

# Different Cattle Production Practices Between Different Countries

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## **Approved veterinary biologics for the use in the prevention, diagnosis, and cure of cattle diseases.**

### **United States:**

There are many approved veterinary biologics that can be used for prevention, diagnosis, and cure of cattle diseases. Out of around 300 cattle vaccines, the top 10 vaccines most farmers and ranchers use are 7-way, tetanus, Bovine Viral Diarrhea (BVD), Bovine Respiratory Syncytial Virus (BRSV), Infectious Bovine Rhinotracheitis (IBR), Leptospirosis, Vibriosis, Brucellosis, Trichomoniasis, and Cattlemaster (which is a combination of IBR, BVD, PI3, and BRVS). It is generally recommended that heifers be vaccinated with 7-way, Cattlemaster, and bangs vaccination. Similarly, it is generally recommended that cow/calf operations administer Trich, Lepto 5-way, Vibrio, and Cattlemaster".<sup>1</sup>

### **Mexico:**

The cattle industry in Mexico continues to be plagued with diseases that have been largely controlled in the United States. Researchers have found that while Mexico has supported a federal Bovine Tuberculosis (TB) program since 1971, bovine TB remains the primary disease that limits Mexico's access to export markets for cattle. There is little publicly available information about what steps Mexico is taking to prevent the spread of this disease, which is a concern because the United States borders Mexico and is importing both beef and cattle from Mexico. Researchers report that "Brucellosis is currently endemic and widespread in Mexican cattle. Since the disease often goes undetected or undiagnosed, the disease's impacts are often underestimated. Brucellosis is also a zoonotic disease, threatening humans, primarily through consumption of unpasteurized milk and dairy products."<sup>2</sup> This is a major concern for humans in Mexico and the United States, by consuming either meat or dairy products.

### **Canada:**

Canada's vaccines are very similar to the vaccines that the United States makes available for the beef cattle industry. Some of the live vaccines available in Canada are: Inforce 3, Vision 8/ Somnugen, Bovishield Gold FP5, and Bovishield Gold /OneShot. Killed vaccines that Canada uses are: Ultrachoice 8 and CattleMaster 5."<sup>3</sup> These vaccines are mostly the same vaccines that the United States uses. Some just have a different name and are produced by a different company.

### **Argentina:**

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<sup>1</sup> "Veterinary Questions." Personal interview. 5 July 2016.

<sup>2</sup> Peel, Derrell. "Cow-Calf Beef Production in Mexico." *United States Department of Agriculture*. N.p., n.d. Web. 18 July 2016.

<sup>3</sup> "Vaccination Protocols." *Alberta Veterinary Center / Vaccination Protocols*. N.p., n.d. Web. 18 July 2016.

There is little publicly-available information on vaccines in use in Argentina. . The top 3 diseases impacting Argentina are Actinosis, Bovine Respiratory Disease (BRD), and Neonatal Calf Diarrhea (NCD).<sup>4</sup>

### **Australia:**

Among the diseases affecting cattle in Australia are Clostridial diseases, which consist of the diseases known as blackleg, black disease, malignant edema, tetanus, pulpy kidney and botulism. These diseases require an effective prevention strategy because treatment is generally not viable. Vaccines used to prevent these diseases in Australia include 5 in 1 vaccines. Clostridial 5 in 1 vaccines registered for use include: Ultravac® 5in1 (Zoetis Animal Health), Websters® LV 5 in 1 (Virbac Australia), Websters® 5 in 1 with Vitamin B12 (Virbac Australia), Tasvax 5 in 1® (Coopers Animal Health).<sup>5</sup> These vaccines help Australian farmers and ranchers out by treating or preventing more than just one disease.

### **Brazil:**

There is little publicly-available information on any vaccines that Brazil uses to prevent diseases. However, there are couple of disease in Brazil that deserve special attention. They include foot-and-mouth disease (FMD) and Johne's disease. Johne's disease is a chronic enteritis of ruminants caused by *M. paratuberculosis*. The Johne's "bacteria embed's itself in the wall of the lower part of the small intestine known as the ileum. As an immune response, infected tissues attempt to regenerate healthy tissue which leads to visible thickening of the intestines. This prevents nutrient absorption, resulting in weight loss."<sup>6</sup> The foot-and-mouth disease is a highly contagious disease of cloven-footed animals like cattle, sheep and deer. The U.S. Department of Agriculture's (USDA's) Animal and Plant Health Inspection Service (APHIS) recently announced it is lifting a ban on beef imports from Northern Argentina and 14 of Brazil's 27 states.<sup>7</sup> Not all Brazilian states are FMD free and cattle that are in free FMD states can easily get infected by the foot and mouth disease because there are no effective border regulations, particularly in remote regions of the country. Despite this, the agency concluded that Argentina and Brazil are able to comply with U.S. import certification requirements and APHIS' risk assessments indicate that fresh (chilled or frozen) beef can be safely imported, "provided certain conditions are met to make sure that beef exported to the U.S. will not harbor the FMD virus."<sup>8</sup>

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<sup>4</sup> O., Miranda. "Epidemiology of Cattle Diseases in the Northeast of La Pampa, Argentina." *Scielo*. N.p., 2014. Web. 25 July 2016.

<sup>5</sup> Pretty, Jacinta. "Livestock Factsheet." N.p., Apr. 2013. Web. 18 July 2016.

<sup>6</sup> "Johne's Disease." *The Cattle Site*. N.p., n.d. Web. 18 July 2016.

<sup>7</sup> Desk, News. "Ban Lifted on Beef Imports From Argentina, Brazil | Food Safety News." *Food Safety News*. N.p., 1 July 2015. Web. 18 July 2016.

<sup>8</sup> Desk, News. "Ban Lifted on Beef Imports From Argentina, Brazil | Food Safety News." *Food Safety News*. N.p., 1 July 2015. Web. 18 July 2016.

## Summary:

Between the six countries discussed above, the United States, Canada, and Australia are more advanced in the areas of veterinary biologics. Based on the minimal information available for Brazil, Mexico, and Argentina, these countries appear inadequate in their veterinary biologic system and need to come up with a vaccination program to ensure that beef slaughtered for their own citizens and exported to other countries is safe for consumption.

## Approved growth hormones, growth implants, and feed additives.

### United States:

For over 50 years in the United States farmers and ranchers have been using growth hormones and growth implants. Growth promotants enhance muscle leanness, increase average daily gain, stimulate feed intake, and enhance rate of gain. Around 1960 the cattle production started to increase significantly and around 1970, it was the highest cattle production with about 130 million head. There are around 30 different growth promotants that are available for use in the cattle industry. Some of the growth promotants are Ralgro which is a brand of Zeranol, and MGA (Melengestrol Acetate).

### Mexico:

Zilpaterol and Optaflexx are the two main growth promotants that are used in Mexico. Zilpaterol which is sold under the trade name of Zilmax, is a feed additive for the final stages of cattle finishing that has long been used legally in Mexico. Studies have found that "steers receiving Zilpaterol had a 1.14 pounds a day increase in average daily gain more than the steers not receiving Zilpaterol (4.28 vs. 3.13 pounds a day). In this study, Zilpaterol increased carcass weight by 4.5%, dressing percentage 3.6%, and the longissimus muscle area by 2.7%." Optaflexx has been competing with Zilmax since January 2004, when it became commercially available for farmers and ranchers.<sup>9</sup>

### Canada:

For the most part Canada uses the same growth promotants as the United States. One of these, Ionophores, is a growth promotant that is delivered through cattle feed. While concerns regarding the use of growth promotants exist, supporters argue that they are both necessary and safe. For example, a recent article states, "Ionophores can improve feed efficiency and weight gain, reduce methane production, reduce the incidence of bloat and acidosis, and prevent diseases like coccidiosis." The article goes on to explain that a person would have to eat more than 180 servings of beef per day, or 30 servings of liver per day, from cattle administered beta-agonists in order to get the effect of one "hit" of asthma medication."<sup>10</sup> The authors also state that if Canada quit making this product or any of the growth promotant products, they would need

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<sup>9</sup> "The Basics of Beta Agonists -- Zilmax & Optaflexx." *BEEF Magazine*. N.p., n.d. Web. 01 July 2016.

<sup>10</sup>

10% more cattle, 10% more land, and 10% more feed to produce the same amount of beef as if they were using growth promotants.<sup>11</sup>

### **Argentina:**

While no information about the use of growth hormones, growth implants, and feed additives was found for Argentina, their country's cattle industry is thriving. A recent article states that, "Argentina beef exports in 2016 are forecast at 265,000 tons of carcass weight, the highest since 2011. The calf crop of 2016 is forecast at 14 million head, 300,000 higher than their estimate for 2015."<sup>12</sup> With these numbers, even though it doesn't specifically say that Argentina is using growth promotants, their significant carcass weight increases during the past 5 years suggests that promotants are in use.

### **Australia:**

In Australia, growth implants have been found to grow cattle faster and when provided good feed than non-implanted cattle. A study found that, "Actual improvements in weight gain and feed conversions will depend on many factors, but average daily weight gain can be improved by 10-30%, feed conversion efficiency by 5-15%, and carcass leanness by 5-8%. This can represent an economic advantage of \$25 to \$100 per head over untreated animals."<sup>13</sup> The study states that Australia's beef industry contributed a total of \$210 million dollars to the country's economy.

### **Brazil:**

While no information was found regarding Brazil's use of growth promotants, the country is the world's largest beef exporter and is ranked second in beef production. In 2014, 1.9 million tons of carcass were sent overseas. Data show that, "In 2013, the livestock chain generated more than \$380 billion, representing a 10.5% increase from 2010. In 2014, beef production reached 10 million tons, having grown by 18.2% over a decade."<sup>14</sup> Clearly, Brazil has a growing beef cattle industry and it is possible that growth promotants have contributed to this growth.

### **Summary:**

Out of the six countries discussed above, Brazil is by far the country with the most beef production and export, but there is no information to confirm that they use growth promotants. The United States, Canada, and Australia are the countries that are expanding their beef production by using growth promotants. Growth promotants reduce the time that cattle need to spend in a feedlot, which increases production and provides economic benefits to cattle producers.

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<sup>11</sup> Ibid

<sup>12</sup> "Argentina." *Beef2Live*. N.p., 11 May 2016. Web. 05 July 2016.

<sup>13</sup> Partridge, Ian. "Using Hormone Growth Promotants to Increase Beef Production." N.p., Nov. 2010. Web. 5 July 2016.

<sup>14</sup> Brasil, Apex. "Drovers Cattle Network." *Brazil Increases Beef Production and Exports While Shrinking Its Pastureland*. N.p., 07 Oct. 2015. Web. 05 July 2016.

**Approved parasite- and pest-management compounds including those for managing worms, grubs, and flies; mandatory testing requirements for pathogens or residues; and residue tolerance levels for wormers, pesticides, compounds, or drugs in cattle or beef.**

**United States:**

Insect and mite pests cause annual losses of \$2.2 billion annually in the cattle industry. Pests can be controlled by ear tags, sprays, pour-ons, dust bags, backrubbers or self-oilers, and oral larvicides. The well-known pesticide, DDT, is an insecticide that was made in 1872 and was canceled in 1972 by Environmental Protection Agency (EPA) . " DDT can still legally be manufactured in the U.S., but it can only be sold to, or used by, foreign countries. In the U.S. the only exceptions for DDT use are for public health emergencies involving vector (insect) diseases and control of body lice." <sup>15</sup> "Animal feed and drugs have been regulated for as long as human food and drugs. When Congress passed the Pure Food and Drugs Act in 1906, it introduced the regulation of food and drugs in interstate commerce for 'man or other animals.' But the 1906 act gave the FDA limited powers to protect consumers against adulterated and misrepresented food and drugs, says FDA Historian John Swann, Ph.D. "It was against the law to make a false or misleading claim for a product, but it could be difficult to prosecute offenders, especially after the law was amended in 1912 to require that fraudulence be proven to establish misbranding," he says. "And violations of the law were misdemeanors with fines that could be as high as \$300 along with jail terms, but more often these were considerably lower. However, the violative products could be seized and destroyed." <sup>16</sup> Therefore, the United States is supposed to make sure there is no residue in the meat that is going to customers. They watch the packing plants and producers carefully to make sure there is no residue in the meat that they are providing the customers.

**Mexico:**

While there was no readily available information on pest or pest management in Mexico, the country is concerned about the liver fluke. The liver fluke is difficult to eradicate but it can be controlled to a great extent by treating with a water soluble, injectable drug. "<sup>17</sup> As a result of disease problems in Mexico there are disease-related movement restrictions for cattle between Mexico and the United States, as well as between Mexican States and Central America."<sup>18</sup>

**Canada:**

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<sup>17</sup> McNerney, Dermot. "Dangers in Feeding Waste Material to Livestock." *Department of Primary Industries*. N.p., Nov. 2014. Web. 1 Aug. 2016.

<sup>18</sup> Peel, Derrell. "Cow-Calf Beef Production in Mexico." *United States Department of Agriculture*. N.p., n.d. Web. 18 July 2016.

Internal parasite control is an integral component of health management in Canada. Cattle that have been dewormed produce more milk, have improved feed efficiency, reproductive performance is better, stronger immune systems, and show overall better body condition. In Canada they are making it a routine to control the pests and insects. "Concepts around deworming the beef cow have moved from 'not necessary' to 'routine' in many progressive cow-calf operations."<sup>19</sup> The approved number of pour-ons, injectables, and drenches has made deworming programs much easier. Testing for drug residues from pesticides is carried out by the Canadian Food Inspection Agency (CFIA) and include monitoring, surveillance, and compliance.

### **Argentina:**

This author did not find information regarding Argentina's pest management practices.

### **Australia:**

Internal parasites can significantly affect animal welfare and economic outcomes for farmers. Also they are a major health issue for cattle, costing Australia an estimated \$38 million dollars a year in lost production and control costs. Australia currently has several ways to administer pest control. Some substances must be administered by the Australian Pesticide and Veterinary Medicines Authority. Diatomaceous earth (DE) and bentonite<sup>2</sup> (very fine clay) are two products used as a dewormer. Residue detection for pesticides, chemicals, antibiotics, and hormonal growth promotants are conducted by Australian Department of Agriculture National Residue Survey. All registered products have a mandatory withholding period. The producers are responsible for making sure that their cattle do not contain unacceptable residues.

### **Brazil:**

Tick infestation in Brazil results in losses from decreased milk production, meat production, and transmission of pathogens. Producers have tried to control the tick infestation indiscriminately with chemical acaricides. It is reported that the lack in judgment in the use of these products has led to contamination of the environment, milk, and meat.

### **Summary:**

All of the countries discussed above are plagued with pest control problems depending on location and environment. While DDT cannot be used in the United States to control insect pests, it can be used in at least some foreign countries that purchase the banned product from United States manufacturers. It appears that Most of the countries have residue testing regulations in place to protect consumers from harmful contamination.

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<sup>19</sup> Clarke, Dr. Ron. "Rethinking Strategic Deworming in Beef Cattle." *Canadian Cattlemen*. N.p., 30 Mar. 2016. Web. 26 July 2016.

## Approved and/or used beta-agonists such as Optaflexx and Zilmax.

### United States:

Growth promotants have been around since 1975 but beta-agonists have been available since 2004, which include Optaflexx and Zilmax. Implants require no withdrawal time prior to slaughter, whereas beta-agonists withdrawal times vary among products. "Generally, Zilmax™ is a more potent beta agonist than Optaflexx™.<sup>20</sup> While researchers did not initially observe any negative effects on animal conformation, cattle with poor skeletal structure (post legged, straight fronted) were found to exhibit problems due to the additional muscle these products added to their frames.<sup>21</sup> In 2013 veterinary pharmaceutical company Merck voluntarily suspend sales of Zilmax in the U.S. and Canada due to concerns that it may adversely affect cattle health by causing lameness and immobility.<sup>22</sup>

### Mexico:

Zilmax has long been used in Mexico as a feed additive for finishing cattle. It is designed to produce greater lean meat and less fat. "Research data steers fed Optaflexx the last 28-42 days of the feeding period gained 10-20 pounds more and had a 14-21% improved feed efficiency."<sup>23</sup>

### Canada:

Beta-agonists adds an additional lean muscle in the last 20-40 days prior to slaughter. Beta-agonists affects muscle at a cellular level and does not affect hormones of the animal. "The beta-agonist binds to receptors in a muscle cell where it initiates an increase in protein synthesis, resulting in an increase in muscle fiber size."<sup>24</sup> As stated above, sales of Zilmax were suspended in the U.S. and Canada in 2013.

### Argentina:

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<sup>20</sup> Radunz, Amy. "Beta Agonists: Growth Promoting Feed Additives for Beef Cattle." *Cooperative Extension*. N.p., 2011. Web. 29 July 2016.

<sup>21</sup> Radunz, Amy. "Beta Agonists: Growth Promoting Feed Additives for Beef Cattle." *Cooperative Extension*. N.p., 2011. Web. 29 July 2016.

<sup>22</sup> [Merck Suspends Sales of Cattle-Feed Additive Zilmax in U.S., Canada, Kelsey Gee, The Wall Street Journal, August 16, 2013, available at <http://www.wsj.com/articles/SB10001424127887324139404579016654038679072>]

<sup>23</sup> "The Basics of Beta Agonists -- Zilmax & Optaflexx." *BEEF Magazine*. N.p., n.d. Web. 01 July 2016.

<sup>24</sup> "University of Nebraska–Lincoln." *Beta-agonists: What Are They and Should I Be Concerned?* N.p., n.d. Web. 29 July 2016.

This author did not find any information regarding the use of beta-agonists in Argentina.

### **Australia:**

A 2013 article indicated that an Australian animal health company was then seeking registration for the use of Zilmax. The article explained that whether or not to use Zilmax comes down to the difference in the productivity benefits gained by using beta-agonists, against the impact on international market for Australian beef. A source close to the registration process reportedly said, "The opportunity to use beta agonists in grainfed beef will not suit all Australian supply chains, but the intention is to make it available to for those that wish to take advantage of its benefits"<sup>25</sup>

### **Brazil:**

Reports indicate that some countries may stop importing Brazilian beef because Brazil cannot guarantee that the supply of beef is free of the beta-agonists. Tyson Foods Inc., JBS, and other meatpackers have acknowledged that cattle fed beta-agonists have been arriving at slaughter facilities with ambulatory problems.

### **Summary:**

Publicly available information seems to suggest that growth implants are more widely used in the U.S. than in other countries. A more popular choice among countries today seems to be beta-agonists. Although beta-agonists have been approved for use in more than 24 countries, some countries have put restrictions on specific types used and other countries have threatened to ban imports from countries using beta-agonists as they believe they cannot be guaranteed a product free from the compound.

## **Approved and/or used non-conventional feedstuffs (meaning and feedstuffs outside the normal grass and grain diet)**

### **United States:**

There is a long history of nonconventional feed resources (NCFR), crop residues, and by-product feeds that are known worldwide. NCFR is feedstuff not found in commercial rations. As feeding has modernized, the use of NCFR's has diminished rapidly.

Straw is available in the U.S. but is not commonly fed because of its limited digestibility and feeding value. Some vegetation not native to the U.S. is fed in other countries. For example,

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<sup>25</sup> Condon, Jon. "Special Report: Beta Agonist Registration Push Could Divide Beef Industry - Beef Central." *Beef Central*. N.p., 15 July 2013. Web. 29 July 2016.

*Leucaena* (*Leucaena leucocephala*), a tropical and semitropical legume found extensively in warm climates. Farmers generally feed leucaena fresh in a cut-and-carry system to all types of livestock." <sup>26</sup>

### **Mexico:**

In Mexico, 10 million tons of animal feed and fodder are consumed by livestock annually. Mexico relies heavily on imports (4-5 million tons) to supplement its production of basic grains. Other feedstuffs that are produced in large quantities and are rich in protein included cottonseed meal, sesame seed meal and fish meal. Sunflower seed meal and safflower seed meal are also available but in smaller quantities. "Other available feedstuffs are: wheat bran, wheat middlings, rice bran, copra meal, alfalfa meal and brewery by-products." <sup>27</sup>

### **Canada:**

Canada has been a recycler of by-products and non-conventional feedstuffs for many years. Sources of by-product feed comes from brewery's grains, bakery waste, dairy by-products, render from slaughter plants, and hulls from cottonseed or soybean. Economically; whether by-product or non-conventional feed is or is not used would depend on how close the producers' farm is to the source of feed. "Variation in nutritional quality of byproduct or non-conventional feeds is a concern " and, "Diet modifications for non-conventional feeds must be done gradually to allow rumen microorganisms to become accustomed to the new feed stuff." <sup>28</sup>

### **Argentina:**

Argentina is the world's largest exporter for three major products; they are soymeal, corn and soybeans. Twenty years ago Argentina's cows grazed freely, but today much of the grassland has been turned into crops. This change took place because it takes three to five years to get a grass fed cow ready to sell for slaughter, on the same ground, however, soy or corn crops can be ready for market in a matter of months.

### **Australia:**

There are many non-conventional feedstuffs in Australia. However, Australian producers are urged to be aware that material not specifically used for feed can cause unacceptable chemical residues in meat. There are control systems in place in Australia to ensure there is no

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<sup>26</sup> "IV. Environmental Impact Assessment of Livestock Production in Mixed Rainfed Systems in Temperate Zones (MRT) (excluding Africa)." *IV. Environmental Impact Assessment of Livestock Production in Mixed Rainfed Systems in Temperate Zones (MRT) (excluding Africa)*. N.p., n.d. Web. 30 July 2016.

<sup>27</sup> "3.0 FEED SUPPLIES." *FAO Corporate Document Repository*. N.p., n.d. Web. 31 July 2016.

<sup>28</sup> Fletcher, Janet. "By-product and Non-conventional Feeds." *Foragebeef.ca*. N.p., 22 Mar. 2016. Web. 31 July 2016.

chemical residue in the animal product. In addition to preventing residue in food, Australian laws are also aimed at preventing the development and spread of several serious animal diseases.<sup>29</sup>

### **Brazil:**

No information was found about Brazil's non-conventional feedstuffs. But, FAR (Rabobank Food & Agribusiness Research) expects that by 2023 beef production in Brazil could increase by an estimated 2.5 million tons per year. Although today Brazil produces 160 million tons of corn and soybeans, additional grain will need to be produced for the expected increase in numbers. This could be a challenge due to the lack of infrastructure. According to FAR, "Brazil's grain farmers will need to increase corn production by 15.1 million tons and soybean production by 4 million tons over the next decade just to supply the domestic demand from animal agriculture."<sup>30</sup>

### **Summary:**

The use of NCFR's seems to have an uncertain future. In each country, nonconventional feedstuffs, has its own challenge. In the United States, nonconventional feedstuffs are diminishing. Australia has restrictions on what kind of nonconventional feedstuffs the farmers and ranchers can get. Mexico relies heavily on imports. Brazil, Argentina, and Canada have additional costs due to transportation.

## **Mandatory testing and vaccination requirements for moving cattle from one state or region to another or to slaughter & Regulations mandating certain transportation practices.**

### **United States:**

The two main diseases that the United States watches out for are Bovine Tuberculosis and Brucellosis when transporting cattle to slaughter or from one state to another. "The control and ultimate eradication of Bovine Tuberculosis and Brucellosis is essential for the well-being and future development of our livestock production for both export and domestic markets."<sup>31</sup>

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<sup>30</sup> Day, Cheryl. "Feedlots to Drive Brazil Beef Industry Growth." - *Feedstuffs Foodlink*. N.p., 21 Oct. 2014. Web. 01 Aug. 2016.

<sup>31</sup> "9. Animal Health and Welfare - Part 1." *DAFM - Department of Agriculture, Food and the Marine*. N.p., n.d. Web. 02 Aug. 2016.

<sup>29</sup> Carmona, Cristina, and Rhonda Skaggs. "Procedures for Exporting Cattle from Chihuahua, Mexico, to the United States1." *NMSU: Procedures for Exporting Cattle from Chihuahua, Mexico, to the United States*. N.p., Jan. 2006. Web. 03 Aug. 2016

Testing is required on animals 18 months or more of age and pre-movement tests is required 60 days prior to moving. As far as transportation goes, animals cannot be confined to a vehicle or vessel for more than 28 consecutive hours at which time they will be unloaded, fed, watered, and given at least 5 hours of rest.

### **Mexico:**

“Every bovine animal that enters the United States from Mexico must be tested for tuberculosis.”<sup>29</sup> Animals are tested for Tuberculosis at the farm or ranch level. Brucellosis is only tested on female cattle destined for exportation for breeding or show. Screening tests are used to identify the presences of Brucellosis, a form must be filled out. At the bottom of the form it is noted that the document is not valid for transporting cattle. There is a form for certificate of origin and a zoosanitary certificate which is required when food or cattle are moved between states.

### **Canada:**

“Transporting livestock is no longer a simple job performed in the country by experienced livestock handlers raised on the farm. It has become a large industry serving an expansive international market.” Cattle within Canada cannot be onboard for longer than 48 hours unless the final destination is within 52 hours. If cattle are on board longer than 52 hours they must be unloaded, fed, watered, and rest for a minimum of 5 hours. “When hauling cattle destined for the US, truckers must be aware of legal liabilities and restrictions. Paperwork is often complex. Legal weight limits may be different for each state. United States border officials will require the documented health status and individual ID of breeding animals. Loads of slaughter cattle will be sealed at the border and can only be opened by authorized personnel at the final destination.”<sup>32</sup>

### **Argentina:**

This author did not find any information regarding the use of beta-agonists in Argentina.

### **Australia:**

“In the 1980s the Australian government considered whether to advance its efforts to eradicate Bovine Tuberculosis from the southern part of the country, where it had been quite successful, to the more remote northern part.”<sup>33</sup> A major problem facing these efforts was the cost of gathering the cattle for the required testing within a given time frame. Many producers in

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<sup>32</sup> Comeau, Kimberly. "Animal Welfare: Transportation of Livestock." *Animal Welfare: Transportation of Livestock*. N.p., 6 May 2013. Web. 03 Aug. 2016.

<sup>33</sup> "Read "Livestock Disease Eradication: Evaluation of the Cooperative State-Federal Bovine Tuberculosis Eradication Program" at NAP.edu." *EPIDEMIOLOGIC/ECONOMIC TUBERCULOSIS STUDIES AND BIOECONOMIC RESEARCH CONSIDERATIONS*. N.p., n.d. Web. 03 Aug. 2016.

the most difficult gathering country would be unable to meet the additional cost. Protecting clean areas would require server restrictions on movement.

### **Brazil:**

Brazil suffers from inadequate transportation infrastructure. Only 12 percent of Brazil's roads are paved and only 5 percent of those are federal roads and only 25% have been rated in good or very good condition. Trucking is highly competitive and self-employed drivers account for over half of Brazil's fleet. Trucking in Brazil is largely unregulated and fiercely competitive, which drives some to cut corners, over-load vehicle, conduct poor maintenance, and drive at excessive speeds.

### **Summary:**

The United States, Canada, and Mexico are similar when it comes down to the testing requirements for transporting cattle to slaughter or to another state or region. The other three countries have different testing requirements and it appears their transportation rules are much more relaxed.

## **Approved reproductive technologies.**

### **United States:**

In the last 30 years, bovine embryo transfer has become a large international business. For several years now, embryo transfer is used to produce artificial insemination (AI) sires from proven genetics. "Throughout the world, approximately 15 percent of bovine embryos are produced by in vitro technology."<sup>34</sup> In the late 80's the concept of multiple ovulation was introduced. Multiple products are available in the U.S. to aid in estrus synchronization. These products include PGF2a, GnRH and controlled Intravaginal Drug (Progesterone) Releasing device (CIDR). Today, artificial insemination is combined with cryopreservation in such a way that a single bull can produce thousands of offspring in one year. Artificial insemination also plays an important role in multiple ovulation and embryo transfer. "The first calf produced by embryo transfer was born more than 50 years ago. Since then, embryo transfer programs have been implemented with acceptable results into livestock production."<sup>35</sup>

### **Mexico, Canada and Argentina:**

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<sup>34</sup>Mapletoft, R. J., and J. F. Hasler. "Assisted Reproductive Technologies in Cattle: A Review." N.p., n.d. Web. 4 Aug. 2016

<sup>35</sup> "Assisted Reproductive Technologies in Cattle: Applications in Livestock Production, Biomedical Research and Conservation Biology." *Newcastle University*. N.p., 16 Mar. 2008. Web. 4 Aug. 2016.

The author did not find specific information regarding reproductive technologies used in Mexico, Canada or Argentina.

### **Australia:**

Australian reproductive technologies have taken artificial breeding to a new level through improved management techniques, which has increased in vitro fertilization (IVF) in cattle. This was achieved by combining benefits of nutrition and herd management to both donor and recipient. The ideal situation is for cattle to be put on a higher nutrition plan approximately 6 weeks prior to artificial insemination. "Fixed time artificial insemination (FTAI) can increase the rate of genetic progression considerably and the benefits can occur quickly over time."<sup>36</sup>

### **Brazil:**

"In Brazil, since 2005 and specifically for Nelore (the major beef breed in the country), there were several frustrated attempts to implement genomics in breeding and selection."<sup>37</sup> Several factors contributing to the failure were that costs were prohibitive or breeders could not access the benefits and companies did not share real data information for selection purposes. "Today, Brazil is the largest producer of Nelore cattle worldwide. Nelore cows have a long and prolific reproductive life, distinct mothering ability, and cows tend to calve very easily due to their large frame and wide pelvic opening."<sup>38</sup>

### **Summary:**

New and improved reproductive technologies are being adopted and practiced around the world. "Worldwide, AI has been the main vehicle for the improvement of genetic quality herds."<sup>39</sup>

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<sup>36</sup> Ziesemer, Lucy. "Reproductive Technology a plus for North Australian Cattle Producers." *Queensland Country Life*. N.p., 09 Feb. 2016. Web. 04 Aug. 2016.

<sup>37</sup> "Genomic Selection and Assisted Reproduction Technologies to Foster Cattle Breeding." N.p., Aug.-Sept. 2013. Web. 4 Aug. 2016.

<sup>38</sup> "Reproductive Technology & Global Production of Beef." N.p., Aug.-Sept. 2011. Web. 4 Aug. 2016.

<sup>39</sup> "Assisted Reproductive Technologies in Cattle: Applications in Livestock Production, Biomedical Research and Conservation Biology." *Newcastle University*. N.p., 16 Mar. 2008. Web. 4 Aug. 2016.