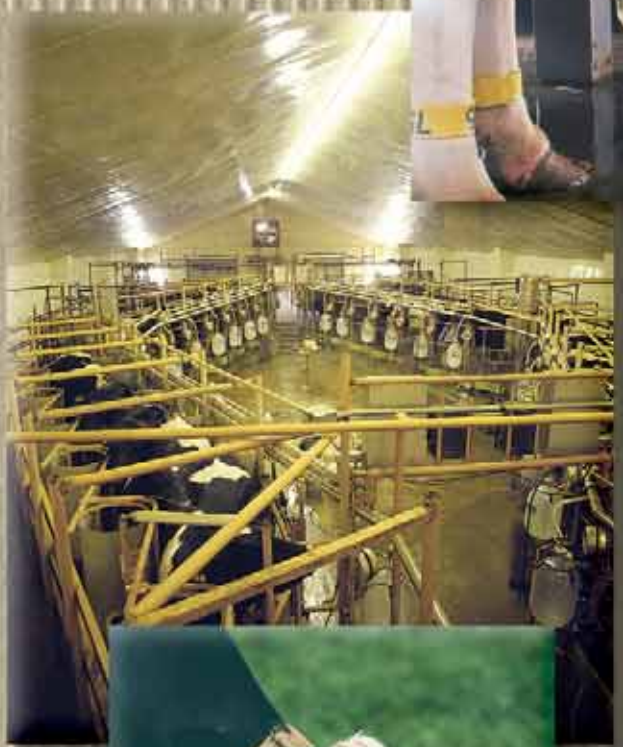
Safe-Guard® (Fenbendazole) / Panacur® (Fenbendazole) Deworming Strategies for Dairy Cattle



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Strategic Safe-Guard® (Fenbendazole) / Panacur® (Fenbendazole) Usage Prevents Losses Due to Gastro-intestinal Parasites

Deworming Dairy Cattle Has Become Increasingly Sophisticated

Many issues must be considered as dairymen begin to understand the overall importance of developing a complete parasite control strategy for their herds. First of all, dairy producers are concerned about the cost of production, and especially economic losses caused by a preventable disease such as parasitism. Knowing how to reduce or prevent these losses from occurring is critical for improving the efficiency of an operation since losses caused by parasites are usually cumulative over time. Then to make matters worse, parasitism has also been shown to make animals more susceptible to other disease problems.[1.]

The impact of parasitism on profitability can be calculated by subtracting the cost of prevention from the potential losses caused by the disease. Deworming dairy cattle involves more than just treating the animals after they become infected. For seasonal control, contamination of the animal's environment must be reduced to prevent harmful levels of parasitism from developing. The build-up of infective larvae in the environment can be damaging even if the ensuing parasitism doesn't fully develop in the animal, as cattle have to give up something in terms of production in order to fight-off these infections.

Detection is Foremost In The Economic Analysis

The ability to detect and evaluate losses as they occur is extremely important. However, measurement of actual losses within a dairy herd is often difficult to assess. Many economic factors are involved, and the proper parameters for measuring the economics of the losses are often lacking or overlooked. The economic effects of parasitism on cattle production have long been studied in general terms, however, specific losses that might be occurring in any given herd are nearly impossible to determine because the parasite infection must first be detected, and then the damage being done must be quantified in terms of economics.

Each dairy herd or dairy operation is a special case in terms of economic losses because of the many interacting factors that are specific to that herd. The influence of management, amount of parasite exposure an individual animal experiences, age when parasite exposure first occurs, maximum genetic potential of the individual animal, and the production goals of the overall herd are different for every dairy herd.

For most producers, the most complicated part of developing an efficient strategic deworming program is understanding the natural incidence and cycles of these parasites in cattle. Producers also need to understand that differences occur between age groups and management conditions, so every operation has a different parasite profile. Some dairy operations may have severe parasite problems while the herd next door may have few concerns. Herd management and production standards play big roles in influencing the severity of parasite damage or the degree of production losses due to parasites that occur in a particular operation. Obviously, the higher the production standards are for an animal and the closer it is to maximum production potential, the greater the damage parasites can inflict. Thus, it takes fewer parasites to cause economic losses in high-producing cows than in lower-producing animals.

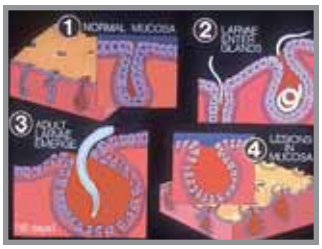
Five Main Categories of Parasitism in Dairy Cattle

Parasitism in dairy cattle can be broken into five main categories: Stomach worms, Intestinal worms, Liver Flukes, Lungworms, and Protozoa.

Stomach Worms:

● ***Haemonchus*** **(barber pole worm)** is a blood-sucking parasite that causes significant economic damage in cattle, but is especially damaging in sheep and goats. It is one of the most important causes of morbidity and mortality in these animals. Larval stages have been found in the rumen and abomasal tissues and are extremely hard to kill. Eggs are easily identified in a fecal exam.

● ***Ostertagia*** **(brown stomach worm)** is probably the most studied and prevalent parasite of cattle. Larval stages invade and temporarily destroy the gastric glands, so large numbers of parasites can significantly reduce acid production which in turn reduces digestion efficiency. *Ostertagia* has also been shown to adversely affect dry matter intake by reducing appetite. Larval stages can undergo inhibition and remain in the glands for months before emerging into lumen of the abomasum to develop into an adult worm. Eggs are easily identified in a fecal exam.



● ***Trichostrongylus*** **(bankrupt worm).** These parasites suck gastric fluids from mucosa and cause necrosis of the mucosa, so they can be very damaging in large numbers. Though this parasite has a distinctive kidney bean-shaped egg, most parasitology technicians don't separately distinguish their eggs from *Ostertagia* and *Haemonchus* but group them all together under the heading of "stomach worms."

Intestinal Nematode Parasites:

● ***Cooperia*** **(small intestinal worm)** disrupts digestive functions of the intestine. *Cooperia* is considered the second most prevalent parasite of cattle. Eggs are easily found in a fecal exam and are distinct because of elongated parallel sides. *Cooperia* is an underrated parasite in terms of damage caused by this worm.

● ***Nematodirus*** **(threadneck worm)** is most commonly found in young animals and is seldom found in adult cattle. Larvae survive well in cold weather and can live for two years on pasture. This parasite is a common cause of diarrhea and often causes death in young calves and yearling cattle. *Nematodirus* is very pathogenic and older animals acquire a strong immunity against this parasite. The egg is very large and is easily identified in a fecal exam.

● ***Trichuris*** **(whipworm)** is another very damaging parasite of young cattle. Symptoms are often confused with coccidiosis because of the bloody diarrhea associated with this parasite. Several hundred worms can kill a young calf. The egg is very characteristic and looks like a football with polar caps on each end. The female worm is not prolific and eggs are often missed in the fecal exam unless carefully conducted.

● ***Bunostomum*** **(hookworm)** adults suck blood feeding on a plug of mucosa in the intestine. The larvae penetrate the skin and migrate through the lungs, causing dermatitis and pneumonia. Calves on manure packs in the winter often become infected with hookworms. Their large eggs are easily identified with a fecal exam.

● ***Oesophagostomum*** **(nodular worm)** is becoming more important because intestines are often condemned at slaughter if nodules are found in large numbers. These parasites are associated with anorexia, depressed weight gain, and diarrhea. Nodular worms are most commonly found in adult cows and older yearling animals..

Gastro-intestinal and Lung Parasite Infections Found in Dairy Cattle

Intestinal Cestode Parasites:

- **(*Monezia benedeni*) Cattle Tapeworms** develop in the soil mite, which is ingested by cattle. The development time to reach an adult after ingestion is reported to be from 6 to 8 weeks. The adult tapeworm lives in the small intestine and can grow to be 1 inch wide and 6 feet long. They absorb nutrients through their cuticle. In high numbers, tapeworms can completely block the intestine. Tapeworm eggs are distinct and easily found in a fecal exam.

Cattle lungworms *(Dictyocaulus viviparous)*

Lungworms are acquired almost exclusively through grazing. Because lungworm larvae are not very mobile, they often require a heavy rain to move out away from the manure pat. Cattle on rotational and intensive grazing systems are often exposed to lungworms. Lungworm eggs are found in a fecal exam, but to detect the lungworm larvae the fecal sample must be subjected to a separate procedure called a "Baermann test." Postmortem check for lungworms entails removing the lungs and trachea intact, filling them with warm water, and pouring the contents on a flat surface so the lungworms are easily visible with the naked eye.

Trematodes Parasites (Liver flukes)

1. ***Fascioloides magna*** **(deer fluke)** is relatively untreatable in cattle. Diagnosis can be accomplished only upon necropsy since this fluke is encapsulated in the liver and cannot release its eggs. Infections can be spread by deer, with an intermediate snail host. The only current method of control is keeping cattle away from wet areas and streams where deer congregate.

2. ***Fasciola hepatica*** *(common fluke)* is found in the Gulf coast from Florida to Texas and along the Pacific coast regions from California/Nevada to Washington and east to Colorado. Treatment in late summer or early fall is desirable to reduce contamination. Snails can carry the infection through the winter, thus re-infecting cattle in the spring when grazing wet areas where infected snail habitat are present.

Protozoan Parasites of Cattle:

1. ***Coccidia*** are single celled protozoan parasites that all cattle are believed to be exposed to sometime in their life. Coccidia are very host specific such that coccidia of swine, dogs, and chickens won't infect cattle. The reverse is also true. Coccidia are ingested through fecal contaminated feedstuff. Wet muddy conditions usually increase infection levels.

   Cattle become infected when they ingest oocysts (egg-like structure) containing sporozoites, which escape the oocysts and penetrate the intestinal wall. A disease condition called *coccidiosis* occurs when coccidia numbers become high and the immune system of the animals becomes low. Coccidia are considered opportunistic, causing problems when animals are stressed or their immune system is under attack by other pathogens. Cattle shedding high number of oocysts indicate that cell damage is on-going. Coccidia oocysts can easily be found in a fecal exam.

2. *Giardia* is one of the most common protozoan parasite pathogens of humans and animals worldwide. Infections can occur with in the first week of life in calves and can persist for several months. A survey of 109 New York dairy farms indicated that 20% of the calves were infected.[2.] *Giardia* is an important parasite in cattle because it can cause diarrhea and ill health in calves and is a zoonotic threat to man from pasture runoff that can contaminate drinking water.

Understanding How Gastro-intestinal Parasites Affect Lactating Dairy Cows

Parasites Can Stress An Already Stressed Animal

Many milk production studies have been conducted over the years measuring the effect of deworming. The results of these studies were variable, often depending upon how the studies were designed and conducted. Since milk production is a highly variable trait greatly influenced by many environmental conditions as well as genetics, it is very difficult to accurately detect treatment benefits when conducting deworming trials under natural field conditions with commercial cattle.

Early studies identified the period following calving, when the dairy cow is under the greatest stress, as the period when parasites exert their greatest damage. It appears that several things transpire at the same time when calving occurs. In a high-producing cow, the calving period is one of "negative energy balance" when dry matter intake cannot meet production needs. As a result, animals have to draw off their stored energy to meet this high demand. An average cow may lose up to 200 lb. or more after calving. If parasites are present in the animal or if she is exposed to infective larvae during this period, another physiological stress is being added to an already stressed animal.

Internal Parasites Can Adversely Affect the Immune System

The second factor is the effect of gastro-intestinal parasites on the animal's immune system. One often-overlooked benefit of deworming is its impact on the effectiveness of vaccinations. Cows infected with parasites have compromised immune systems caused by the negative nutritional impact gastro-intestinal parasites exert on the immune system. In addition to this indirect impact, some parasites have a direct impact on the immune system though mechanical damage caused to the animal itself.

Immunosuppression occurs when parasites actively hinder one or more of the host's defense mechanisms.[3,] For example, Ostertagia secrete substances that suppress the host's immune system. During their development, Ostertagia larvae damage the glands of the abomasum, disrupting metabolism and possibly impeding immunity development simply by reducing availability of necessary nutrients like protein and trace minerals.

It has been shown that some parasites can cause cows to create immune cells that shut down the production of antibodies and macrophages, key components in a functioning immune system. Such measures ensure that the parasite will survive and be able to reproduce in the cow. These immune suppressive tactics that protect the parasite leave the cow susceptible to other invaders such as bacteria and viruses. As noted previously immunosuppression interferes with the host's ability to respond to a vaccination, one of our most effective tools for preventing infectious disease.

Risk Factors and Production Losses Caused by Gastro-intestinal Parasitism

How Many Parasites Are Needed to Cause a Problem?

Even a few parasites in a high-producing lactating dairy cow can reduce production. With internal parasites, it is well established that even a few parasites present during early lactation could become a detriment to achieving true production potential. The presence of parasitism soon after calving magnifies the stress which the cow is already undergoing and erodes her immune system. Parasitized cattle are harmed not only by the parasites themselves but also by the indirect damage parasites cause to the immune system. A recent study showed dewormed cattle had significantly fewer health problems compared to non-dewormed cattle.[4.] Pastured cattle have the greatest risk since their exposure to parasites is higher than cattle housed on dirt lots or in a confined facility.

Deworming studies conducted in the U.S. and Canada have demonstrated lactating cows may lose anywhere from 100 to 1,200 pounds of milk per lactation due to internal parasites [Table 1 on page 7 [5. - 13.]]. The greatest responses with treatment came from high-producing herds with moderate levels of parasite contamination. The deworming strategy was to keep the lactating animals parasite free for the first 90-100 days of lactation, i.e., deworming conducted at freshening and again six weeks later. These studies demonstrated that by removing parasites during the period of greatest stress during the early lactation period, production losses due to internal parasites could be prevented. A separate study conducted at the University of Wisconsin, confirmed this premise when parasite-free cows were exposed to infective larvae. Cows that were less than 90 days fresh lost on average 6.4# of milk per head per day.[5.]

The process whereby a 1600-lb. Holstein cow can be harmed by a few tiny parasites is complicated. Damage caused by parasites in the abomasum changes the physiology of the digestive system. Ostertagia, for example, completes its life cycle by spending time in a gastric gland. While a larva is in the gland it undergoes a molt, growing and expanding within the gland. The parasite mechanically destroys the gland, temporarily shutting-down acid production and causing blood leakage back into the gut tract. When acid production is reduced by the parasites in the gland, the pH rises and digestion efficiency is reduced.

Level of Efficiency Can Affect Production Losses

The more efficient an operation is the fewer parasites it takes to cause a problem. Further complicating the picture is the fact that parasite contamination levels may be less than they were just 20 years ago because of increased usage of better and more efficient dewormers. However, economic losses caused by parasitism are greater now because of increases in efficiency and higher production standards than were present just a few years ago.

Production standards have increased greatly over the past few years due to new technologies, such as the use of hormones, growth promoters, improved nutrition, improved genetics, and numerous other management changes. A few parasites in a cow producing 25,000 lb. annually will cause more problems to her health, reproduction, and production levels than a higher worm burden in a lower-producing cow. As dairy technology improves and animals move closer and closer towards their maximum genetic potential, it becomes very important for these herds to monitor for parasites and maintain a strategic deworming program for all animals in the herd.

Variation in Parasites Numbers and Levels of Contamination Rates Exists

Changes in weather, nutrition, management, and immune status of animals, and the amount of exposure each animal has within a parasite contaminated area (such as a pasture), affects the type of parasites present. This contamination will determine the numbers and type of parasites that are picked up and develop within cattle. Each type or species of parasite is different in terms of where it lives within the animal and how it survives during the part of its life cycle that is spent outside the animals.

Shifts in parasite populations have been reported where the predominate parasites found early in the year

may be different than those found later in the year. Dairy calves and heifers tend to have different parasite makeup and levels of parasites than adult cows. Also, the susceptibility of animals to parasites varies according to season of the year and the age and immune status of the cattle. Seasonal variation becomes a factor in northern climates where cattle are exposed to parasite infection from early spring to late fall. During winter months, animals have no opportunity to ingest infective larvae and,thus, immunity to parasites decreases until spring when exposure begins again. This is reflected in fecal worm-egg counts when non-treated adult cows have higher egg counts in late winter to early spring than in summer to late fall when immune status of the animal is the highest. The same is true for the lactation cycle when cows seem to be more refractory to parasites late in the lactation cycle. During the first few weeks after calving, cows undergo a "peri-parturient relaxation of resistance" and worm-egg counts appear to be the highest.

Age and Management Variations Affect Parasite Build-up in the Animals

Parasite build-up in animals is strongly related to management practices. How the animals are handled on pasture (stocking rate and grazing management) plays a major role in total parasite burden. Where the animals are housed is also important. Young animals housed on a "manure pack" during cold winter months can develop heavy infections with a number of intestinal parasites. These infections are called "barnyard" infections and are seldom ever seen in adult cows. These barnyard infections include *Trichuris* (whipworm), *Nematodirus* (threadneck worm), *Monezia* (tapeworm), *Bunostomum* (hookworm) and *Strongyloides* (threadworm). (See parasite description on page 2).

The actual numbers of parasites found in adult cows is small compared to young cattle with the same exposure to parasites. A survey of cull cows from 54 Wisconsin herds demonstrated that 0 to 12,000 parasites were found; but in a similar survey at 10 locations across the US and Canada involving 120 yearling cattle, from 0 to 265,000 parasites were recovered.[14,15] The reason for this large difference between mature cattle and young animals is not fully known. Certainly, age resistance plays a role, but it is not clear if this effect is due to an activated immune system of the cow resulting from parasite exposure, or due to mechanical damage to tissues caused by parasites at an earlier age that prevents larval development later on. Parasite numbers found in a animal may not be as important to production loss as the immune status of the animal, production levels of the animal, stage of lactation, and degree of exposure to parasites.

Production Losses in Dairy Cows Due to Gastro-intestinal Parasites

Table 1: Published trials measuring parasite effect on milk production in lactating dairy cows following anthelmintic treatment.

Study Location	No. of Herds	No. of Cows	Deworming Strategy	Results
Wisconsin[5.]	22	1,003	Dewormed Once Avg. 144 DIM*	+1.2 1b./day or +366 lb./lactation
Wisconsin[6.]	1	48	All cows exposed** To parasites Cows <90DIM 1# = 200 lb. / lactation	 +6.4 lb. / day +1,280 lb. / lactation
Wisconsin[7.]	12	488	Dewormed at Freshening	+ 423 lb. / lactation
Vermont[8.]	9	267	Parasite free First 90 days***	+ 534 lb. / lactation
Pennsylvania[9.]	9	180	Parasite free First 90-days	+769 lb. / lactation
North Carolina[10.]	5	160	Parasite free First 90 days	+1,075 lb. / lactation
England[11.]	1	210	Parasite free First 90-days	+ 827.2 lb. / lactation
Australia[12.]	1	58	Parasite free First 90 days	+338.8 lb. / lactation
Netherlands[13.]	81	2,025	Dewormed prior To freshening	+ 292.4 1b. / lactation
England[14.]	9	268	Dewormed prior To Freshening	+ 380.6 lb. / lactation
Overall	150 Herds	4,707 cows	One to three dewormings In early lactation	+ 628.6 lb. / lactation

* DIM = days in milk. ** Artificially exposed to parasite larvae. ***First 90 days of lactation.

The usage of endectocide pour-ons containing ivermectin, doramectin, eprinomectin or moxidectin may promote parasite resistance.

Endectocide pour-ons have become popular among cattlemen because they are easy to apply and cause less stress to animals compared with injectable formulations of the same product. Some concerns have risen about the prolonged usage of pour-on products by a number of parasitologists. Several of these concerns are:

1. Production losses due to failure of pour-ons to adequately remove internal worm burden may occur in some cases.
2. Continued egg shedding in pastures and, therefore, continued contamination if not dosed properly.
3. Parasites left following treatment by pour-ons may cause resistance to develop.

The reason for the potential lower efficacy is reduced absorption into the bloodstream of the active ingredient compared to injectable formulations.[16.] Blood level determination following treatment with doramectin in an injectable (90% absorbed) and pour-on formulation (15% absorbed) is described as follows:

1. 200 mg/kg injectable delivers a maximum plasma concentration of 32 µg/mL.
2. 500 mg/kg pour-on delivers a maximum plasma concentration of 12 µg/mL.

Two separate, but similar, field trials in New Zealand have shown moxidectin and ivermectin pour-ons perform poorly compared to a doramectin injectable. In the first trial, fecal egg counts from the pour-on-treated cattle reached a low of only 200 eggs per gram (epg)14-days following treatment. Counts rose to over 450 epg by day 28. In the second trial, egg counts from the pour-on-treated cattle groups reached a low of only 100 epg at 14 days. Counts in these groups climbed to 400 epg by the end of the trial at day 56. In both trials, cattle treated with doramectin injectable out-gained the cattle treated with moxidectin and ivermectin pour-ons. The average advantage was approximately 20 lb. ($P < 0.05$) over the 56-day period for both trials.

Nearly all endectocide manufacturers claim, "persistent efficacy" for these products, indicating long-lasting protection ranging from 14-28 days following treatment. A trial conducted at Louisiana State University by Dr. Williams indicates extended efficacy does not occur for ivermectin pour-on or doramectin pour-on formulations in those studies.[17.] (Table 2 page 8.)

Lack of extended efficacy.

The persistent efficacy indicated on the label for some products claims protection from re-infection during the persistent period. Once the animal is re-infected, the parasite undergoes a prepatent period during which time it develops into an adult stage. Another 4-6 weeks are required before worm eggs should appear in feces.

In the study below, neither pour-on product exceeded 85% reduction in fecal worm counts. The World Association for the Advancement of Veterinary Parasitology (WAAVP) has set a standard that if the efficacy of a product does not reduce worm egg counts greater than 90% following treatment, the product is designated as a "parasite resistant product."

Table 2: Fecal worm egg counts and percent reductions taken at weekly intervals from cattle following treatment with ivermectin and doramectin pour-on formulations.

Treatment Group	Post Treatment (worm eggs/3 g. samples)									
	0	7	14	21	28	35	42	49	56	70
Controls	193.7	96.8	93.0	100.7	73.1	53.0	77.0	111.3	98.3	55.5
Ivermectin	128.2	26.1	53.7	24.6	19.0	24.6	12.1	27.8	32.2	24.8
% Reductions		73%	43%	76%	74%	54%	85%	75%	68%	56%
Doramectin	217.8	36.7	42.5	41.5	37.2	27.3	18.1	33.6	21.1	20.0
% Reductions		62%	55%	59%	50%	49%	77%	70%	79%	64%

Source: Williams, et. al, 1999. Fecal worm counts were taken every seven days following treatment.

Monitoring Dairy Herds for Gastro-intestinal Parasite Infections

Every Herd Is Different When It Comes To Internal Parasitic Infections

There is a need for specific and adequately sensitive tests to detect the existence of a known subclinical disease and to measure the adverse effects of the subclinical disease. A highly sensitive test for detecting internal parasites in dairy cattle is the modified Wisconsin sugar flotation technique. It is proven to be an excellent test to determine the presence of parasite egg-shedding within a herd. Once the presence of parasite egg-shedding and the location within a herd is established, a specific control strategy can be implemented.

One key element for many dairymen is to first determine the parasite contamination level for their herd. One method to determine contamination level is to use the general guideline for determining parasite exposure under different types of herd management. The key issue is that the more the cattle are exposed to pasture conditions, the more parasite exposure occurs.

The Following Are Guidelines For Determining Parasite Exposure Of A Dairy Herd Based On Animal Management

1. High parasite contamination levels.

- Cows rotationally grazed during lactation.
- Cows exposed to pasture during lactation.

2. Moderate parasite contamination level.

- Cows exposed to pasture during the dry period.
- Cows with access to an exercise lot with grass (at least part of the year).

3. Low parasite contamination level.

- Cows with access to a dry, dirt lot only.

4. Extremely low parasite contamination level.

- Cows in total confinement on a dry lot.

A fecal exam is the most reliable and least expensive way to scientifically determine where infections exist on an operation. Lactating dairy cows can produce close to 100 lb. of manure each day. Looking for worm eggs in the feces is, therefore, like looking for a needle in the haystack, so a sensitive test must be used. The most sensitive fecal exam method developed to use with adult dairy cows is the modified Wisconsin sugar flotation technique. The type of exam conducted is very important; the Wisconsin sugar flotation method is the only exam sensitive enough to accurately detect parasite egg shedding in lactating dairy cows. The fecal exam technique is listed on page 18.

Obtaining A Comprehensive "Parasite Fecal Check" Of The Herd Can Be Important

Fecal checks help provide scientific information about parasite levels within a certain category of animals on an operation and determine exactly where the parasite infections occur within the herd. Fecal checks can determine whether the cows, heifers, or calves are harboring internal parasites, as well as the type of parasites present. One can then make an accurate assessment about the deworming strategy for each category of animal checked. Sampling approximately 5% to 10% of the herd is adequate. Samples should be obtained from every major age-group or category of animals on an operation. A small "zip-lock" bag is the best collection device to use, inverting the bag over the hand to pick up a golf ball-size sample from a fresh fecal pad. Make sure the sample bag is properly marked to identify where the samples were collected. Samples should be refrigerated or otherwise kept cool to prevent worm eggs from hatching before examination.

Based on approximate parasite exposure level, the following individual deworming programs are recommended for dairy cows

1. High parasite contamination level

- Treat all cows in the herd to remove parasite infections to begin program.
- Treat at freshening and again 6-8 weeks later.

2. Moderate parasite contamination level

- Treat at freshening and again 6-8 weeks later.
  (The second treatment is optional during the winter.)

3. Low parasite contamination level

- Treat once a year at freshening. A second treatment is probably not necessary.
  No treatment is required with a negative fecal exam.

4. Extremely low parasite contamination

Seasonal Control of Gastro-intestinal Parasitic Infections in Dairy Operations Using Safe-Guard® / Panacur®

(Fenbendazole) (Fenbendazole)

Establishing a Strategic Deworming Program

The economics of parasitism not only involves the development of parasites on pasture and under confined systems of management, but also involves the prevalence of parasitism in these systems. Knowing whether parasites are present on the operation is the first step to establishing a control strategy. Once the parasite presence is established, a control strategy can be implemented. Parasite development is usually seasonal depending upon location of the operation. Seasonal treatment is compromised slightly in lactating cows because their lactation cycles seldom match seasonal weather conditions. Strategic use of a dewormer on a seasonal basis may reduce parasite challenge for the entire year by as much as 85%. With lactating cows, keeping them parasite-free during the first trimester of lactation may require a slightly different approach. The best program for lactating dairy cows is a combination of seasonal treatment and individual treatment (see below).

Steps Necessary to Develop a Successful Control Program for the Prevention of Parasitism on an Operation

1. Select the Correct Product:

A deworming product must have FDA approval for use in lactating dairy cows without milk withdrawal, and should be highly efficacious with 98% efficacy against all of the important internal parasites (including lungworm) and all stages of parasites within the animal. This feature is important because a late fall deworming should remove all parasites from cattle at the time of treatment, so animals remains relatively parasite-free until the following spring. The dewormer should work quickly, especially with lungworms because cattle may die from infection if 2 or 3 days are required before the parasites are completely removed.

Safe-Guard®/Panacur® (fenbendazole) has been shown to be an extremely safe and most efficacious gastro-intestinal and lungworm dewormer, destroying worms within the first 12 hours after treatment. It can be used at any stage of lactation or gestation so it's safe to use in pregnant animals and it has zero milk withdrawal. Safe-Guard®/Panacur® can be administered as a single oral dose as a drench or paste, or top-dressed, mixed in the ration, or mixed in the TMR (total mixed ration). For non-lactating animals such as replacement heifers, Safe-Guard®/Panacur® can be administered in a medicated block or medicated mineral, which can be given free-choice to be eaten over a 3- to 6-day period to make sure all animals have time to come to the source and receive an adequate deworming dose.

Oral deworming with fenbendazole has been demonstrated efficient in removing both immature and mature stages of parasites. Deworming through the feed is a highly effective method because it places the dewormer into the gastro-intestinal tract exactly where the parasites are located. For free-choice deworming with Safe-Guard®/Panacur®, the dosage is cumulative in the parasite, so they are destroyed even if it takes several days for cattle to consume the adequate dose. Pour-ons are only effective if enough product is absorbed into the blood, which must then transport drug to the gastro-intestinal tract to kill the parasites. Recent studies demonstrate that most pour-on dewormers lack adequate absorption into the blood stream to be fully effective. Blood level studies show that only one-third the amount of pour-on product reaches the blood when compared to injectable formulations of the same product.[6]

2. Select the Correct Treatment Time for Adult Dairy Cows:

The best dewormer in the world used at the wrong time is a wasted resource. Treatment can be given on a herd basis or an individual basis or a combination thereof.

Strategy One - Overview

Individual or Group Treatment - Treat individual cows or use a feed-through dewormer every 2 to 3 weeks in the pre-fresh group, or individually at the time of calving. Ideally, deworming should be repeated 6 weeks postpartum or at breeding time when moderate or high levels of parasite contamination is found. The most important part of this strategy is to have the pregnant cows dewormed just prior to freshening, to make sure these cows are parasite-free at the beginning of the lactation period.

Deworming lactating dairy cows during transition period.

Deworming dairy cows just prior to freshening means that in herds where a separate group of cows close to freshening are housed and fed together deworming here may be easier than on the day of calving. Many operations find that when feeding transitional groups in free-stalls, deworming the cows via the feed in the TMR (total mixed ration) is cost-effective and labor saving.

By removing internal parasites during the pre-fresh period or just prior to freshening, cows are able to better handle stress associated with transition and early lactation. Since cows are continually entering and leaving the transition group, a set deworming schedule should be established for treating the whole transition group with feed-grade Safe-Guard® (fenbendazole) at the rate of 5 mg/kg.

In order to minimize extra deworming cost by deworming some cows twice during this period, a schedule should be designed which considers the length of the transition period and management practices of the farm. The following are two examples of how to set up a transition group-deworming program on the farm:

1. 14-day transition period – treat every two weeks
2. 21-day transition period – treat every three weeks.

The producer needs to estimate the weight of the cattle times the projected number of cows in the transition group for any given 2- or 3-week period. This calculation tells how much product needs to be mixed into the TMR.

Strategy Two - Overview

Herd Treatment – This treatment regime should be initiated in late fall, with a follow-up deworming given 4 to 6 weeks into spring grazing. The late-fall deworming should be given after a hard frost or after the pastures are dormant. The goal is to render the animal parasite-free going into the winter. Feeding parasitized animals during the winter is highly inefficient. The overall goal is two-fold: first, to create a parasite-free animal for maximum over-wintering ability; and secondly, to create an animal that remains parasite-free until it returns to spring pasture. This is required so this animal will not be shedding parasite eggs or recontaminating the pasture at the beginning of spring. Animals will not contribute to the recontamination of the pasture until they become reinfected by consuming infective larvae which have over wintered on the pasture, and until these parasites are mature egg laying adult parasites.

Strategy Three - Overview

Combination Treatment – All cows and young stock are dewormed in the fall as a whole-herd deworming. Beginning the following spring and early summer as cows and bred heifers come into the milk line, an individual deworming is given to each animal just prior to or at the time of freshening.

3. Selecting the Correct Treatment time for Replacement Heifers and Other Young Stock:

Replacement Heifer Treatment – Replacement heifers and other young stock on the operation should be treated on a seasonal basis depending on whether they are turned-out to pasture or not.

Pastured young stock – Treat all animals 4 and 8 weeks after turnout onto pasture or paddocks. Young cattle will begin shedding worm eggs in the feces 25 to 30 days after turnout onto spring pastures. Deworming the young stock twice 4 weeks apart in the spring significantly reduces pasture contamination for the entire summer grazing season. Deworm all animals at the end of the season in late fall or early winter to maintain parasite-free status.

Confined young stock – Most calves raised in confinement or on concrete yards are parasite-free unless housed on a manure pack or have access to dirt lots. Animals raised in total confinement should be checked for parasites every 6 months. Otherwise, deworming should be given at breeding time and again just prior to the time they enter the milk herd, i.e., just prior to freshening. Occasional fecal checks are important to make sure animals are parasite-free. Deworm all animals if any parasite eggs are found.

Animals in confinement can pick up "barnyard" infections, which include whipworm, threadworms, tapeworms, hookworms, and threadneck worms (*Nematodirus*).

4. Maintaining an Annual Treatment Program.

The economic benefits from strategic deworming improve year after year because as parasite contamination is reduced in the cows' environment, parasite control is easier to achieve. Strategic deworming is a management tool producers can use to make sure cattle are treated at the proper time each year, and to be assured that parasites are not interfering with their animals' production efficiency. The second year on a strategic deworming program is usually better than the first year because environmental contamination gets less each year the program is in place.

Conclusion:

Deworming dairy cattle is a venture that extends beyond just the treatment of clinical disease. The treatment of parasitism should be aimed first at the threat of economic loss and then at the reduction or elimination of the parasites as a potential future risk within an operation.

STRATEGY ONE

Individual 0-6 Deworming

Program with Safe-Guard®/ Panacur®
(Fenbendazole) (Fenbendazole)
for Adult Dairy Cows and First Calf Heifers

Day 0. Administering an Individual or Group Treatment Just Prior to Freshing: Deworming dairy cows and bred heifers just prior to freshening removes harmful parasites at a time in the lactation cycle when parasites can have their greatest adverse impact. In years past, many producers dewormed their cows at "dry off" and then turned them out into a "dry cow" pasture where the animals became reinfected. These cows would then return to lactation carrying significant worm burdens. A better option is to wait to deworm until just prior to freshening to achieve maximum benefit from the deworming, allowing the fresh cow to begin her production cycle parasite-free. Deworming trials demonstrate that adult cows and bred heifers entering the milking herd will all benefit from a deworming if parasites are present. Even cows with low parasite burdens responded to a pre-fresh deworming. The method of deworming cows just prior to freshening or at freshening will vary from operation to operation depending upon herd management.

6-Week Deworming. Administering Second Deworming in Early Lactation: Cattle that have access to pasture during lactation need additional treatment to control parasites acquired after the pre-fresh treatment. The strategic choice for the second treatment is 6 to 8 week s into lactation. Treatment at freshening and again 6 to 8 weeks later is based on the parasite life-cycle in the adult cow of approximate 40 to 45 days from the time of larvae ingestion until an adult worm is present in the gastro-intestinal tract. These two strategic timed treatments given to adult dairy cows are designed to provide maximum protection from parasites during their first 100 days of lactation. Deworming 6 to 8 weeks after freshening is timely because of the following:

- It removes any new infection acquired during early lactation when dairy cows are milking near peak production.
- It reduces further egg shedding, reducing herd exposure.

Treatment Method: At calving time, some herds will treat cows while in the calving pen, some will deworm during the close-up transition period, while others will deworm the day of calving. Herds that divide cows by production with high and low groups can rotate treatment in the high groups to make sure all cows receive the second treatment. Some operations will deworm by top-dressing Safe-Guard® on the feed, mixing Safe-Guard® in the TMR or other feed supplement, or by oral administration of a Panacur®/ Safe-Guard® with a specially designed dosing gun using either the suspension or paste. The paste gun can be hung by the calving pen and used as the cows are moved into the pen, and can be used in all types of weather including very cold conditions.

Strategy One

The 0-6 Individual Program For Adult Dairy Cows

Parasite Contamination Level	Dry Period	Freshening**	6 weeks into Lactation
High	Wait	Deworm	Deworm
Moderate	Wait	Deworm	Deworm (optional in winter)
Low	Wait	Deworm	Wait
Extremely Low	←	Monitor Annually	→

**If bred heifers were exposed to parasites during gestation, plan to deworm at freshening and then follow cow program.

STRATEGY
TWO

The Seasonal Herd Treatment

Program with Safe-Guard®/Panacur®
(Fenbendazole) (Fenbendazole)
for Adult Dairy Cows

Many dairymen prefer to deworm the whole herd at the same time. This allows the herdsman to focus on a single day where all animals on the operation receive a deworming treatment. In other dairy operations, individual cow treatments are inconvenient or impossible, and the only way to accomplish parasite control is through a whole-herd deworming.

The two best times for whole-herd deworming is (1) in late fall or early winter, and (2) again in mid to late spring:

Fall deworming is designed to remove gastro-intestinal parasites just prior to winter but after a hard frost, to reduce re-infection potential. The fall deworming, if given at the right time with the correct product, will maintain the cattle parasite-free throughout the winter period. These cattle should remain parasite-free until spring warm-up occurs and parasite larvae again become active. For herds with low or moderate worm burdens that only deworm once a year, usually the fall is selected for best maximum long-term protection.

Spring deworming is designed for dairy cows that are exposed to moderate or high levels of parasites. The cows grazing pasture or that are running on contaminated exercise lots all need a strategic mid-spring deworming to reduce environmental larval contamination. These cattle should be dewormed approximately 6 to 8 weeks after spring green-up or turnout. The timing of this treatment is important because it allows cows to pick-up infective larvae present in the spring. It then removes these parasites just before they reach maturity and begin shedding eggs back in the environment. In most adult cows it takes between 40 to 45 days for an infective larva to develop into a mature worm. Deworming 6 to 8 weeks after turnout or 6 to 8 weeks after pasture green-up allows the cattle to work like vacuum cleaners and pick-up infective larvae present in the spring. The strategic treatment removes these parasites before they have a chance to fully mature and begin laying eggs back into the environment. In yearling cattle and young calves this interval is 3 to 4 weeks.

Treatment Method: Some operations will deworm by top dressing Safe-Guard® on the feed, mixing Safe-Guard® in the TMR or other feed supplement, or by oral administration of a Panacur®/ Safe-Guard® with a specially designed dosing gun using either the suspension or paste.

Strategy Two

The Seasonal Herd Treatment Program for Adult Dairy Cows

	Late Fall	6 Weeks After Turnout**
High	Deworm	Deworm
Moderate	Deworm	Deworm
Low	Deworm	Wait
Extremely Low	←	Monitor Annually →

** or six weeks after
Monitor Annually start of spring grazing season.

STRATEGY
THREE

Combination Treatment

The Annual Whole Herd Deworming Strategy Given in Late Fall Plus Individual or Group Deworming Given During The Rest Of The Year

Dairy herds with pasture access during the dry period or anytime during the lactation period are often exposed to significant parasite challenges. These cattle need extra deworming attention throughout the year to prevent internal parasites from causing hidden damage. The following program involves a whole-herd deworming given in the fall, followed by individual deworming just prior to freshening during the rest of the year. Many dairymen find this a convenient and effective way to get year-round parasite control for adult dairy cows and bred heifers with moderate to high parasite exposure.

1. **Late Fall - Whole Herd Deworming:** Whole herd deworming is a convenient way to deworm all animals in a herd and protect them from parasites throughout the winter months. In most parts of the U.S., parasite contamination during winter months is limited, so a late fall deworming will eliminate parasites throughout the winter and into early spring before the reinfection process begins again. For best results, the timing of the deworming should occur late into the fall period, preferably in late November to early December to make sure pastures are dormant and the parasite season is completed.

2. **Individual or Group Deworming** at the time of freshening, just prior to freshening or during the transition period: Parasite transmission is seasonal in most parts of the country. Deworming cows just prior to freshening provides a strategically timed deworming that removes harmful parasites just prior to the time of greatest stress to lactating cows. Economically, deworming prior to freshening also spreads the cost of deworming over the year and attacks the parasites when they can cause the most damage.

Treatment Method: At calving time, some producers will treat cows while in the calving pen, some will deworm during the close-up transition period, while others will deworm the day of calving. Herds that divide cows by production with high and low groups can rotate treatment in the high groups to make sure all cows receive the second treatment. Some operations will deworm by top dressing Safe-Guard® (fenbendazole) on the feed, mixing Safe-Guard® in the TMR or other feed supplement, or by oral administration of a Panacur®/ Safe-Guard® with a specially designed dosing gun using either the suspension or paste. The paste gun can be hung by the calving pen and used as the cows are moved into the pen, and can be used in all types of weather including very cold conditions.

Overview

Combination Treatment – All cows and young stock are dewormed in the fall as a whole-herd deworming. Beginning the following spring and early summer, as cows and bred heifers come into the milk line, an individual deworming is given to each animal just prior to or at the time of freshening.

Strategic Treatment Guidelines

1. **Animals weighing less than 300 to 400 lbs.:**
   - Treat 3 to 4 weeks after turnout onto pasture and again 3 to 4 weeks later.

2. **Greater than 400 lbs., but less than 800 lbs.:**
   - Treat at turnout, or start of grazing; then 3 to 4 weeks after turnout and 3 to 4 weeks later. Treatment at turnout is not necessary if animals were treated at the end of the previous grazing season.

3. **Greater than 800 lbs.:**
   - Treat at turnout and 4 to 5 weeks later. Treatment at turnout is not necessary if animals were treated at the end of the previous grazing season.

4. **First-calf heifers:**
   - Deworm all of them before they enter the adult herd.

Strategy Guidelines for Replacement Heifers, Bulls and Steers

Treatment During Grazing Season			
	1st	2nd	3rd
300 - 400 lbs.	3-4 weeks after turnout*	3-4 weeks later	
400 - 800 lbs.	Turnout*	3-4 weeks later	3-4 weeks later
>800 lbs.	Turnout*	4-5 weeks later	

*or at the start of the grazing season.

Overall Strategic Deworming Objectives for Dairy Herds

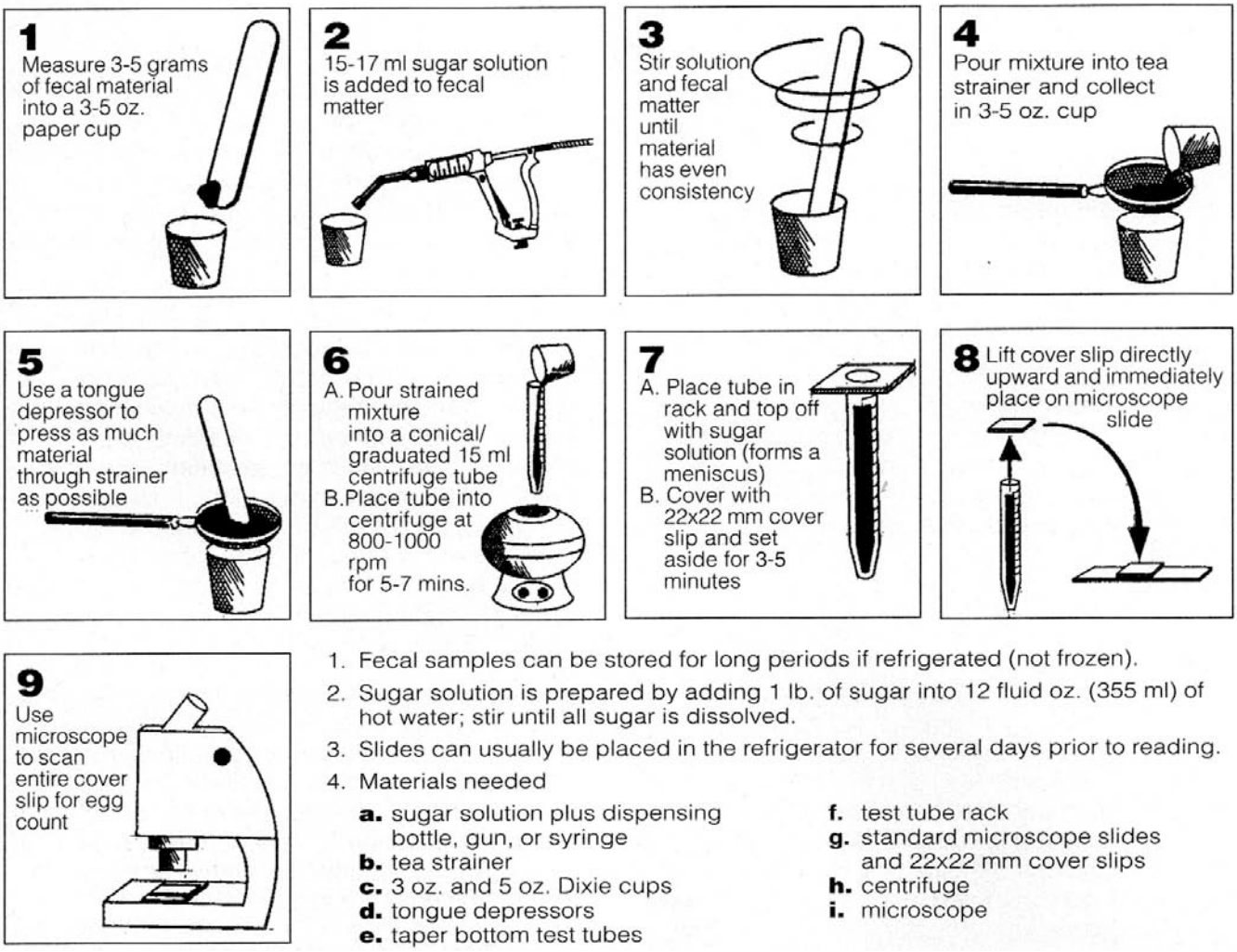
A strategic deworming program for the whole herd achieves these objectives:

- Replacement heifers attain maximum growth and development to reach breeding size unhampered by parasites.
- Replacement heifers are "parasite free," so as not to introduce any new infections to the milking herd.
- Control measures are in place for all cows exposed to any parasite contamination levels.
- Lactating cows attain maximum lactation potential, unhampered by parasites.
- Deworming dollars are not wasted on cows in late lactation, on dry cows or on parasite-free animals.

Dairy producers should consider deworming as they would any management tool, with an eye toward maximum return on investment. By carefully following a strategic deworming program with an effective and convenient treatment regimen, today's dairy producer can realize economic benefits from lactating cows, steers, and replacement heifers that far outweigh the costs..

Modified Wisconsin Sugar Fecal Worm Egg Flotation Method

Determining whether a herd is exposed to parasites can be accomplished easily using a sensitive fecal worm egg flotation technique. The Modified Wisconsin Sugar Flotation Method is the recommended technique for dairy cattle.



1. Fecal samples can be stored for long periods if refrigerated (not frozen).
2. Sugar solution is prepared by adding 1 lb. of sugar into 12 fluid oz. (355 ml) of hot water; stir until all sugar is dissolved.
3. Slides can usually be placed in the refrigerator for several days prior to reading.
4. Materials needed
   - **a.** sugar solution plus dispensing bottle, gun, or syringe
   - **b.** tea strainer
   - **c.** 3 oz. and 5 oz. Dixie cups
   - **d.** tongue depressors
   - **e.** taper bottom test tubes
   - **f.** test tube rack
   - **g.** standard microscope slides and 22x22 mm cover slips
   - **h.** centrifuge
   - **i.** microscope

The Wisconsin Sugar-Flotation technique is more sensitive than the Fecalyzer technique if low numbers of eggs are present as is usually the case in dairy cows. A fecal sample from a dairy cow was subdivided and the following results were obtained:

Method	Number of Subsamples	Number Positive (%)	Avg.. EPG from Pos. Subsamples
Wisconsin Sugar	10	10 (100)	7.8
Cornell-McMaster	10	2 (20)	50.0
Fecalyzer	10	3 (30)	1.0

IT PAYS TO COMPARE

DEWORMING COMPARISON CHART

Not all dewormers are created equal. There are different worms. Different stages. And different levels of efficacy. To get the most out of your investment and your cows, you need the product that's proven successful against the internal parasites that have the most potential to steal performance and profit. That product is Panacur® *(fenbendazole)* / Safe-Guard® *(fenbendazole)*

WORMS		PANACUR®/ SAFE-GUARD® SUSPENSION (Fenbendazole)	CYDECTIN® POUR-ON [1,2] (Moxidectin)	EPRINEX®[1,2] (Eprinomectin)	RUMANTEL® (Morantel Tartrate)
BROWN STOMACH (*O. ostertagi*)	ADULT	★	★	★	★
BARBERPOLE (*Haemonchus spp.*) (*Placei & Contortus*)	ADULT	★	★	★	★
	L4	★	★	★	NO
SMALL STOMACH (*T. axei*)	ADULT	★	★	★	★
	L4	★	★	★	NO
BANKRUPT (*T. colubriformis*)	ADULT	★	★	★	★
	L4	★	★	★	NO
SMALL INTESTINE (*Cooperia punctata, C. oncophora*)	ADULT	★	★	★	★
	L4	★	★	★	NO
THREADNECKED (*Nematodirus helvetianus*)	ADULT	★	★	★	★
	L4	★	★	★	NO
HOOKWORM (*B. phlebotomum*)	ADULT	★	★	★	NO
	L4	★	NO	★	NO
NODULAR (*O. radiatum*)	ADULT	★	★	★	★
	L4	★	★	★	NO
LUNGWORM (*D. viviparus*)	ADULT	★	★	★	NO
	L4	NO	★	★	NO

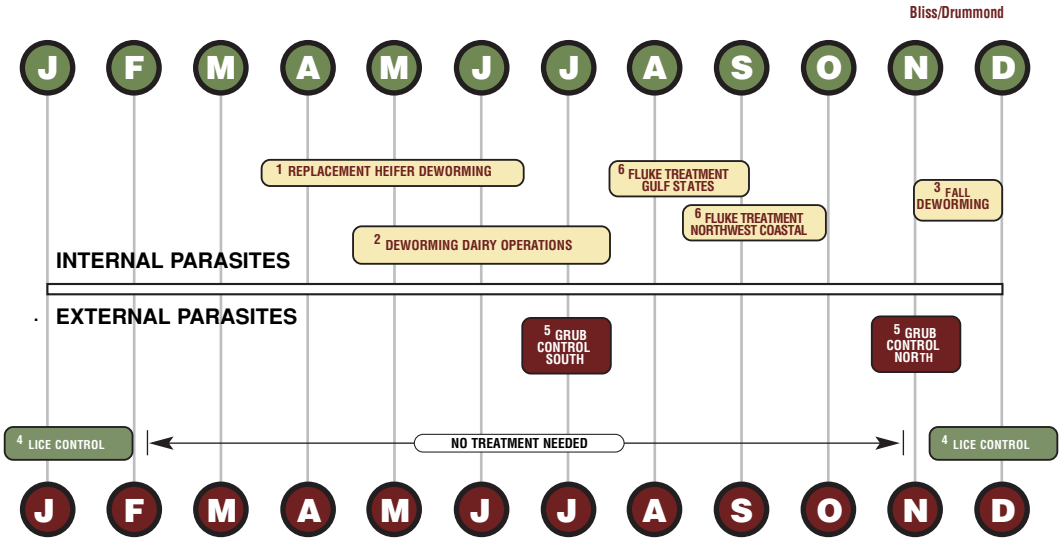
[1] Also approved for external parasite control
[2] Also approved for horn-fly control

CONTROL THE RIGHT WORMS, AT THE RIGHT TIME.

When you need to deworm, Panacur® / Safe-Guard® is your best choice against the internal parasites that can cause the most economic damage.

1. Replacement heifers dewormed at turnout, four and eight weeks after onset of grazing (0-4-8).
2. If cattle were not dewormed in the fall, adult dairy cows should be dewormed at pasture turnout and again six weeks after onset of grazing.
3. All cattle retained over winter should be dewormed.
4. During lice season, two treatments two to three weeks apart may be necessary
5. Grub treatment three to four months after the end of heel fly season, varies south to north. Requires systemic, annual control only.
6. Cattle grazed along the Gulf Coast and Northwest coast should be treated for adult and immature liver flukes.

(Horn-fly control as needed to keep populations below 200 flies per animal.)



References

1. Kelly JD. Immunity and epidemiology of helminthiasis in grazing animals. *New Zeal Vet J* 1973; 21:183-194.
2. Segwlken R. Pathogenic parasite study could preserve farming in New York City water shed. *Cornell Science News* 1996; July.
3. Sonstegard TS, Gasbarre LC. Genomic tools to improve parasite resistance. *Vet Parasite* 2001; 101:387-403.
4. Smith RA, Rogers KC, Husae S, et al. Pasture deworming and (or) subsequent feedlot deworming with fenbendazole. I. Effects on grazing performance, feedlot performance and carcass traits in yearling steers. *Bovine Practitioner* 2000; 34(2):104-114.
5. Bliss DH, Todd AC. Milk production by Wisconsin dairy cows after deworming with Baymix™. *VM/SAC* 1973; October.
6. Bliss DH, Todd AC. Milk Losses in dairy cows after exposure to infective trichostrongylid larvae. *VM/SAC* 1977; October.
7. Bliss DH, Todd AC. Milk production by Wisconsin dairy cattle after deworming with thiabendazole. *VM/SAC* 1974; May.
8. Bliss DH, Todd AC. Milk Production by Vermont dairy cattle after deworming (two deworming during the first 90 days of lactation). *VM/SAC* 1976; September.
9. Todd AC, Bliss DH, Grisi L, Crowley JW. Milk production by dairy cattle in Pennsylvania and North Carolina after deworming (treatment at freshening and systemically over the first three months of lactation. *VM/SAC* 1978; May.
10. Bliss DH, Jones RM, Condor DR. Epidemiology and control of gastro-intestinal parasitism in lactating, grazing adult cows using a morantel sustained release bolus. *Vet Record* 1982; February.
11. Mathews GL, Gray RM, McGowan AA. Effects of anthelmintic treatment immediately after calving on milk production. *Aust Vet J* 1983; April.
12. Ploeger HW, Koosterman A, Bargeman G, et al. Milk yield increase after anthelmintic treatment of dairy cattle related to some parameters estimating helminth infection. *Vet Parasitology* 1990; 35.
13. McBeath DG, Dean SP, Preston NK. The effect of prepartutient fenbendazole treatment on lactation yield in dairy cows. *Vet Record* 1979; December.
14. Gutierres V, Todd AC, Crowley JW. Natural populations of helminthes in Wisconsin dairy cows. *VM/SAC* 1979; 74:369-374.
15. Bliss DH, Newby TJ. Efficacy of the morantel sustained-release bolus in grazing cattle in North America. *J Amer Vet Med Assoc* 1988; 192(2):177-181.
16. Pfizer Inc. Dectomax® Monograph. 1996.
17. Gaynard V, Valvinerie M, Toutain PL. Comparison of pharmacokinetic profiles of doramectin and ivermectin pour-on formulation in cattle. *Vet Parasitology* 1999; 81:47-55.
18. Williams JC, Loyacano AF, DeRosa A, et al. Comparison of persistent anthelmintic efficacy of topical formulations of doramectin, ivermectin, eprinomectin and moxidectin against naturally acquired nematode infection of beef calves. *Vet Parasitology* 1999; 85:277-288.

PANACUR® (fenbendazole) BEEF AND DAIRY CATTLE DEWORMER

1 Gallon (3785 mL)
Suspension 10% (100 mg/mL)

▶ RESIDUE WARNINGS: ◀

- **Cattle must not be slaughtered for human consumption within 8 days following treatment.**
- **Do not use at 10 mg/kg in dairy cattle. Dose rate of 10 mg/kg is for beef cattle only. Dose rate of 10 mg/kg in dairy cattle could result in violative residues in milk.**
- **A withdrawal period has not been established for this product in pre-ruminating calves. Do not use in calves to be processed for veal.**

CAUTION:
Federal law restricts this drug to use by or on the order of a licensed veterinarian.

Keep this and all medication out of the reach of children.

DOSAGE:
Beef and dairy Cattle - 5 mg/kg (2.3 mg/lb) for the removal and control of:
Lungworm: *(Dictyocaulus viviparus)*
Stomach worm (adults): *Ostertagia ostertagi* (brown stomach worm).
Stomach worm (adults & 4th stage larvae): *Haemonchus contortus/placei* (barberpole worm), *Trichostrongylus axei* (small stomach worm).
Intestinal worm (adults & 4th stage larvae): *Bunostomum phlebotomum* (hookworm), *Nematodirus helvetianus* (thread-necked intestinal worm), *Cooperia punctata* and *C. oncophora* (small intestinal worm), *Trichostrongylus colubriformis* (bankrupt worm), *Oesophagostomum radiatum* (nodular worm).

Beef Cattle Only - 10 mg/kg (4.6 mg/lb) for the removal and control of:
Stomach worm (4th stage inhibited larvae): *Ostertagia ostertagi* (Type II Ostertagiasis).
Tapeworm: *Moniezia benedeni*

▶ Do not use in dairy cattle at 10 mg/kg. ◀

DIRECTIONS:
Determine the proper dose according to estimated body weight. Administer orally. In beef and dairy cattle, the recommended dose of 5 mg/kg is achieved when 2.3 mL of the drug is given for each 100 lb. of body weight. In beef cattle only, the recommended dosage of 10 mg/kg for treatment of Ostertagiasis Type II (inhibited 4th stage larvae) or tapeworm is achieved when 4.6 mL of the drug is given for each 100 lb. of body weight.

EXAMPLES:

Dose (5 mg/kg)	Dose (10 mg/kg)	Cattle Weight
2.3 mL	4.6 mL	100 lb
4.6 mL	9.2 mL	200 lb
6.9 mL	13.8 mL	300 lb
9.2 mL	18.4 mL	400 lb
11.5 mL	23.0 mL	500 lb
23.0 mL	46.0 mL	1,000 lb
34.5 mL	69.0 mL	1,500 lb

Under conditions of continued exposure to parasites, retreatment may be needed after 4–6 weeks. There are no known contraindications to the use of the drug in cattle. For dairy cattle there is no milk withdrawal period at 5 mg/kg.

Distributed by:
Intervet Inc., Millsboro, DE 19966

Store at or below 25°C (77°F).
Protect from freezing.
Shake well before use.

NADA #128-260,
Approved by FDA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