All Adverse Events by Age				
Group	**Age Group[0]**	**Total Animals**	**Total Animals Affected**	**Percent of Animals Affected**
Control	**Young**	**177**	**84**	**47.5**
Control	**Old**	**178**	**7**	**3.9**
Vaccinated	**Young**	**359**	**149**	**41.5**
Vaccinated	**Old**	**355**	**14**	**3.9**

[0] Young animals were 8 days of age or younger, Old animals were approximately 30 days of age.

Number of Adverse Event Observations					
VEDDRA Term[1]	**Control Young[0]**	**Control Old[0]**	**Vaccinates Young[0]**	**Vaccinates Old[0]**	**Total**
Diarrhea	**37**	**2**	**71**	**1**	**111**
Pneumonia	**37**	**0**	**65**	**0**	**102**
Tachypnoea	**10**	**0**	**24**	**0**	**34**
Otitis media	**3**	**0**	**9**	**0**	**12**
Rhinitis	**6**	**0**	**5**	**0**	**11**
Dyspnea	**0**	**1**	**5**	**0**	**6**
Death	**0**	**2**	**0**	**3**	**5**
Lethargy	**1**	**1**	**0**	**3**	**5**
Respiratory tract disorder NOS[2]	**0**	**0**	**0**	**5**	**5**
Cough	**1**	**1**	**1**	**0**	**3**
Lameness	**0**	**1**	**2**	**0**	**3**
Distension of abdomen	**1**	**0**	**1**	**0**	**2**
Joint pain NOS[2]	**1**	**0**	**0**	**1**	**2**
Omphalitis	**1**	**0**	**1**	**0**	**2**
Ataxia	**0**	**1**	**0**	**0**	**1**
Eye disorder NOS[2]	**0**	**0**	**1**	**0**	**1**
Eye redness	**0**	**0**	**1**	**0**	**1**
Kerato-conjunctivitis	**0**	**0**	**0**	**1**	**1**
Muscle pain	**0**	**0**	**1**	**0**	**1**
Otitis interna	**0**	**0**	**1**	**0**	**1**
Otitis NOS[2]	**0**	**0**	**1**	**0**	**1**

[0] Young animals were 8 days of age or younger, Old animals were approximately 30 days of age.

[1] Multiple instances of an AE per VEDDRA term in the same animal were only counted once in the summary and an animal may have had more than one AE.

[2] NOS = Not otherwise specified.

One out of 714 (0.14%) vaccinated calves developed arthritis in which the vaccine strain was isolated from the affected joint.

USDA Approval Date	03/13/2020