

ECTOPARASITES AND THE LEATHER INDUSTRY*

by

JAY R. BROWN

Merial, Ltd

3360 MAURY AVENUE

ST. LOUIS, MO 63116

Even without knowing it, the first time I was exposed to the effect ectoparasites have on hide quality was when I was 4 years old and standing in the cattle barn, one late winter day, at my grandfathers farm in Illinois. One of his roan colored Shorthorn cows just gave birth to a white bull calf the previous spring and my grandfather told me that was "my calf". When he weaned the calf in the fall, I had to feed it, clean its stall, and brush it with a currycomb. All of this attention was to tame the calf and make sure it would become a gentle animal around the farm. That late winter Saturday when I was brushing this calf as it ate from the feedbunk, I could feel these very unusual "bumps" on its back. When I asked my grandfather what they were, he examined the calf and said "DAMN WARBLER" and then began to part the hair and squeeze these bumps like he was trying to "pop a pimple". And, sure enough out came several grub-like masses from the back of my beloved white bull calf. As a four-year old, that was quite traumatic and I can still recall it today as if I'm standing in the middle of that cattle stall in my grandfather's barn.

Little did I know that some 30+ years later I would still be working in a field which deals with things like *Hypoderma bovis*, *Linognathus vituli*, *Psoroptes bovis*, and *Hematobia irritans* almost on a daily basis. That is, I work with herd health programs and products designed to control Grubs, Lice, Mites, and Flies in U.S. beef herds.

As many of you know, ectoparasites may cause hide damage both directly as well as indirectly. Directly, by damaging the hide via penetration of their mouth or feeding apparatus to feed on serum or blood. And, indirectly by causing the host animal to scratch or itch themselves on objects in an attempt to rid themselves of these pests. This hide damage occurs in livestock produced throughout the world as these ectoparasites are prevalent throughout the world.

Why are we concerned about some damage that a "biting bug" might cause on the hide of some "critter in Kansas"? Well, for one thing there is an international, multi-million dollar leather industry fueled by hides, a by-product of the beef, pork, and lamb industries in several countries throughout the world. In the U.S. alone, hides have an export value

of \$1.5 billion.¹ Hide damage can contribute to significant losses to the leather industry. Industry experts have estimated there are losses of \$16-23 per hide in the U.S. from a variety of damaging factors.² Titchener, et. al., indicated that in the U.K. market, the hide value loss from lice alone exceeded \$12 million, while another \$30 million was attributed to traumatic damage due to itching, because of the lice.³

Several of my colleagues at Merial (and its predecessor company, Merck AgVet) have developed parasite control programs to greatly reduce the effect of and/or completely eliminate the effect of many of these damaging pests. Not only do these pests cause hide damage, which is directly of interest to this audience, they also can cause a multitude of other negative effects on overall herd productivity and profitability.

Below is the results of some of these control programs and/or studies documenting the benefit of using a broad-spectrum endectocide compounds such as ivermectin in parasite control programs. First of all we will look at some of the documented studies in which ivermectin was proven to have superior ectoparasite control over untreated or similarly treated groups.

Many of the parasite studies Merial field technical staff have conducted through the years have been under "real world" ranch conditions. One such trial was conducted to evaluate the practice of treating adult cows in the fall and their calves at late-summer, preconditioning; comparing 2 different treatment programs against untreated controls.⁴ This trial involved >1000 mixed breed cows on 5 different ranches located in SW Nebraska. Each ranch was used as a replicate in the study with the resident cows randomly allocated to one of three treatment groups on each operation. Beginning in the fall of 1995 and terminating at the fall weaning of 1997, each ranch maintained three separate, yet similar, spring-calving herds during summer grazing, winter cornstalks, and spring calving thereby avoiding any possible cross-contamination. The cows and their calves were treated with either IVOMEK® (ivermectin) Pour-On, SAFE-GUARD® (fenbendazole) and topical fenthion, or fenthion

*An Invited Lecture presented at the 98th annual meeting of the American Leather Chemists Association at Sky Top Lodge, PA on June 20 - 23, 2002

TABLE I
Combined 1996 and 1997 Data

1996 & 1997	IVOMEC PO	Safeguard/OP	Control/OP
Cow Eggs/gram	2.2	1.1	2.0
Mean Birth Date	Feb 26	Mar 3	Feb 29
Mean Birth Wt.	87.8	86.8	87.2
Mean Days of Age	226	225	229
Mean Weaning Wt.	608.0a	577.7b	583.9b
Mean Wt. Gain	520.3a	490.9b	496.4b
Mean ADG	2.31a	2.19b	2.20b
Calf Pre-Treat (Eggs/gram)	4.3	3.46	10.0
Calf Post-Treat (Eggs/gram)	9.9	15.9	83.6

only. Each group of cows was treated in the fall at pregnancy examination and then their calves were treated the following late-summer at preconditioning; which was from 45-60 days prior to weaning.

When combining data from both years (Table I), calves weaned from cows treated with IVOMEC Pour-On and treated themselves at pre-conditioning had higher weaning weights, weight gains, and average daily gains than calves weaned from cows treated with a combination of fenbendazole and fenthion; or calves weaned from cows treated only with fenthion.

An interesting development occurred in year 2 of the trial. During the late winter of 1997, the two treatment groups which used fenthion in the previous fall treatment of the cows experienced a re-infestation of biting lice in 4 of the 5 cooperating herds. Photographs taken in the early spring of 1997 depicts the three treatment groups. (Figure 1. Controls- fenthion only, Figure 2. Fenbendazole and Fenthion, and Figure 3. IVOMEC Pour-On) Visible signs of lice re-infestation appear in both the fenbendazole/fenthion and fenthion treated cows. This obvious, visible difference in lice infestation levels indicate that the cows treated with IVOMEC had a lower lice infestation level and therefore one could assume less insect damage to their hides (although this was not part of the trial parameters measured).

Other controlled parasite studies have been published indicating the superior effect IVOMEC has on controlling external parasites, such as lice. Below are 2 such studies. Figure 4 is from a trial involving lice negative calves randomly assigned to either a negative control or given IVOMEC Pour-On on Day 0. On Day 14 all the calves were exposed to lice positive donor calves. Lice counts were conducted weekly. The results indicated the calves treated with IVOMEC Pour-On remained negative through Day 49 of the study while the non-treated control calves were lice infested within 7 days of being exposed.

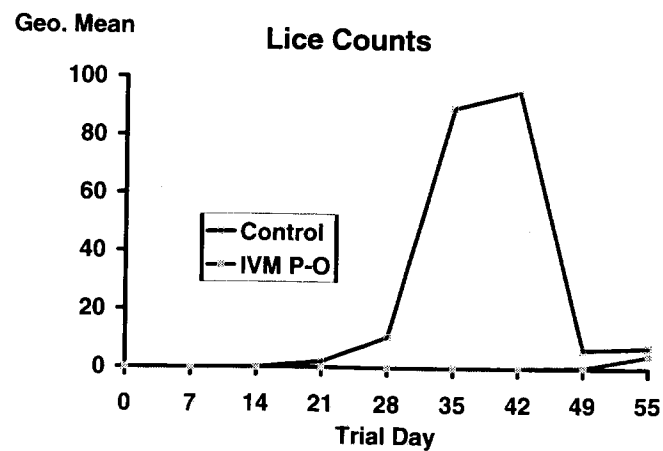


Figure 4. - Both groups Exposed to Lice Positive Donor Calves on Day 14 (Titchener, et. al., Veterinary Record, 1994)

Figure 5 is from a trial involving lice positive calves randomly assigned to be treated with either IVOMEC Pour-On or a pour-on product containing another endectocide product, Cydectin™ (moxidectin). The calves treated with IVOMEC Pour-On became lice-free by Day 14 and remained lice-free until the end of the study on Day 56. The calves treated with the moxidectin pour-on did not become lice free at any time during the 56-day study.

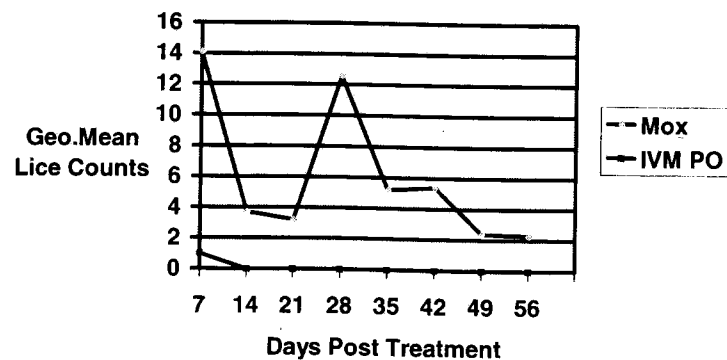


Figure 5. - IVOMEC Pour-On versus Cydectin (Polley, et. al., Veterinary Record, 1998)



Figure 1. - Fenthion only cows



Figure 2. - Fenbendazole and fenthion cows



Figure 3. - IVOMEC pour-on cows

In addition to these types of parasite studies, Merial field technical personnel have also sponsored studies looking directly at the effect controlling external parasites in cattle has on hide quality. A trial was conducted in New Zealand specifically to investigate the effects of ectoparasite control on hide quality.⁵ Five groups of 20 cattle were pastured separately to prevent cross infestation; the five treatment groups comprised:

- * Untreated control
- * IVOMEC[®] (ivermectin) injection for cattle given at 1ml/50kg liveweight
- * Amitraz 125g/l aqueous solution applied as a body spray.
- * Fenthion 2% aqueous solution applied topically as a pour-on.
- * Famphur 125 g/l solution applied topically as a pour-on.

The treatments were given according to local MAF (Ministry of Agriculture & Fisheries) guidelines which was at 4, 7 and 11 months of age. Parasite evaluations, using a scoring technique, were made 14 days before and after each treatment, at 14 months of age and immediately prior to slaughter at 18 months of age. Hides were evaluated after processing, again by a scoring system, for visible damage attributed to parasite infestation. The results of the effects of treatment on hide defects are shown in the table below:

TABLE II
Effects of Treatment on Hide Defects

Treatment	Mean Score for Hide Damage	
	Follicular Lesion	Grain Erosion
Control	2.1 ^a	1.7 ^a
Ivermectin	1.0^b	0.8^b
Amitraz	1.9 ^a	1.7 ^a
Fenthion	1.8 ^a	1.8 ^a
Famphur	2.0 ^a	1.8 ^a

^{a,b}Values in column with different superscript letters are significantly different P<0.05

As can be seen, the only treatment significantly reducing the incidence of the parasite-induced lesions and erosions in the hides was IVOMEC. At all inspections, the only ectoparasites found were lice, both biting (*Damalinia bovis*) and sucking (*Linognathus vituli*) with the latter predominating. The comparison between lice scores and hide damage shown below demonstrates that the improvement in hide quality seen in the group treated with IVOMEC was reflected in the superior control of lice compared to the other treatments.

TABLE III
Comparison Between Lice Score and Hide Damage

Treatment	Mean Lice Score ^a	Grain Erosion
Control	1.4	1.7
Ivermectin	0.1	0.8
Amitraz	0.5	1.7
Fenthion	0.9	1.8
Famphur	0.3	1.8

^aMean of scores at 11, 14 & 18 months of age

What these results show is that routine treatment of cattle with IVOMEC can control lice infestations with consequent improvements in hide quality and benefits to the leather industry.

As many of you are aware, the Beef Industry is undergoing some rapid structural changes. Consumer demand for beef has now been "increasing" for 10 straight quarters; a turnaround of some 20 years of declining beef demand. Even in the face of massive amounts of U.S. press coverage of Mad Cow and Foot & Mouth events in other parts of the world, beef demand was 5% greater in the 2nd quarter of 2001 versus 2nd quarter of 2000. Also, the emergence of Branded Beef Companies and the development of >100 "new" Beef Products are having an impact on these structural changes. Producers are no longer 'cattlemen', they are 'food producers' in the Beef Industry.

Animal Scientists have been conducting research on the effect and value of health in beef calves during the feeding phase of production for many years. Recently, they have focused their attention on not only the productivity parameters but also on the carcass parameters while evaluating the overall economic effect. Data from many sources have concluded that calves not having any Bovine Respiratory Disease (BRD) during their lifetime not only have better productivity than their counterparts who have been treated for BRD, but also have improved carcass quality grades and carcasses which are more tender. The publishing of these studies has led the U.S. cattle feeding industry to dramatically shift their focus from grazing and feedlot performance parameters only to a blend of productivity performance and carcass value. Simply put, the leading edge cattle feeding companies are now actively seeking replacement feeders, both calves and yearlings, which have received a known and documented health and management program.^{6,7,8}

Pre-conditioning programs for weaned calves and stockers were developed over 30 years ago. Just recently published

scientific research began to document the true value of these programs. During the first years of pre-conditioning programs, sponsoring cattlemen's groups and university personnel focused on creating "supply" of pre-conditioned cattle with little to no documentation on the real value to the next phase of production and the beef industry overall. For sure, little "demand" marketing was done in support of these various programs. The results were many segmented, fragmented pre-conditioning programs throughout the U.S. These programs focused solely on trying to add value only to the cow/calf producers and even then most programs tried to promote only the extra "price" a cow/calf producer might receive if they weaned and processed their calves prior to sale.

More recent data indicates there is true value in pre-conditioned calves due to the added dollars a cow/calf producer will gain, not so much from higher prices but from added weight and a truly immunized calf, prepared to move to the next stage of production. Thus, the cow/calf producer is selling more pounds (and dollars) per cow. Total dollars returned per cow is more important to the cow/calf producer's bottom line than price per pound. In addition, there is true value created for the total beef industry if calves and stockers are pre-conditioned before moving into the next phase of production in not only improved productivity performance but also in less death loss, treatment costs, and vastly improved carcass parameters. The days of looking strictly for "green" cattle to experience so-called "compensatory gain" appear to be a thing of the past.

In reviewing the protocols of a great number of the state, regional, and local pre-conditioning programs, we at Merial noticed almost all of these programs were based on Vaccination Only. The veterinary literature contains numerous studies on the factors effecting the bovine immune system. The administration of a potent and efficacious vaccine is only one factor. In fact, if the calf's immune system is "suppressed" or under stress, it is unable to mount an effective immune response even when efficacious vaccines are administered. That is why many arrival programs for stockers and feedlot cattle are designed with a second vaccination or "booster". For many cattle suffering a suppressed immune system or stress from various factors, this second vaccination is actually the first to cause any effect on the bovine immune system. The first "shot" did not cause immunization because the calf's immune system being unable to respond.

Scientists at Merck and now Merial, as well as leading veterinary scientists throughout the world have been studying the immunosuppressive effects of bovine parasites for over

30 years. In addition, many animal scientists have studied the effect of nutritional deficiencies, the effect of management stressors, and the effect environmental factors (such as weather) on the suppression of the immune system.

Parasites of all kinds; internal nematodes, external pests, and liver flukes have all been shown to have a negative effect on the bovine's immune system. One specific study, applicable to this discussion, was conducted in 1984 by Klesius, et. al. at Auburn University. This study looked at the effect of treating parasite-infected cattle with IVOMEC on the immune response to a Clostridial vaccine and an IBR vaccine given in the same time frame. Three groups of calves were studied in this trial. Two groups of parasite-free calves were infected with just one parasite, the nematode *Ostertagia*. And, one group was left as parasite-free. All three groups were vaccinated with a Clostridial vaccine and an IBR vaccine. One of the parasite-infected groups was also treated with IVOMEC. The immune response, both cell mediated and humoral, in the calves infected with parasites, but not treated with IVOMEC, was lower than the parasite-free calves. However, the parasite-infected calves treated with IVOMEC had an immune response to vaccination equal to the parasite-free calves.

This type of scientific information on the effect of health on productivity performance and carcass quality, the evidence indicating parasites can be immunosuppressive, and the studies showing certain management changes can improve the bovine's immune response led to the development of the first nationwide veterinarian certified pre-conditioning program, SUREHEALTH[™]. Merial with input from cattlemen (including cow/calf, stocker, and feedlot operations), beef industry leaders, and bovine veterinarians developed the Merial Certified SureHealth Calf Program.

Although SUREHEALTH is a "pre-conditioning" program for calves and stockers, it contains many unique segments compared to other programs of the past. SUREHEALTH increases the true value of any Certified SUREHEALTH Calf as the program will fit with any state, regional, or local pre-conditioning program. It requires different management procedures designed to improve the calf's immune response to vaccination, such as parasite control with a broad spectrum endectocide (IVOMEC) and a full 45 day weaning and acclimation period where all calves in the group are adjusted to a feed bunk and water trough. In addition, there is a complete vaccination protocol certified by a licensed veterinarian. This protocol includes 2-doses of the 4 viral antigens, IBR, BVD, PI3, and BRSV along with a one-dose Pasteurella leukotoxoid, and 2-doses of 7-way Clostridials. This unique feature of requiring both internal

AND external parasite control in the SUREHEALTH protocol can lead to improving hide quality for the beef industry due to the reduction of hide damage caused by external parasites.

Another unique feature of SUREHEALTH is that it also provides the beef industry Source and Process Verification for every calf is uniquely identified on the enrollment form and Merial is maintaining a database of each, should it ever be needed. This is becoming more and more important as the industry moves from the cattle industry to the beef industry and becomes more oriented on serving the consumer who wants to know where their steaks come from.

And, lastly (and maybe most importantly), Merial's support for SUREHEALTH goes beyond creating just a "supply" of SUREHEALTH calves like so many previous pre-conditioning programs have done. Merial is assisting in creating the "demand" for these calves by working with progressive marketing and auction companies to set up exclusive Certified SUREHEALTH Sales. In addition, to further increase demand and awareness of Certified SUREHEALTH Calves, Merial has developed the surehealth.com website. This website is designed as an information tool for stocker operations and feedlots in the market for these value-added calves; to find Certified SUREHEALTH Sales in their area. Merial will be conducting a direct mail campaign to these same potential buyers announcing these sales.

The cattle industry is rapidly changing. Through SUREHEALTH Merial is adding value to the Beef Industry and providing a unique product and service to the Leading Edge Cattlemen producing the safe and high quality beef the U.S. consumer is now demanding and also improving hide quality by reducing potential hide damage from external parasites.

REFERENCES

1. Byford, R. L. et. al.; A Review of Ectoparasites and Their Effect on Cattle Production. *J. Anim. Sci.* **70**, 597-602, 1992
2. National Cattlemen's Beef Association (1992): Final Report of the National Beef Quality Audit - 1991

3. Titchener, R. N. and Newbold, J. W.; Leather damage due to louse infestation of cattle. Proceedings of VIth European Multicolloquium of Parasitology, The Hague, Netherlands, Sept 7-11, 1992
4. Otto, D. L.; Comparison of Strategic Parasite Control with Different Compounds on the Productivity of a Beef Cow-calf Herd in the Northern United States., TS-USA-186, Merial Technical Bulletin
5. Halligan, G.; The relationship between bovine ectoparasite treatments and grain leather quality. *JSLTC* **75**, 94-98, 1991.
6. McNeil et. al.; 2000 TAMU, Ranch to Rail Program.
7. Garner et. al.; *J. Anim. Sci.*, 1999.
8. Cravey; SW Nutrition & Management Conf., 1996

CONVENTION DISCUSSION

David Rabinovich, Jos. H. Lowenstein & Sons, Inc. - My experience has been mainly in the tropics. Hides coming from the lower elevations, coastal plains, and deep valleys where the climate is hotter, lets say below 200 - 300 feet elevation, have much less grub holes than more temperate climate cattle between, lets say 800 meters and 1600 meters where coffee grows. When you get up high, past 1800 meters also you have less warble. Is this because of a fly or does it have to do with the surface temperatures?

I am not trained in entomology but my exposure to it from working for the company indicates that it would be related to the fly. You can't get the grub until you get the fly. If the fly is around, it has to have the cycle to be a fly again. The grub is just the intermediate stage of the fly. The flies only live for a short period of time. So it has to have that grub, the warble, to make another fly the next season whenever that is. So again, if you don't see the damage to the cattle and you don't see the grub itself, you don't have the flies there. So, evidently the elevation and or the temperature - the climatic conditions results in the flies not being there. You don't have mosquitoes when you get above a certain elevation so it is temperature and probably other types of climatic conditions that prevent that fly from being there. If the cattle are there and the fly was there, you would have the grub.