

**Awareness assessment of Safe-Guard® in the  
U.S. cattle industry**

by

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## ABSTRACT

This research focuses on the cattle producer's overall awareness of an internal deworming product available in the U.S. cattle market. Parasitism in cattle can be very costly for the producer, and identifying a need for deworming is instrumental to the decision-making process for animal health protocols. The additional cost of deworming products can be beneficial for profitability for cattle producers when used properly. Likewise, when there is no proven need for deworming products in certain operations, the additional cost is an unnecessary expense that can be avoided. Proper awareness and education regarding deworming products and the benefits they can provide is one crucial piece to improving herd health, better rates of gain, and increased profitability.

The main objective of this study is to determine the awareness of non-handling formulations of Safe-Guard. To understand and assess awareness, a survey was used. A population of participants was developed and asked to participate in the survey either online or in hard copy. A binary logit is used to analyze how cattle producers make decisions in adopting animal health products into their operations. Influencing factors of operation type, size, location, producer's age, and information sources are used in the assessment.

Factors that were the most influential to the decision-making processes for producers were discussions with veterinarians, nutritionists, and animal health sales representatives. In addition to face-to-face discussions with neighboring producers/friends, industry meetings, and reading industry journals and publications were also important.

These producers were aware of a few formulations of Safe-Guard, and used them within the previous twelve months of taking the survey. However, participants were generally unaware of the product, and its different formulations.

Upon review of the assessed unawareness of the product formulations, it is apparent that the company needs to identify and select a better way to make producers aware.

Different approaches to targeted marketing campaigns and more in depth product training for the animal health company's sales representatives should be implemented to increase awareness and sales.

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## **Dedication**

This work is dedicated to my late father, John A. Ligtenberg. The wonderful lessons he taught me about life have shaped who I am today. He encouraged me in everything from education, career, and life, and is the reason I push myself when pursuing each of my goals. He taught me to be strong, believe in myself, and keep looking up. There was always love, honesty, hard work and dedication in everything he did, and these traits are a legacy that he left with my mother, brother, and I. He is in my thoughts always!

## CHAPTER I: INTRODUCTION

Cattle production in the United States ranked first in cash receipts among agricultural commodities, totaling \$78.2 billion for 2015, arguably making it one of the most important industries (USDA 2016). In 1867, the United States Department of Agriculture (USDA) began taking cattle inventory and reported just over 28 million head. Conversely, the largest cattle inventory in the United States was in 1975 with 132 million head. As of January 1, 2016, there are at nearly 92 million head of cattle with milk cows accounting for 9.32 million head, milk replacement heifers at 4.82 million head, and the remainder (77.9 million head) being beef operations (USDA 2016). This is a three percent increase in inventory from 2015, and the largest year over year increase in total cattle numbers since 1975.

Nearly 41.5 billion pounds of beef were produced in 2015, which was a three percent increase in total production. Gross cattle income decreased by four percent when compared to 2014. Those figures tell a very plain story that cattle operations, and other production agriculture ventures, can be risky financial investments for producers, due to the cyclical nature of agriculture. Important inputs such as feed, labor, pharmaceuticals/animal health costs, and the price that producers receive when marketing their product are all factors to be considered in the day-to-day operations of cattle production.

Animal health expenses in the form of disease and health management can be a large cost of cattle production, as there are many aspects of cattle health, not only in maintenance and prevention, but treatments as well. Producers take great measures to ensure cattle health for proper nutrition, reproduction, respiratory, pink eye, clostridial disease, therapeutic/treatment, growth promotants, mastitis, and parasite control to name a

few. Although the financial cost of animal health management can seem high, it outweighs the potential economic losses from illness, poor performance or production, reduced fertility, and even death all resulting from lack of proper animal health management.

Parasite control is one aspect of disease management that could potentially cause significant economic losses to producers, if little or no action is taken to manage the level of parasites. In dairy cows, internal parasitism can reduce milk production by 6.5 pounds per cow per day when compared to cows without parasites (Merck Animal Health 2007). The July 2016 Class I (fluid milk) base price at \$13.70/hundredweight (cwt) and Class III (cheese) base price at \$13.22/cwt (Hoard's Dairyman 2016), the losses range between \$1,170 and \$1,350 per day in a herd size of 1,500 head (Merck Animal Health 2007).<sup>1</sup> That is a potential loss of almost \$500,000 in a year.

Concerned with these potential economic losses, and decreased profitability due to parasitism, many cattle producers in the United States have implemented some form of deworming into their operations' protocols. Not all cattle need to be dewormed, as the parasite levels and frequency of deworming will vary throughout different operations and geographies. There are many types of cattle production facilities that utilize strategic deworming, including but not limited to dairy farms, custom heifer raisers, cow/calf operations, stockers, feedlots, ranches and those that pasture/graze their cattle.

Some producers do not invest in internal deworming products for several reasons including: 1) cattle generally become infected with parasites when they have had access to grass, since the parasite can live in grass, and not all cattle have access to grass; 2) deworming cattle can cost approximately \$1.25-\$3.00 per head depending on weight at

treatment; and 3) they perceive that the cost of the treatment and cost of labor is not of value to them.

Parasiticide is defined as any substance or agent used to destroy parasites, which is also referred to as a “dewormer” (Webster 2016). These substances come in forms such as those in human medicine, veterinary medicine, and environmental parasiticides. There are two main types of parasites within veterinary medicine: 1) ectoparasites-any parasite that lives on the outer surface of an animal; and 2) endoparasites-any parasite that inhabits internal organs or tissue of an animal or plant. Therefore, a product labeled as an endo- or ecto-parasiticide is one that aids in the control and/or treatment of the parasite that is occupying the animal internally or externally, respectively. These products are generally used on their own, or in combination with other parasiticides to eliminate said parasites. Cattle typically become infested with internal parasites by having access to grass or pasture where the cattle come in contact with the parasites, and potential contamination increases as the grazing season progresses.

### **1.1 Objectives**

The main objective of this research is to assess customer awareness of the internal deworming product called Safe-Guard that is available for purchase and use in cattle operations throughout the United States. Merck Animal Health feels that if current customers use a form that is more suited to the needs of their operation, they will increase sales over all product forms. Additionally, Merck Animal Health believes that increased awareness could gain new customers that currently do not use Safe-Guard and its many forms due to lack of awareness. The secondary objective is to identify future marketing strategies to increase overall awareness of the wide range of products available to satisfy customer needs in a cost-effective manner.

By understanding that there are many forms of the product available to fit their feed delivery methods, producers can make more informed decisions on how they implement strategic deworming into their protocols. Many producers use some form of deworming product for a variety of reasons, but through implementing a proper deworming protocol in their operation, and more specifically one that uses the product form that is suited toward their operations, they can potentially increase overall economic profitability.

### **1.2 Importance of deworming for producers**

Parasitism can be costly for cattle producers due to reduced immune function, feed intake, growth, and reproduction. Many of today's producers have started to see the value of deworming their cattle due to more emphasis on the economic benefits of doing so. One study shows that by implementing a strategic deworming program, the average advantage of 48.0 pounds per head was observed at the end of a 118-day grazing period, and a total weight gain of 98.0 pounds for the treated group versus the controls (R. Smith, et. al, n.d.). Many studies have shown that internal parasites, especially *Ostertagia*, can produce substances that suppress the animal's immune system. Producers stand to benefit from deworming having a positive impact on the effectiveness of the vaccines given to the animal (Bliss 2007).

By becoming infected with internal parasites, it reduces the animal's ability to fight infection caused by viral diseases, as well as reduced vaccination response. In turn, the very vaccine that producers administer to their cattle, to aid in the prevention and control of other diseases, can be hindered if an animal is heavily parasitized.

When a producer uses a deworming product, they could perceive it to have more benefit when that product allows for less handling of the animal, less cost associated with

labor to do so. With the availability of multiple “non-handling” forms of the dewormer Safe-Guard, customers could see added savings in treatment costs.

### **1.3 Importance for Merck Animal Health**

Analyzing customer awareness is important to Merck Animal Health due to the potential increase in sales of the product. Personnel at Merck Animal Health have the perception that overall awareness of Safe-Guard among U.S. cattle producers is not at its highest potential. Consequently, sales of the product are not reaching their full potential or expectations. Two handling forms accounted for 31.0% of the nearly \$59 million in sales of Safe-Guard in 2015. Non-handling forms increased by 5.0% and handling forms increased by 9.4% from 2014 to 2015 ( Merck Animal Health 2016).

In addition to immune response being important to producers, it also is for Merck Animal Health. The Ruminant Business Unit (RBU) of Merck Animal Health has several formulations of Safe-Guard cattle dewormer available for purchase in the United States. If animals get an illness that the producers have vaccinated to protect against, they could potentially say that the cause was that the vaccine administered to the animal simply failed to work. There are many reasons for animals to become ill, but looking into a deworming program could eliminate the possibility that the vaccine “failed” simply due to the animal being immuno-suppressed from internal parasite damage. Immuno-suppression can occur when the parasitic infection does not allow the host’s immune response to function properly, or essentially when the parasite suppress’ the immune system of the host animal. This allows the parasite to grow due to antibody production being shut down, and creates a snowball effect of susceptibility to bacteria and viruses, and interferes with the positive reaction that vaccines normally have when administered to healthy animals.

## CHAPTER II: LITERATURE REVIEW

This chapter discusses the internal deworming product Safe-Guard, and product awareness. This chapter discusses a brief history of Safe-Guard and its performance in the market. Marketing strategies and product awareness are discussed, as well as a brief overview of the many Food and Drug Administration (FDA) approved deworming products.

When an animal becomes infected with internal parasites, the effects can be damaging. Two of the big concerns are the animal's overall health, and the economic gain for the producer. Parasiticide use over the past 20 to 30 years has resulted in reduced losses from parasitic infection such as wasted feed, inhibiting growth and milk production, and overall productivity that can all affect the producer's economic outcome. This could be a contributing factor of the increasing U.S. beef production over the past few decades by producing healthier animals and lower death loss from the negative effects of parasite infection. Although parasiticide use is a small contributing factor, it is an important factor to the cattle industry's efficiencies.

A parasite is an organism that lives in or on another organism (its host) and benefits from deriving nutrients at the host's expense. Internal parasites that are most damaging to cattle are hookworm, bankrupt, barberpole, tapeworm, nodular, lungworm, small intestine, small stomach, threadnecked, brown stomach worms, and the liver fluke that can migrate from the intestine to the liver (figure 2.1). External parasites that commonly infect cattle are lice, grubs, mites, and flies of all types including horn-flies.

Figure 2.1: Guide to Internal Parasites of Ruminants



Source: (Merck Animal Health 2016)

## 2.1 Safe-Guard

A need was identified for deworming products in cattle operations, not only in the United States, but around the world. Because of the internal parasites damaging impact to cattle productivity, producers have invested in deworming protocols. For Hoechst-Roussel AgriVet, the need was met with a non-ivermectin molecule designed to aid in controlling and/or reducing parasite loads in cattle, known as fenbendazole (FBZ).

The first branded product to contain fenbendazole was Panacur suspension in 1979, followed by Safe-Guard approval for use in cattle in 1984 that was developed by scientists at the German company Hoechst-Roussel AgriVet. Their United States growth promotants product, Regu-Mate, and fenbendazole products were acquired by Intervet, Inc. on December 12, 1999. Intervet, Inc. and Schering-Plough merged to become Intervet

Schering-Plough Animal Health in 2007, and in November 2009 merged with Merck and is called Merck Animal Health (Wheeler 2016). The Safe-Guard product is currently owned and manufactured by Intervet, Inc. dba Merck Animal Health, a subsidiary of Merck.

Fenbendazole's formulation of 4%, 8%, and 20% premix was approved and released in the fall of 1983 under the Safe-Guard brand. This product initially had the perception of solely being a cattle product, but was also approved for use in swine. In the mid to late 1990s, the company received FDA approval for multi-species such as equine, swine, cattle, goats, camelids, canine, feline, etc., except for the 20% label remaining approved only in cattle and swine. One of the reasons that the company applied for label claims to include multiple species was to make it more difficult for generic competition to copy the product and its label claims. Some of the differing claims for the product are a legal single day feeding for cattle and equine, while the swine label states a three to twelve day feeding, and six days for turkeys.

In early 2016, Merck Animal Health produced eleven formulations of Safe-Guard and three forms of Panacur. This does not include the formulations approved for use in dogs and cats. Panacur is the prescription version of fenbendazole and is currently licensed to be sold as Panacur paste, suspension, granules and Panacur powerpac with different labels for horses, cattle, dogs, and cats. Safe-Guard is available over-the-counter (OTC). Two forms of Safe-Guard, paste and oral suspension, are what the company refers to as handling, as it requires physically handling the animal to administer the product. The paste comes in a 290-gram cartridge that deworms 29 head of 440-lb cattle, and a 92-gram syringe that deworms eight head of 500-lb cattle. It is described as being a low-dose volume paste in apple cinnamon flavor for improved palatability. The oral suspension is

available in 1-liter bottles, gallons, and 10-liter bottles. Safe-Guard's oral suspension is a low-dose volume suspension that offers reduced stress dewormer application, with an easy-to-use applicator gun for accurate dosing. Each liter bottle deworms 86 head of 500-lb cattle, the gallon and 10-liter bottle deworms 330 head and 869 head of 500-lb cattle respectively.

The remaining nine forms are referred to as non-handling, due to the option of not needing to physically handle the animal to administer the product. The different formulations are alfalfa based pellets for top-dress feeding, free-choice liquid feed, free-choice mineral, 1.96% scoop dewormer as a flake meal or soft mini-pellet, crumbles, cubes, and two kinds of blocks. The crumbles, cubes, and some mineral formulations are also manufactured through third-party feed companies such as J.D. Heiskell and Archer Daniels Midland (ADM). The packaging and production of these forms varies by feed manufacturer.

Each formulation has a different withdrawal time and dosing and application rates. The application rate is how long to give the product that varies from a single dose to feeding over a three to six-day period. The dosing rate is how much of the product is recommended to administer to the animal based on body weight and species and varies by formulation. An established withdrawal period is the amount of time after a product is last administered before producers are able to harvest saleable meat or milk. Examples of Safe-Guard Cattle formulations are found in figure 2.2.

**Figure 2.2: Safe-Guard Cattle Formulation**

CATTLE HANDLING FORMULATIONS - SAFE-GUARD				
FORMULATIONS	DESCRIPTION	SIZE	DOSE	APPLICATION RATE
<b>PASTE</b>	<ul style="list-style-type: none"> <li>Low-dose volume paste</li> <li>Apple-cinnamon flavor for improved palatability</li> <li>Specially designed metal hook for convenient design</li> </ul>	<ul style="list-style-type: none"> <li>290-g paste cartridge</li> <li>92-g paste syringe</li> </ul>	<ul style="list-style-type: none"> <li>Each 290-g paste cartridge deworms 29 head of 440-lb. cattle</li> <li>Each 92-g paste syringe deworms eight head of 500-lb. cattle</li> </ul>	<ul style="list-style-type: none"> <li>Single dose application</li> </ul>
<b>ORAL SUSPENSION</b>	<ul style="list-style-type: none"> <li>Low-dose volume suspension offers stress-less dewormer application</li> <li>Easy-to-use applicator gun for accurate dose</li> </ul>	<ul style="list-style-type: none"> <li>Gallons</li> <li>10 and 1-liter bottles</li> </ul>	<ul style="list-style-type: none"> <li>Each gallon deworms 330 head of 500-lb. cattle</li> <li>Each liter deworms 86 head of 500-lb. cattle</li> </ul>	<ul style="list-style-type: none"> <li>Single dose application</li> </ul>
CATTLE NON-HANDLING FORMULATIONS - SAFE-GUARD				
<b>PELLETS</b>	<ul style="list-style-type: none"> <li>Alfalfa-based pellet for improved palatability</li> <li>For top-dress feeding</li> </ul>	<b>Animal Health Distributor:</b> <ul style="list-style-type: none"> <li>1 lb., 5lb., 10 lb. bags</li> </ul>	<ul style="list-style-type: none"> <li>1/2 lb. per 500 lbs. body weight</li> </ul>	<ul style="list-style-type: none"> <li>Feed for one day</li> </ul>
<b>Free-choice LIQUID FEED 504 grams per ton</b>	<ul style="list-style-type: none"> <li>Free-choice liquid supplement</li> </ul>	<ul style="list-style-type: none"> <li>Does not apply</li> </ul>	<ul style="list-style-type: none"> <li>9 lbs. per 1,000 lbs. body weight</li> </ul>	<ul style="list-style-type: none"> <li>Feed free-choice over a 3-6 day period</li> </ul>
<b>Feed Manufacturer CRUMBLES</b>	<ul style="list-style-type: none"> <li>Palatable crumbles for use when adding to meal rations</li> </ul>	<ul style="list-style-type: none"> <li>Packaging may vary by feed manufacturer</li> </ul>	<ul style="list-style-type: none"> <li>Read and follow label directions from manufacturer</li> </ul>	<ul style="list-style-type: none"> <li>Feed for 1 day</li> </ul>
<b>Feed Manufacturer CUBES</b>	<ul style="list-style-type: none"> <li>High-quality range cubes for pasture top-dress</li> </ul>			
<b>Feed Manufacturer Free-Choice MINERAL</b>	<ul style="list-style-type: none"> <li>Formulations vary by company</li> </ul>			
<b>EN-PRO-AL® BLOCKS</b>	<ul style="list-style-type: none"> <li>Soft-poured molasses block</li> </ul>	<ul style="list-style-type: none"> <li>25 lb. block</li> </ul>	<ul style="list-style-type: none"> <li>1 1/2 lb. per 500 lb. body weight</li> </ul>	<ul style="list-style-type: none"> <li>Feed over a 3-day period</li> </ul>
<b>SWEETLIX® 20% PROTEIN BLOCKS</b>	<ul style="list-style-type: none"> <li>Cold-pressed protein block</li> </ul>	<ul style="list-style-type: none"> <li>25 lb. block</li> </ul>		
<b>FREE-CHOICE MINERAL</b>	<ul style="list-style-type: none"> <li>20% salt</li> <li>Only dewormer available in a free-choice mineral form</li> </ul>	<b>Animal Health Distributor:</b> <ul style="list-style-type: none"> <li>25-lb. plastic pail (20% salt)</li> </ul>	<ul style="list-style-type: none"> <li>8 oz. per 500 lb. body weight (20% salt)</li> </ul>	<ul style="list-style-type: none"> <li>Feed over a 3-6 day period</li> </ul>
<b>1.96% SCOOP DEWORMER</b>	<ul style="list-style-type: none"> <li>Two convenient formulations: Flaked meal and soft mini-pellets</li> <li>Unique, high-concentration, low-volume dose</li> </ul>	<b>Animal Health Distributor:</b> <ul style="list-style-type: none"> <li>25-lb. plastic pail</li> </ul>	<ul style="list-style-type: none"> <li>1 oz. per 240 lb. body weight</li> </ul>	<ul style="list-style-type: none"> <li>Feed for 1 day</li> </ul>

Source: (Merck Animal Health, 2016)

## 2.2 Product training and market competition

Prior to the acquisition of Hoechst-Roussel products, Intervet only had a few swine and companion animal vaccines. Sales representatives at Intervet were subjected to seventeen weeks of training for Safe-Guard. The extensive training that Intervet provided was deemed necessary due to the fact that the company had so few products to sell at the

time. The training included knowledge of proper protocols, dosing rates, withdrawal time, and what each parasite's name was in addition to the negative effects they caused to the animal (Wheeler 2016).

To be properly dewormed of internal parasites, as well as reduce pasture re-infection, Safe-Guard is generally recommended to be used two to three times per year to achieve maximum results. An example for grazing beef cows would be to treat the cattle in the chute before turnout, treat 28 days later to interrupt the worm life cycle, and finally re-treat four to six weeks later in high parasite burden areas.

Much of the recent training of Merck Animal Health sales representatives has been very brief as opposed to the extensive training initially provided. The essential information concerning the product is covered, and perhaps as a result many internal representatives stick to detailing just one or two product forms, and they are typically not a suitable form for the producer. An internal marketing strategy, to be discussed more in depth later, could be something for the company to implement in an effort to gain more awareness.

### *2.2.1 Competitive products*

When Safe-Guard was initially developed, another product was made as a result of fermented Safe-Guard. This is sold as the product Synanthic (Oxfendazole) and was approved at a lower volume dose. It is shown to be a third less efficacious than fenbendazole. This lower dose appeared to help increase market share for Synanthic based on the idea that a lower volume dose was less costly per head (Wheeler 2016).

In 1981, a product called IVOMEC (ivermectin) was developed for sale in the United States. This product started out as the major competitor to Safe-Guard, and is still the case 35 years later. Oddly enough, IVOMEC was discovered and developed by scientists from Merck labs. An interesting observation regarding Ivomec Pour-On and

Safe-Guard oral drench is that studies have shown that concurrent use in treated heifers resulted in improved live and carcass weight, in addition to better general health (Intervet, Inc. 2004). Examples of additional deworming products are found in table 2.1.

**Table 2.1 Chart for Cattle Endectocides**

Drug Name	Brand Name	Manufacturer	Route	Parasites targeted (Endo or Ecto)
Albendazole	Valbazen®	Zoetis	Oral	Endo
		Intervet, Inc. dba		
Fenbendazole	Safe-Guard®/Panacur®	Merck Animal Health	Oral	Endo
Oxfendazole	Synanthic®	Boehringer Ingelheim	Oral	Endo
Morantel tartrate	Rumatel® 88	Phibro	In Feed	Endo
Doramectin	Dectomax® Injectable	Zoetis	Oral	Endo & Ecto
	Dectomax® Pour-On	Zoetis	Topical	Endo & Ecto
Eprinomectin	EPRINEX® Pour-On	Merial	Topical	Endo & Ecto
	LONGRANGE®	Merial	S.C.	Endo & Ecto
Ivermectin	IVOMEK®	Merial	S.C.	Endo & Ecto
	IVOMEK® Pour-On	Merial	Topical	Endo & Ecto
	Agri-Mectin®	AgriLabs	S.C.	Endo & Ecto
	Bimectin® Injection	Bimeda	S.C.	Endo & Ecto
	Bimectin® Pour-On	Bimeda	Topical	Endo & Ecto
		Norbrook/Aspen/		
	Ivermax® 1%Injection	Bimeda	S.C.	Endo & Ecto
		Norbrook/Aspen/		
	Ivermax® Pour-On	Bimeda	Topical	Endo & Ecto
Ivermectin, clorsulon	Agri-Mectin® Plus			
	Clorsulon	AgriLabs	S.C.	Endo & Ecto
	Endo-Mectin®	Aspen	S.C.	Endo & Ecto
	IVOMEK® Plus	Merial	S.C.	Endo & Ecto
	Noromectin® Plus	Norbrook	S.C.	Endo & Ecto
Moxidectin	Cydectin® Injectable	Boehringer Ingleheim	S.C.	Endo & Ecto
	Cydectin® Pour-On	Boehringer Ingleheim	Topical	Endo & Ecto

\*\*Each product has an established withdrawal period found on the product label.

A common misstep regarding dewormer is whether the product targets internal or external parasites. Some products have been approved and labeled for treating infections

and infestations for internal and external parasites. Without proper understanding of the product labels, consumers potentially use a product believing they will gain control over parasites that the product is not labeled for. A possible situation is a producer that intends to treat/control internal parasites and applies products that also treat for external parasites so that the animal is not infested with lice and grubs. Use of these products tend to be costlier investments in animal health than necessary when an animal is not infected. Research into the needs of the animal can assist producers in choosing an appropriate product to implement into their protocols. When looking for an internal deworming product, comparison charts can be useful tools in identifying which products target specific parasites (see figure 2.3).

**Figure 2.3: Deworming Comparison Chart**

<b>WORMS</b>		<b>PANACUR®/SAFE-GUARD® SUSPENSION</b> <small>(fenbendazole)</small>	<b>DECTOMAX® POUR-ON<sup>1,2</sup></b> <small>doramectin</small>	<b>DECTOMAX® INJECTABLE<sup>1</sup></b> <small>(doramectin)</small>	<b>CYDECTIN® POUR-ON<sup>1,2</sup></b> <small>moxidectin</small>	<b>EPRIXIN®<sup>EV,2</sup></b> <small>ephrinomectin</small>	<b>IVOMEC® INJECTABLE<sup>1</sup></b> <small>ivermectin</small>	<b>IVOMEC® POUR-ON<sup>1,2</sup></b> <small>(ivermectin)</small>	<b>VALBAZEN®<sup>EV,3</sup></b> <small>albendazole</small>	<b>SYNANTHIC®</b> <small>(oxfendazole)</small>	<b>RUMATEL®</b> <small>morantel Tartrate</small>	<b>LEVASOLE® TOTALON®</b> <small>(levamisole)</small>
<b>BROWN STOMACH</b> <small>(O. ostertagi)</small>	ADULT	★	★	★	★	★	★	★	★	★	★	★
	INHIBITED L4	★ <sup>4</sup>	★	★	★	★	★	★	★	23%-83.5% <sup>†</sup>	NO	NO
	TYPE II ostertagiosis	★ <sup>4</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>BARBERPOLE</b> <small>(Haemonchus spp.)</small>	ADULT	★	★	★	★	★	★	★	★	★	★	★
	L4	★	★	★	★	★	★	★	★	NO	NO	NO
<b>SMALL STOMACH</b> <small>(T. axei)</small>	ADULT	★	★	★	★	★	★	★	★	★	★	★
	L4	★	NO	★	★	★	★	★	★	NO	NO	NO
<b>BANKRUPT</b> <small>(T. colubriformis)</small>	ADULT	★	★	★	★	★	★	★	★	NO	★	★
	L4	★	★	★	★	★	★	★	NO	NO	NO	NO
<b>SMALL INTESTINE</b> <small>(Cooperia punctata, C. oncophora)</small>	ADULT	★	★	★	★	★	★	★	★	★	★	★
	L4	★	★	★	★	★	★	★	★	★	NO	NO
<b>THREADNECKED</b> <small>(Nematodirus helvetianus)</small>	ADULT	★	NO	NO	★	★	84%	NO	★	NO	★	★
	L4	★	NO	NO	★	★	NO	NO	★	NO	NO	NO
<b>HOOKWORM</b> <small>(B. phlebotomum)</small>	ADULT	★ <sup>4</sup>	★	★	★	★	★	NO	★	★	NO	★
	L4	★	NO	NO	NO	★	★	NO	NO	NO	NO	NO
<b>NODULAR</b> <small>(O. radiatum)</small>	ADULT	★	★	★	★	★	★	★	★	★	★	★
	L4	★	★	★	★	★	★	★	★	NO	NO	NO
<b>LUNGWORM</b> <small>(D. viviparus)</small>	ADULT	★	★	★	★	★	★	★	★	★	NO	★
	L4	NO	★	★	★	★	★	★	★	★	NO	NO
<b>TAPEWORM</b> <small>(M. benedeni)</small>	ADULT	★ <sup>4</sup>	NO	NO	NO	NO	NO	NO	★	★	NO	NO

<sup>1</sup> Do not administer to female cattle during first 45 days of pregnancy or for 45 days following removal of bulls

<sup>2</sup> Also approved for external parasite control

<sup>3</sup> At 10 mg/kg dosage, Panacur label only. Do not use at the rate of 10 mg/kg in dairy cattle.

<sup>4</sup> Dose rate of 10 mg/kg in dairy cattle could result in violative residues in milk.

<sup>†</sup> FOI Summary of Pivotal Studies

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Source: (Merck Animal Health, 2016)

Fenbendazole has shown safe elimination of parasite loads more rapidly than cattle treated with other products such as ivermectin (Merck Animal Health 2007). Because some parasitic infections in cattle cause reduced feed intake, efficiency of protein digestion, and weight gain, the benefit of a strategic deworming protocol is apparent. Fenbendazole has been known to repeatedly show a reduction in parasite loads more quickly than ivermectin products, resulting in improved performance. In looking at trial summaries in feedlot cattle treated with fenbendazole and organophosphate, increased feed efficiencies of cattle were improved by nearly 2% as opposed to treatment with ivermectin injections only (Intervet, Inc. 2004). Parasite infections suppress the bovine immune system by reducing both cell mediated and humoral immune responses in cattle (Intervet, Inc. 2004). This results in cattle infected with internal parasites more likely to become ill, and simultaneously less likely to positively respond to vaccinations. In addition to improving performance, reducing parasite loads in cattle aids in reducing their susceptibility to disease.

### **2.3 Testing for Internal Parasites**

Producers have become increasingly aware of the value of deworming cattle, but knowing if it is necessary to treat the animal is often something that is an unknown. Many have implemented a deworming product into their protocol because they know that having heavily parasitized animals is detrimental to their business. This has created overuse and therefore resistance to some products.

Merck Animal Health recommend the use of fecal egg count reduction testing (FECRT) in an effort to visualize a need for deworming, in addition to being one of the most accurate ways to determine if deworming is successful. The World Association for

the Advancement of Veterinary Parasitology set a standard of a 90% or greater (Post-Treat) reduction in fecal egg count for a product to be effective and not designated as a “parasite resistant product” (Bliss 2007). Prior to treating animals with a deworming product, fecal samples are collected and sent to a laboratory for analysis that determines the level of parasites. Individuals and/or groups can be sampled, and typically when groups are sampled (20 random animals) individual fecal samples are collected. The recommendation is to collect golf-ball size rectal or freshly observed samples in a re-sealable bag which is then sealed, identified, and refrigerated. The analysis is commonly done by the Modified Wisconsin Sugar Flootation Technique (figure 2.4) that allows the lab to count the number of eggs that are present within the sample. Producers then receive a report with the egg count for each sample. One of the many benefits of this test is when the report shows an absence of eggs to indicate that the animals are “clean”, and therefore do not need to be treated with an internal deworming product which saves the producer from unnecessary cost.

After the initial sampling for the FECRT, animals that are parasitized are treated, then re-sampled 10-14 days’ post treatment. As previously stated, a successful deworming will be a 90% reduction in the fecal egg count. This testing method is a very useful tool in analyzing a need for deworming, as well as the performance of whichever deworming product was used.

**Figure 2.4: Modified Wisconsin Sugar Floatation Technique**



Source: (Bliss 2007)

## 2.4 Marketing

Certain steps are taken in designing and implementing marketing plans or strategies, and often starts with identifying the target market or audience. This begins with a distinct target audience in mind, that includes current or potential users. Identifying the audience will greatly influence the company on how to communicate their message (Keller and Koelter 2012). A market segment is a group of customers with a similar need, and the marketer's job is to pinpoint how many segments there are and then decide which ones to target. Once the targets are confirmed, the company can move to set specific objectives and a budget for the marketing plan.

Product awareness in specific segments may assist companies to guide their campaigns and deliver a more tailored message to customers. After an assessment is made, the marketer can target certain segments according to their needs. For example, a Pennsylvania dairy farm with pasture access may have different needs for deworming products than a feedlot in the Texas panhandle, and sending a targeted message could help achieve the company objectives while simultaneously serving the customer.

Potential threats to segmentation are added costs, inaccurate segmentation and targeting markets that are heavily saturated with competition. However, if a product is unique enough to differentiate from its competition, this could be an advantage.

## **2.5 Internal Marketing**

Organizations like Merck Animal Health have hundreds of sales representatives and must have a well-developed plan when it comes to product launches, training, and market penetration. A poorly trained salesforce is one way that products fail, and customers are not served well. Internal marketing is described as training and motivating employees to serve customers, and can be thought of as an extension of the marketing department through the salesforce (Keller and Koelter 2012). When the customers have a need that the company has identified, then the sales team must fully support that message to be successful. Implementing a thorough training process for new team members is crucial to their confidence and eventually to the level of service the customer receives.

People or employee development is the act of encouraging employee advancement and success through learning and development opportunities such as extensive and thorough training. Investment in employee training could be considered an investment into research and development of a product or service. Companies that lack in proper employee development for certain products, services or marketing campaigns that were heavily

invested in may not succeed as well as forecasted. Investment in employee development shows that the company views them as an extension of that product and a valuable contributing success factor. However, development is not a one-way street and must have manager support and feedback. Perhaps the lack of awareness in products can be attributed to the lack of knowledge internally amongst the sales force.

The learning process can provoke people's behaviors to change due to the experience gained. This knowledge is then more accessible to be taught to other individuals such as a consumer learning about a product that is economic, efficacious and tailored to meet their specific needs and wants (Keller and Koelter 2012). Increased knowledge in sales representatives also benefits positive brand associations the customer experiences in the form of attitude, experience, and perceptions, of the product, sales person and the company. Sharing knowledge provides a positive experience for the customer that in-turn increases their awareness of products and services the company provides. Coaching and feedback in people development also aids to increase productivity and performance.

Company investment into people could be compared to cattle producers that cut costs when the livestock markets are on a down swing. Producers often reduce expenditures in certain areas of animal health management, that often results in negative consequences long-term. The same can be said when companies cut learning and development opportunities for their employees which is a foundation for success of the individual and the company. Training courses cannot be "one-and-done", but instead need to be continual development of talent to better adapt to changing environments.

## **2.6 Contributions**

The research discussed in this paper will contribute to previous studies by determining the factors that help drive awareness of a product. Those results will help identify future marketing strategies that can be developed and implemented within the company to expand product and company awareness throughout cattle markets to increase overall market share in the animal health sector.

## CHAPTER III: THEORY, METHODS AND DATA

Research has shown the value of strategic deworming in cattle operations throughout the United States. However, with increased awareness in the forms of Safe-Guard available that are suited to the cattle operations current feed delivery method, more economic benefit could be obtained. Awareness of products will be assessed from the results of the survey conducted for this research. This chapter provides a discussion of the methods and data used for this research with a description of the theoretical and empirical models, followed by discussion of the variables, and the survey design in conclusion.

### 3.1 Theory and Methods

The binary logit model provides the framework to analyze how cattle producers make decisions in adopting animal health products such as Safe-Guard into their operations. It is assumed the utility received by producer  $p$  from choosing alternate  $i$  can be represented as:

$$(1) \quad \begin{aligned} U_{ip} &= V_{ip} + \varepsilon_{ip}, i = 1, \dots, I \text{ and} \\ p &= 1, \dots, P, \end{aligned}$$

where  $U$  is the producer's expected utility from choosing alternative  $i$ ,  $V$  is the deterministic portion of the utility, and  $\varepsilon$  is the stochastic error term. The probability a producer,  $p$ , will choose alternative  $i$  is found by:

$$(2) \quad \begin{aligned} P_p(i) &= \Pr(U_{ip} \geq U_{jp}) \\ &= \Pr(V_{ip} + \varepsilon_{ip} \geq V_{jp} + \varepsilon_{jp}) \\ &\text{for all } i, j \in C_p \end{aligned}$$

where  $C_p$  is the choice set for producer [ $C_n = \{i, j\} = \{\text{Familiar, Not Familiar}\}$ ].

Assuming the stochastic errors in equation (1) are independently and identically distributed over the  $i$  alternatives and  $p$  individuals, then equation (2) is logistically

distributed. Lusk, Roosen, and Fox (2003) have shown that the probability of producer  $p$  choosing between alternative  $i$  is given by:

$$(3) \quad P_p(i) = \frac{e^{\mu V_{ip}}}{\sum_{j \in C_p} e^{\mu V_{jp}}}$$

where  $\mu$  is the scale parameter and is assumed equal to one because it is unidentifiable within any particular data set and cannot be distinguished from the overall scale of the estimated  $\beta$  parameters. Given two choices, a binary logit model gives the choice probability for alternative  $i$  as:

$$(4) \quad \begin{aligned} P_p(i = 1) &= \frac{e^{\mu V_{ip}}}{e^{\mu V_{ip}} + e^{\mu V_{jp}}} \\ &= \frac{1}{1 + e^{-\mu(V_{ip} - V_{jp})}} \\ &= \Phi(\mathbf{V}) \\ &= \Phi(\boldsymbol{\beta}' \mathbf{x}), \end{aligned}$$

where  $\boldsymbol{\beta}'$  is the vector of parameters to be estimated and  $\mathbf{x}$  is the vector of observations.

Assuming the deterministic portion of the utility,  $V_i$ , is linear in the parameters, the regression specification is:

$$\begin{aligned} AWARENESS_{ip} &= \beta_0 + \beta_1 TYPE_n + \beta_2 SIZE_n + \beta_3 CUSTOMERAGE_p \\ &\quad + \beta_4 LOCATION_p + \beta_5 FEEDDELIVERY_p + \varepsilon'_p \end{aligned}$$

The variables are outlined in table 3.1 and include type (TYPE) and size of operation (SIZE), customer's age in years (CUSTOMERAGE), primary operations geographic location (LOCATION), and feed delivery methods used (FEEDDELIVERY).

Awareness is defined as a customer being familiar or not familiar with the product indicated by Yes or No answer for each of the following product formulations of Safe-Guard: oral suspension 10%, paste 10%, premix, 1.96% soft mini-pellets, 1.96% flake

meal, 0.5% pellets/crumbles, En-Pro-AI blocks, protein blocks, Sweetlix 20% blocks, cattle cubes, Free-Choice mineral, equi-bits, equine paste, EZ Scoop, zoo and wildlife dewormer, and Panacur: suspension, paste, and powerpac.

**Table 3.1: Variables and Description Used in the Binary Logit Model**

Variable	Definition
<b>Dependent Variable</b>	
<i>AWARENESS</i>	Familiarity with formulations of Safe-Guard: Yes (1) No (0)
<b>Independent Variables</b>	
<i>TYPE</i>	Cattle production facility type; calf ranch, cow/calf, dairy w/pasture/grass access dairy no pasture/grass access, feedlot, purebred, stocker, other
<i>SIZE</i>	Facility size by number of head at primary facility; 1-25 hd, 26-75 hd, 76-150 hd 151-500 hd, 501-1,500 hd, 1,501-3,000 hd, 3,001-6,000 hd, 6,000 hd or greater
<i>CUSTOMERAGE</i>	Participants age in years during survey
<i>LOCATION</i>	Location of facility designated by five digit zip code
<i>FEEDDELIVERY</i>	Feed delivery methods used at facility; hay, green chop, mineral, commercial feed, blocks, cubes, cake, commodities, annual grazing, tubs, liquid, range land, permanent pasture, total mixed ration (TMR), built-in roughage (BIR), other

### 3.2 Variables

This section gives a brief overview of the variables and their importance in relation to this research and the results. Cattle producers are surveyed due to the product being used and labeled primarily for use in beef and dairy cattle. All forms of Safe-Guard, including the Zoo & Wildlife formulation are assessed to gain a complete view of overall awareness.

The demographics assessed in the survey are age of participant, and primary location of the cattle facility designated by five-digit zip code. Age is obtained to allow the researchers to assess the correlation between age of the producer and the producer's information source. This was age specific as opposed to an age range.

Location of the participant's operation by zip code allows a better understanding of awareness of the different products by region, as well as determine the types of operations

that are in specific areas. Size of the participant's operations provide a better understanding of herd size within the market that can be beneficial for developing marketing campaigns, in addition to assessing correlation in awareness and herd size.

Participants are asked to choose their primary type of operation from a list of eight options: 1) calf ranch - a large farm where mainly calves of non-lactating age are raised, typically dairy cattle of either sex; 2) cow/calf - an operation that maintains a herd of breeding cows, replacement heifers and bulls, and sells weaned calves; 3) dairy; no pasture/grass access - a farm/facility that has no access to pasture/grass, where cow's milk is harvested; 4) dairy; with pasture/grass access - a farm/facility that has access to pasture/grass where cow's milk is harvested; 5) feedlot - a confined beef cattle operation where cattle are fed until "fat" for slaughter; 6) purebred - cattle operation with registered animals; 7) stocker - operation that run weaned cattle on grass or other feed; and 8) other - operation type not listed.

Operation type is used to assess the correlation of overall awareness of the Safe-Guard products. Typically, unless an animal has access to some type of grass, they will not become infected with internal parasites. Many dairies in the United States are "dry-lot" dairies, and those animals generally do not have access to grass. This question helped determine if a participant operates a dairy and what the difference in awareness of Safe-Guard is based on pasture/grass access vs. no pasture/grass access. The outcomes are of interest to see how much dewormer is being used in operations of that type, if any.

One hypothesis of this research is that producers are unaware of the convenient forms of Safe-Guard that "match" their primary feed delivery method. Varying feed delivery methods are used in cattle operations, and participants are given fifteen options to

choose from in the survey: 1) hay, 2) green chop, 3) mineral, 4) commercial feed, 5) blocks, 6) cubes/cake, 7) commodities, 8) annual grazing, 9) tubs, 10) liquid, 11) range land, 12) permanent pasture, 13) total mixed ration (TMR), 14) built-in roughage (BIR), and 15) other. Safe-Guard is available in many formulations and this question assesses the knowledge of the forms of the product as compared to the similar type of feed delivery used in various operations.

Merck Animal Health uses a multitude of advertising and communication avenues when conveying information about the company and its many products. Due to the importance of reaching customers, participants are asked where they obtain their information on animal health products. Many companies use advertising and communication through social media, and it is important to understand if that is where the customer base is looking for information, or if they are relying on other methods. Understanding this can be helpful to determine future marketing strategies and the best use of marketing funds.

Another instrumental choice that customers make is who they rely on to assist in the decision-making process for the animal health products that are best for their operation's needs. It is important to understand who and/or what the producer relies on so that they are included in the company's strategies for marketing, sales training, advertising, etc.

When assessing awareness of the formulations of Safe-Guard, participants are given the various Safe-Guard formulation options and were asked to indicate their familiarity with each form by choosing yes or no. The basis of this research hinges around this question, and is necessary to determine awareness of the handling and non-handling forms

of the product. The following question concerned motivational factors used to purchase a deworming product. This was to determine why producers use deworming products in their protocols. Participants are provided with nine options: 1) improve herd health, 2) eliminate/control parasites, 3) add more pounds of milk, 4) better rate of gain, 5) low cost deworming product, 6) higher pregnancy rates, 7) increase profitability, 8) ease of product administration, and 9) other, and asked to choose all that were applicable.

Another important factor is where participants purchase their animal health products from. This is of importance in order to understand their purchasing preferences, and to ensure that all market places are being properly informed on the product choices that are available from the company.

The final question asked participants to indicate all deworming products they had used on their cattle in the past twelve months from a list of some popular choices from multiple companies. These choices include products that are used to control parasites internally, externally, or a combination of the two. This is a valuable piece to the marketing portion of this research in that many producers use a dewormer, but could be using one that is not suited to their needs. Every question asked helped provide useful information for a very diverse cattle industry that varies in type, size, purchasing behaviors, and geography.

### **3.3 Survey**

A survey instrument is designed through Qualtrics, an online survey software, and distributed to 1,002 cattle producers located throughout the United States. Participants are randomly chosen from the Beef and Dairy Spotters, which are published industry directories, and an internal Merck Animal Health annual program participant list. It is not

known if potential participants are current users of the product Safe-Guard. The focus of this survey is to determine the influencing factors that drive awareness of a product.

In March 2016, participants were mailed the survey instrument along with an introduction letter and a return envelope. The introduction letter outlines the purpose of the survey and requested that it be completed to their preference of hard copy or electronically and included a link to Qualtrics of <http://bit.ly/tiffcattle>. A copy of the introduction letter and survey questions are provided in Appendix A. The survey was offered for five weeks in March and April of 2016 and saw 281 complete surveys for a total response rate of 28.0%. The decision was made to offer this survey both electronically and in hard copy due to the assumption that participants in the cattle industry would be more likely to respond via mail as opposed to the electronic option. The result was 58 (20.6%) completed electronically with the remaining 223 (79.4%) returned in the mail.

## CHAPTER IV: RESULTS

This chapter provides discussion and interpretation of the survey data results, followed by analysis of the models that assessed awareness.

### 4.1 Survey Results

The survey response rate of 28.0% (n=281) provided the data for this research. Different types of cattle operations in the United States were represented in the participant's answers; 39% dairy no pasture/grass access, 10% dairy with pasture/grass access, 21% feedlot, 16% stocker, 7% cow/calf, 4% calf ranch, and 1% of both purebred and other (table 4.1). Nearly half of the participants operate dairy facilities while the other half operate beef operations.

**Table 4.1: Primary type of operation**

Type of Operation	Number of Responses	%
Calf ranch	12	4
Cow/Calf	21	7
Dairy; no pasture/grass access	109	39
Dairy; with pasture/grass access	28	10
Feedlot	60	21
Purebred	4	1
Stocker	45	16
Other	2	1
Total	281	100

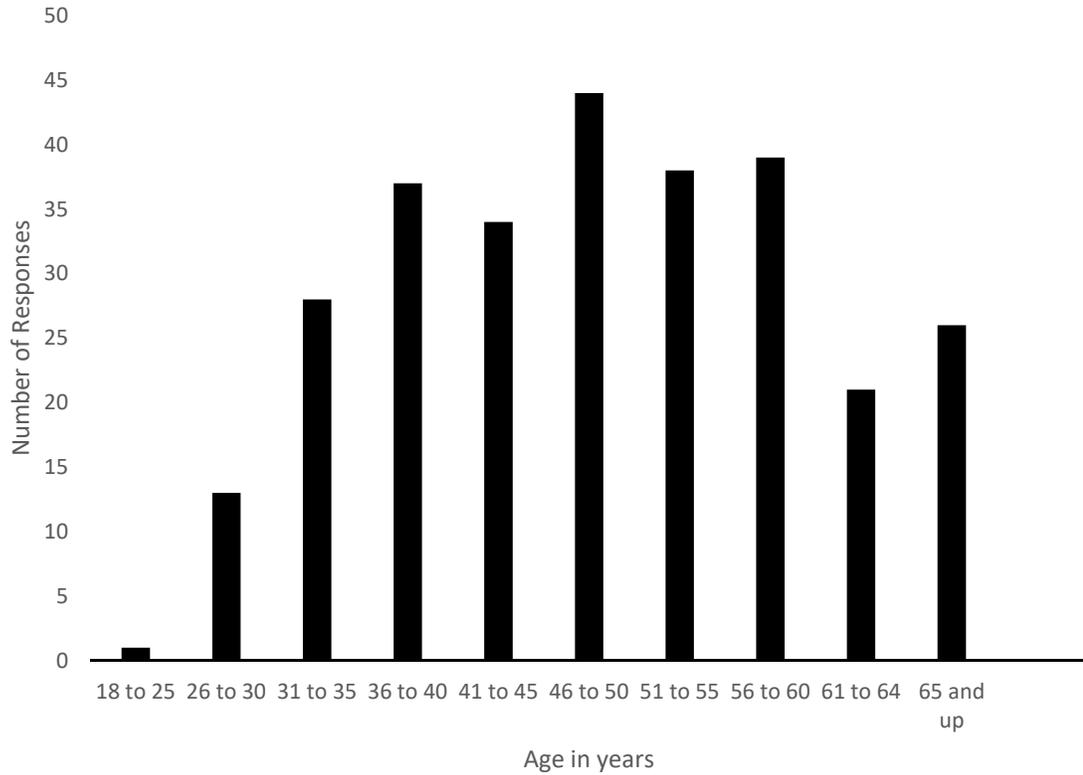
The 2012 USDA Agriculture Census indicated the average herd size was 98.5 head. However, an average dairy herd in the Southwest is 2,100 head, and many feedlots operate with 6,000+ head. (U.S. Department of Agriculture n.d.). Most survey participants (28%) indicated 1501-3000 head as the size of their operation (table 4.2). This was expected to be a high number, but it was surprising that so few participants chose 151-500 head.

**Table 4.2: Size of operation**

Number of Head	Number of Responses	%
1-25 head	1	0
26-75 head	3	1
76-150 head	8	3
151-500 head	17	6
501-1500 head	71	25
1501-3000 head	78	28
3001-6000 head	49	18
6001 head or greater	53	19
Total	280	100

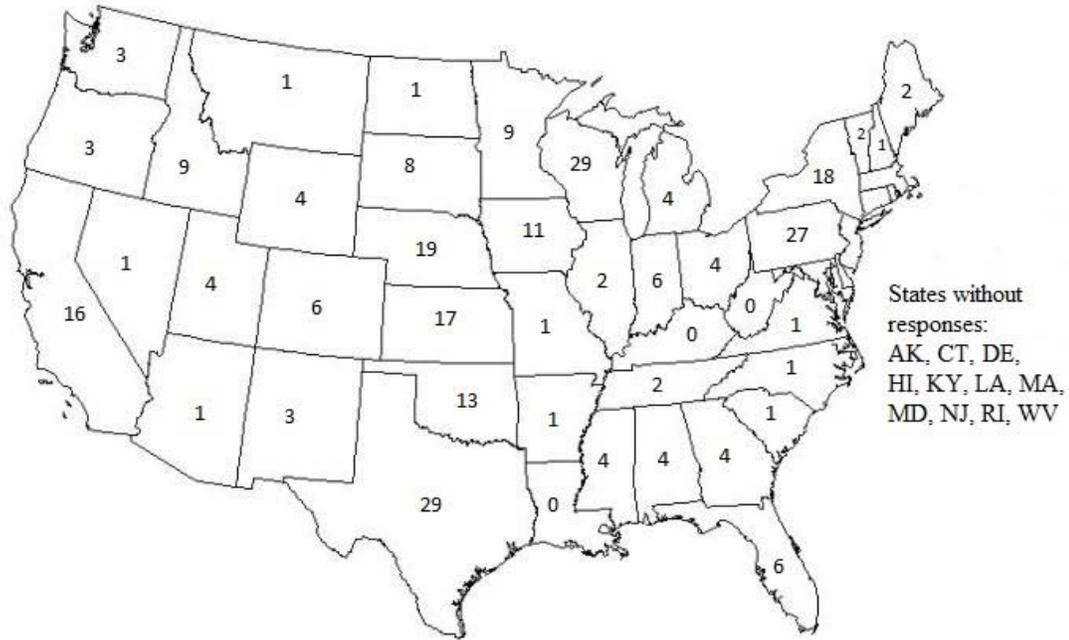
The 2012 Census of Agriculture provides a summary of demographic information about farmers including average age. When asking about the age of survey participants, the results are consistent to those shown in the Census data with 51% of survey participants aged 49 +, where the average age of farmers in 2012 was 58 (USDA 2016)(figure 4.1). The range was from 23 years to 81 years with sixty-six respondents (23%) indicating they were 58 years of age or higher, and matches the average American cattle operator (Mathews and McBride 2011).

**Figure 4.1: Age of Respondents**



There were 39 states represented in the survey results, with table 4.3 outlining different regions, in addition to the United States map in figure 4.2 that provides a visual summary. The regions were formed based on Merck Animal Health cattle business unit regions to relate the survey results to the defined regions. This helps understand each market when analyzing product awareness.

**Figure 4.2: Location Responses by State**



**Table 4.3: Location Regions by State**

Region	States	Total Count
1-Northeast	CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT	50
2-Southeast	AL, FL, GA, KY, MS, NC, SC, TN, VA, WV	23
3-Midwest	IL, IN, MI, OH, WI	45
4-N. Central	IA, MN, ND, NE, SD	48
5-S. Central	AR, KS, LA, MO, OK, TX	44
6-Rocky Mountains	AZ, CO, MT, NM, NV, UT, WY	37
7-West	CA, ID, OR, WA	31
	*AK, HI, DC not included	278

When looking at the various types of feed and feed delivery methods within the cattle operations, it is important to understand which methods are used to provide a convenient product that can be administered in a corresponding way. Hay, commodities, mineral, total mixed ration (TMR), commercial feed (pellets, textured feed, etc.), and liquid feed were among the top choices among survey participants feed delivery methods with 28% or greater response rate (table 4.4). Many of the non-handling forms of Safe-Guard

would fit well with these choices due to the ease of administration and similarity in feed and product type. The results show that 74% of survey participants chose mineral as one of their feed types, yet 81% stated they were not familiar with the mineral form of Safe-Guard. Similarly, when asked about Safe-Guard pre-mix, crumbles, pellets, and flaked meal, 69 to 88% were not familiar, where 45 to 85% use feed types that are compatible with those forms (table 4.4 and table 4.5). Having knowledge of multiple forms of a deworming product is beneficial to cattle producers due to the compatible options available in feed delivery methods. Safe-Guard can be administered multiple ways, which gives producers options to obtain the form that fits their operation.

**Table 4.4: Feed delivery methods used**

Feed Delivery Type	Number of Responses	%
Hay	239	85
Commodities	216	77
Mineral	208	74
Total mixed ration (TMR)	204	73
Commercial feed (pellets, textured feed, etc.)	127	45
Liquid	78	28
Annual grazing	68	24
Permanent pasture	67	24
Tubs	53	19
Green chop	48	19
Blocks	36	13
Range land	36	13
Other	23	8
Cubes, cake	21	7
Built-in roughage (BIR)	7	2

**Table 4.5: Familiarity with Safe-Guard products**

Product	Total Response	% Yes	% No
Safe-Guard Oral Suspension 10%	279	55	45
Safe-Guard Paste 10%	279	43	57
Safe-Guard Premix	277	20	79
Safe-Guard 1.96% Soft Mini-Pellets	278	15	85
Safe-Guard 1.96% Flake Meal	276	11	88
Safe-Guard 0.5% Pellets, Crumbles	277	30	69
Safe-Guard En-Pro-AI Blocks	275	11	87
Safe-Guard Protein Blocks	276	19	80
Safe-Guard Sweetlix 20% Blocks	273	19	79
Safe-Guard Cattle Cubes	275	17	82
Safe-Guard Free-Choice Mineral	274	17	81
Safe-Guard Equi-bits	274	5	93
Safe-Guard Equine paste	275	27	72
Safe-Guard EZ Scoop	274	6	92
Safe-Guard Zoo and Wildlife Dewormer	274	3	95
Panacur suspension	274	22	77
Panacur paste	272	19	78
Panacur powerpac	270	8	89

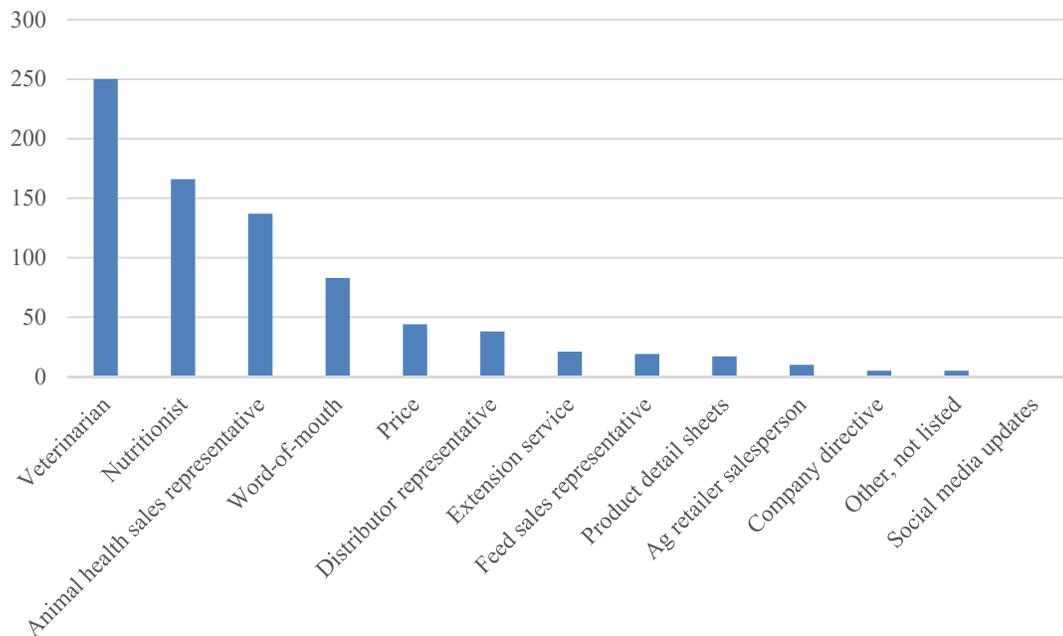
Another important factor in marketing animal health products is where cattle producers obtain their information. With a move to market through social media, this question results reveals that some industries, such as cattle production, still rely on conventional means of communication to gather information on animal health products. The survey results had one respondent aged between 18-25, thirteen between 26-30, and twenty-eight between 31-35. Social media was not the most popular option and garnered a response rate of 5.6% (16 participants), where face-to-face visit/discussions or meetings was 85% of the responses, industry meetings (54%) and journals/publications (45%) were the top three choices (table 4.6). Those respondents that chose Other wrote in answers that included veterinarian, themselves, or sales representatives to name a few.

**Table 4.6: Information sources for animal health products**

Information Source	Total Response	%
Face-to-face visit/discussions or meetings	235	85%
Industry meetings	152	55%
Journals, Publications	126	45%
Product or Company website	64	23%
Cooperative Extension Services/University	58	21%
Other	52	19%
Newspaper (including digital news)	24	9%
Social media (Facebook, Twitter, etc.)	16	6%
Television	10	4%
Total	278	100%

Additional information about decision-making for purchasing animal health products allowed respondents to choose the top three from a list of various outlets. These results show that the three most important resources were the veterinarian (89%), nutritionist (59%), and animal health sales representative (49%) (figure 4.3). This is valuable information for Merck Animal Health in that many times, the veterinarian and nutritionist receive their information from the sales representatives. Having properly educated employees will translate to well-informed influencers like the veterinarian, nutritionist, and others involved in the day-to-day interactions with cattle producers. The results also show that social media (<1%) is again at the bottom of respondent's choices as being crucial or important to their decision-making process and information gathering as it pertains to animal health products.

**Figure 4.3: Decision making sources**



#### **4.2 Summary**

Initial review of the survey responses show potential issues when a clarification of the type of dewormer of Safe-Guard as compared to other deworming products mentioned in the research. However, this information assists in visualizing the overall perception of a dewormer as not being a separate product intended for different use and indicates that marketing segmentation is important to convey to the end-user what the product is intended for, and why they should or should not use a specific product. The hypothesis that awareness of non-handling forms of Safe-Guard is true, shown by the outlined summary statistics. The regression results were used to assess awareness of different formulations of the product and are discussed in the remainder of the chapter.

There are eighteen products evaluated in this thesis (table 4.6). These products (i.e., dependent variables) were used to determine producer awareness.

**Table 4.7: Safe-Guard product abbreviations for dependent variable**

Abbreviation	Product Name
SGOS10P	SAFE-GUARD ORAL SUSPENSION 10%
SGP10P	SAFE-GUARD PASTE 10%
SGPREMIX	SAFE-GUARD PREMIX
SG196SMP	SAFE-GUARD 1.96% SOFT MINI PELLETS
SG196FM	SAFE-GUARD 1.96% FLAKE MEAL
SGP5PPEL	SAFE-GUARD 0.5% PELLETS
SGEPABLK	SAFE-GUARD EN PRO AL BLOCK
SGPTNBLK	SAFE-GUARD PROTEIN BLOCK
SGSLIXBLK	SAFE-GUARD SWEETLIX BLOCK
SGCATCUB	SAFE-GUARD CATTLE CUBES
SGFCM	SAFE-GUARD FREE CHOICE MINERAL
SGEQUIB	SAFE-GUARD EQUIBITS
SGEQUIP	SAFE-GUARD EQUINE PASTE
SGEZSCP	SAFE-GUARD EZ SCOOP
SGZWD	SAFE-GUARD ZOO & WILDLIFE DEWORMER
PANSUS	PANACUR SUSPENSION
PANPST	PANACUR PASTE
PANPP	PANACUR POWERPAC

A binary logit model was used and the SGOS10P (Safe-Guard oral suspension 10%) model resulted in a McFadden R-squared of 0.31, which falls in the middle of the range 0.20 to 0.40 that is considered an “extremely good fit” (Hensher 1981), suggesting a relationship between awareness of Oral Suspension 10% and the regressors included in the model (table 4.7). The number of cases that were correctly predicted for this model equaled 215 (or 76.5%).

Explanatory variables used in the estimation include type, size, location, and age. Regarding Oral Suspension 10% (SGOS10P), dairy operations without pasture were 29.3% less likely when compared to calf ranch and other types of operations. This value is obtained from the marginal effect column for dairy: no past type of operation. This result was unexpected to have a calf ranch be more aware of this product than dairies, regardless of having pasture or not. Typically, calf ranch operations would have less need for a

dewormer since the young stock are housed in individual or group pens with no grass/pasture access. With each year increase in age, producers were 0.78% less likely to be aware of Oral Suspension 10%. When compared to operations that have 6,001 head or greater, producers that report having less than 500 head, between 501-1500, 1,501-3,000, and 3,001-6,000 head were 33.3%, 31.8%, 33.3%, and 25.9% less likely to be aware of Oral Suspension 10%, respectively. Many of the larger operations could use the suspension formulation more than the smaller herds because of the convenience factor that the liter and gallon sizes provide. Producers located in the Northeast, Midwest, North Central, West, and Rocky Mountains were 41.7%, 47.9%, 43.3%, 55.8%, and 32.4%, respectively, less likely to be aware of Oral Suspension 10% when compared to producers in the South-Central region. This could be a result of the grazing potential that South-Central producers have as compared to other geographies, in addition to larger feedlot and stocker operations being located within the south-central regions. Overall, many producers were generally unaware of this product due to the market segment they are in, versus where the Oral Suspension 10% formulation fits.

The next three models had relatively low McFadden R-squared results, less than 0.20, which suggests that these models do not explain the variation in the dependent variable that well. The SG196SMP (Safe-Guard 1.96% soft mini pellets) model had a McFadden R-squared of 0.15 (table 4.8). The number of cases that were correctly predicted for this model equaled 251 (or 89.3%).

Explanatory variables used in the estimation include type, size, location, and age. In regards to 1.96% soft mini pellets, dairy operations without pasture and feedlots were 11.5% and 12.6%, respectively, less likely to be aware when compared to calf ranch and

other types of operations. Two potential reasons for their lack of awareness are their perception of need for a deworming product due to lack of access to grass, in addition to not being made aware of a non-handling formulation dewormer. Both operation types, dairy; no pasture and feedlot, could benefit greatly from a dewormer that is easily mixed into their TMR (total mixed ration), after an assessment of their herd's parasite load. With each year increase in age, producers were 0.3% less likely to be aware of 1.96% soft mini pellets.

When compared to operations that have 6,001 head or greater, producers that report having between 1,501-3,000 head, were 8.6% less likely to be aware of 1.96% soft mini pellets, which is an expected result. Operations with larger herds find the soft mini pellets easier to administer into a TMR, and reduce labor expenses from using this non-handling form. Producers located in the Midwest and West were 10.8%, and 12.6%, respectively, less likely to be aware of 1.96% soft mini pellets when compared to producers in the South-Central region. This could show that producers in the West that have large "dry-lot", or confined types of operations have the perception that they do not need to use any type of internal dewormer. Those operations in the Midwest could be unaware of the 1.96% mini pellets due to the use of other types, or the marketing and communication for this formulation has not been as successful in that, or the West, market.

The SGPTNBLK model had a McFadden R-squared of 0.14, and the number of cases that were correctly predicted for this model equaled 233 (or 82.9%) (table 4.9).

Previous models were similar in that the explanatory variables used in the estimation include type, size, location, and age. In regard to protein blocks, when compared to operations that have 6,001 head or greater, producers that report having

between 501-1,500 head, and 1,501-3,000 head, were 13.2% and 12.1% less likely to be aware of protein blocks. Producers located in the Northeast, Southeast, Midwest, Rocky Mountains, and West were 19.1%, 11.4%, 16.9%, 11.1%, and 11.8% less likely to be aware of protein blocks, respectively, when compared to producers in the South-Central region which was expected. It is assumed that many operations graze cattle during a large portion of the year, where the protein block can be a cost-effective and convenient formulation for the South-Central market. However, since all the other regions are less aware of this product, it points to a combination of poor communication and marketing from the sales representatives and company.

The SGEPABLK model had a McFadden R-squared of 0.14, and the number of cases that were correctly predicted for this model equaled 250 (or 89.0%) (table 4.10).

In regards to the En-Pro-AI blocks, dairy operations without pasture, feedlots, and combination types (cow/calf, purebred, stocker) were 10.4%, 8.5%, and 9.0%, respectively, less likely to be aware when compared to calf ranch and other types of operations. This result also points to a lack of communication to specific markets about the formulation types that match up to the feed delivery methods of the operations, specifically feedlots, and combination types. Producers located in the Northeast, Midwest, North Central, Rocky Mountains, and West were 10.3%, 10.9%, 5.5%, 6.5%, and 8.4%, respectively, less likely to be aware of En-Pro-AI blocks when compared to producers in the South-Central region. Like the protein blocks, 1.96%, and other products that were evaluated, the overall impression of awareness points to education of the various products not being passed to the producers, their veterinarians, etc.

With the information presented in the models, there is a general lack of awareness of both non-handling and handling forms of Safe-Guard within the U.S. cattle market. There are some steps that Merck Animal Health can take to improve the awareness of a product that has multiple applications that meet one common goal, which is to provide producers with a product that works to improve their animal's health.

**Table 4.8: SGOS10P Model Results**

Variable Name	Coefficients	Standard Error	p-values	Marginal effect
<i>Constant</i>	4.211 ***	1.004	<0.0001	
<i>Type</i>				
Dairy: no past	-1.231 *	0.679	0.070	-0.293
Dairy: w/past	-0.724	0.817	0.375	-0.179
Feedlot	0.310	0.717	0.665	0.073
Combo	0.483	0.768	0.530	0.112
<i>Size</i>				
501-1500 head	-1.319 **	0.540	0.015	-0.318
1501-3000 head	-1.390 ***	0.518	0.007	-0.334
Less than 500 head	-1.391 **	0.709	0.050	-0.333
3001-6000 head	-1.060 *	0.547	0.053	-0.259
<i>Age</i>	-0.032 **	0.015	0.025	-0.008
<i>Location</i>				
Northeast (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)	-1.792 ***	0.675	0.008	-0.418
Southeast (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	1.108	1.176	0.346	0.227
Midwest (IL, IN, MI, OH, WI)	-2.132 ***	0.646	0.001	-0.479
N. Central (IA, MN, ND, NE, SD)	-1.873 ***	0.638	0.003	-0.433
West (CA, ID, OR, WA)	-2.774 ***	0.723	0.000	-0.558
Rocky Mountains (AZ, CO, MT, NM, NV, UT, WY)	-1.346 **	0.646	0.037	-0.324
	Mean dependent var	0.544	S.D. dependent var	0.499
	McFadden R-squared	0.306	Adjusted R-squared	0.224

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively

**Table 4.9: SG196SMP Model Results**

Variable Name	Coefficients	Standard Error	p-values	Marginal effect
<i>Constant</i>	1.853 *	1.031	0.072	
<i>Type</i>				
Dairy: no past	-1.331 *	0.772	0.085	-0.115
Dairy: w/past	-1.361	0.950	0.152	-0.086
Feedlot	-1.951 **	0.811	0.016	-0.127
Combo	-1.089	0.801	0.174	-0.085
<i>Size</i>				
501-1500 head	-0.910	0.586	0.121	-0.073
1501-3000 head	-1.081 *	0.603	0.073	-0.086
3001-6000 head	-0.711	0.638	0.265	-0.056
Less than 500 head	0.689	0.685	0.314	0.081
<i>Age</i>				
Age	-0.032 *	0.018	0.078	-0.003
<i>Location</i>				
Northeast (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)	-1.247	0.779	0.110	-0.088
Southeast (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	-0.790	0.694	0.255	-0.058
Midwest (IL, IN, MI, OH, WI)	-1.745 **	0.808	0.031	-0.108
N. Central (IA, MN, ND, NE, SD)	-0.645	0.619	0.298	-0.052
Rocky Mountains (AZ, CO, MT, NM, NV, UT, WY)	-0.764	0.609	0.210	-0.058
West (CA, ID, OR, WA)	-2.691 **	1.187	0.023	-0.126
	Mean dependent var	0.146	S.D. dependent var	0.354
	McFadden R-squared	0.139	Adjusted R-squared	0.002

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively

**Table 4.10: SGPTNBLK Model Results**

Variable Name	Coefficients	Standard Error	p-values	Marginal effect
<i>Constant</i>	0.814	0.966	0.399	
<i>Type</i>				
Dairy: no past	-0.236	0.784	0.764	-0.030
Dairy: w/past	0.650	0.902	0.471	0.099
Feedlot	-0.635	0.793	0.423	-0.071
Combo	0.197	0.813	0.808	0.026
<i>Size</i>				
501-1500 head	-1.281 **	0.536	0.017	-0.133
1501-3000 head	-1.129 **	0.509	0.027	-0.122
3001-6000 head	-0.847	0.535	0.113	-0.089
Less than 500 head	-0.012	0.687	0.986	-0.002
<i>Age</i>	-0.010	0.016	0.520	-0.001
<i>Location</i>				
Northeast (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)	-2.456 ***	0.821	0.003	-0.192
Southeast (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	-1.328 **	0.638	0.037	-0.115
Midwest (IL, IN, MI, OH, WI)	-2.122 ***	0.748	0.005	-0.170
N. Central (IA, MN, ND, NE, SD)	-0.813	0.532	0.126	-0.086
Rocky Mountains (AZ, CO, MT, NM, NV, UT, WY)	-1.177 **	0.547	0.032	-0.111
West (CA, ID, OR, WA)	-1.336 **	0.679	0.049	-0.119
	Mean dependent var	0.192	S.D. dependent var	0.395
	McFadden R-squared	0.140	Adjusted R-squared	0.024

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively

**Table 4.11: SGEPABLK Model Results**

Variable Name	Coefficients	Standard Error	p-values	Marginal effect
<i>Constant</i>	0.619	1.044	0.553	
<i>Type</i>				
Dairy: no past	-1.605 **	0.804	0.046	-0.104
Dairy: w/past	-1.618	1.074	0.132	-0.070
Feedlot	-1.705 **	0.798	0.033	-0.085
Combo	-1.693 **	0.822	0.040	-0.090
<i>Size</i>				
501-1500 head	-0.889	0.661	0.179	-0.053
1501-3000 head	-0.343	0.591	0.562	-0.023
3001-6000 head	-0.434	0.638	0.497	-0.027
Less than 500 head	0.381	0.817	0.641	0.031
<i>Age</i>	0.012	0.020	0.541	0.001
<i>Location</i>				
Northeast (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)	-2.456 **	0.988	0.013	-0.103
Southeast (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	-0.999	0.751	0.184	-0.050
Midwest (IL, IN, MI, OH, WI)	-2.857 **	1.137	0.012	-0.109
N. Central (IA, MN, ND, NE, SD)	-1.003 *	0.605	0.097	-0.055
Rocky Mountains (AZ, CO, MT, NM, NV, UT, WY)	-1.334 **	0.658	0.043	-0.065
West (CA, ID, OR, WA)	-2.208 **	0.941	0.019	-0.084
	Mean dependent var	0.114	S.D. dependent var	0.318
	McFadden R-squared	0.140	Adjusted R-squared	-0.021

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively

## CHAPTER V: CONCLUSIONS

Research has shown the benefits of implementing strategic deworming programs throughout U.S. cattle operations. Merck Animal Health sells excellent deworming products that can add value to producer's operations; these products sales data do not reflect what are being used across the market. Although many producers use some form of parasite control product in their animal health protocols, Merck Animal Health sales of the non-handling formulations of Safe-Guard have lagged in comparison to the handling formulations, based on prior years' sales analysis.

This research project had an overall objective of assessing awareness of the product Safe-Guard within the U.S. cattle industry. The information from this research indicates a general lack of awareness of both non-handling and handling forms of Safe-Guard. Although there are certain operation types and locations that appear to have a slight increased awareness of the product when compared to others, most of the results point to producers being less likely to be aware of the products.

When participants were asked to indicate their awareness of the formulations of Safe-Guard through a survey, 55% of the 281 respondents indicated familiarity with Oral Suspension 10%, with 43% being familiar with Paste 10%, both of which are cattle handling formulations. Many of those respondents had operations in areas of the South-Central and South-East United States, and operated cow/calf operations that generally handle their cattle twice per year. The results show a general lack of awareness of other Safe-Guard formulations as 11% of respondents indicated familiarity with 1.96% flake meal, that can be conveniently mixed into Total Mixed Rations (TMR). However, 73% of respondents indicated TMR's as a feed delivery method. Another observation is that more

respondents indicated a higher percentage of familiarity with Safe-Guard equine paste (27%), than with all but one of the twelve non-handling formulations for cattle. Pellets and crumbles had 30% familiarity. This could be due to many beef operations also keeping horses, yet are unaware of the other formulations of Safe-Guard.

Use of internal deworming products, like Safe-Guard, have proven benefits for cattle producers. This product has the potential to grow with increased awareness and overall education about the features and benefits. Areas that potentially increase overall awareness and can aid company sales representatives in fully understanding the product features and benefits. Once these strategies have been implemented, sales representatives would then transfer their knowledge by helping producers understand the why of deworming is important and the differences in internal and external cattle deworming products, and the benefits of using a corresponding product form to their feed delivery methods.

People development is another strategy for Merck Animal Health to consider. By investing in their employees, they benefit through the increase in employee's knowledge and ability to share the information with producers. In addition, targeted marketing campaigns for specific geographies to include veterinarians, nutritionists and local feed stores will assist the sales representatives in better communicating their product mix to the customer.

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## APPENDIX A

Dear Producer,

My name is Tiffany Ligtenberg and I am a graduate student working to complete my Masters in Agribusiness (MAB) with an emphasis in Animal Health. The final step in fulfilling my MAB requirements is completing a thesis. As a part of my research for the thesis, I am interested in better understanding awareness of certain cattle deworming products available on the market, in addition to the economic impact of deworming protocols in cattle operations throughout the United States. You are invited to take an anonymous survey, either online or in print. Participation will take approximately 6-10 minutes. Your participation in this research is voluntary, and greatly appreciated.

Your name or personal identifiers will not be collected. When reporting and sharing data with others involved in my thesis, your responses will be combined with data from all participants, with no possible way of identifying individuals.

*If you have any questions, please contact Tiffany Ligtenberg at [tiffligt@gmail.com](mailto:tiffligt@gmail.com), or (575) 644-0951.*

To complete the short survey on your PC, tablet, or smartphone; please use the following link:

<http://bit.ly/tiffcattle>

Or if you choose to fill out this hard copy, you will find a pre-addressed envelope to return the completed survey.

Thank you for time, and for your assistance!

*Tiffany Ligtenberg*

Tiffany Ligtenberg  
*Graduate Student*

Cattle Deworming Product Survey conducted by Tiffany Ligtenberg

Q1. What is your primary type of operation?

*Circle your response.*

Calf ranch

Cow/Calf

Dairy; no pasture/grass access

Dairy; with pasture/grass access

Feedlot

Purebred

Stocker

Other; \_\_\_\_\_

Q2. What is the size of your operation?

*Circle your response.*

1-25 head

26-75 head

76-150 head

151-500 head

501-1500 head

1501-3000 head

3001-6000 head

6001 head or greater

Q3. What is your age?

Q4. What zip code is your primary business located in? (please give the 5-digit zip code)

Q5. Which of the following feed types do you use on your operation? (Choose all that apply)

*Circle your responses.*

- |                                       |                         |              |                   |
|---------------------------------------|-------------------------|--------------|-------------------|
| Hay<br>(pellets, textured feed, etc.) | Green chop              | Mineral      | Commercial feed   |
| Blocks                                | Cubes, cake             | Commodities  | Annual grazing    |
| Tubs                                  | Liquid                  | Range land   | Permanent pasture |
| Total mixed ration (TMR)              | Built-in roughage (BIR) | Other; _____ |                   |

Q6. Where do you gather information on animal health products? (choose all that apply)

*Circle your responses.*

- Television
- Face-to-face visit/discussions or meetings
- Social media (Facebook, Twitter, etc.)
- Product or Company website
- Newspaper (including digital news)
- Journals, Publications
- Industry meetings
- Cooperative Extension Services/University
- Other; \_\_\_\_\_

Q7. Of the following choices, which are instrumental in decision-making for animal health products? (choose the top 3)

*Circle your top 3 choices.*

Product detail sheets

Veterinarian

Nutritionist

Feed sales representative

Animal health sales representative

Distributor representative

Ag retailer salesperson

Social media updates

Word-of-mouth from neighboring producers and/or friends

Company directive

Extension service (Ag extension, Universities)

Price

Other; \_\_\_\_\_

Q8. Are you familiar with the following products?

*Please circle YES or NO for each option*

YES	NO	Safe-Guard Oral Suspension 10%
YES	NO	Safe-Guard Paste 10%
YES	NO	Safe-Guard Premix
YES	NO	Safe-Guard 1.96% Soft Mini-Pellets
YES	NO	Safe-Guard 1.96% Flake Meal
YES	NO	Safe-Guard 0.5% Pellets, Crumbles
YES	NO	Safe-Guard En-Pro-AI Blocks
YES	NO	Safe-Guard Protein Blocks
YES	NO	Safe-Guard Sweetlix 20% Blocks
YES	NO	Safe-Guard Cattle Cubes
YES	NO	Safe-Guard Free-Choice Mineral
YES	NO	Safe-Guard Equi-bits
YES	NO	Safe-Guard Equine paste
YES	NO	Safe-Guard EZ Scoop
YES	NO	Safe-Guard Zoo and Wildlife Dewormer
YES	NO	Panacur suspension
YES	NO	Panacur paste
YES	NO	Panacur powerpac

Q9. What motivates you to purchase a deworming product? (choose all that apply)

*Circle your responses.*

Improve herd health

Eliminate/control parasites

Add more pounds of milk

Better rate of gain

Low cost deworming product

Higher pregnancy rates

Increase profitability

Ease of product administration

Other: \_\_\_\_\_

Q10. Where do you purchase your animal health products? (choose all that apply)

*Circle your responses.*

Animal health store

Animal health route delivery truck

Local feed store

Ag retailer

Online order

Veterinarian/Veterinarian clinic

Catalog order

Other: \_\_\_\_\_

Q11. Over the past twelve months, what deworming products have you used on your cattle?  
(choose all that apply)

*Circle your responses.*

Agri-Mectin

Bimectin

Cydectin Injectable

Cydectin Pour-On

Dectomax Injectable

Dectomax Pour-On

Ivermax (any form)

Ivermectin Injectable

Ivermectin Pour-On

IVOMEK

LONGRANGE

Panacur

Safe-Guard

Synanthic

Valbazen

Vetrimec

Other: \_\_\_\_\_

Thank you for taking time to participate in this survey, and assisting me in my research!