Preventable Losses Due to Gastro-Intestinal Parasites

Deworming Dairy Cattle Has Become Increasingly Sophisticated

As dairymen begin to understand the overall importance of developing a complete parasite control strategy for their herds many things need to be considered. 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 very valuable to the efficiency of an operation since losses caused by parasites are usually cumulative over a period of time. To make matters worse, parasitisms have been also shown to make animals more susceptible to other disease problems.

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

Detection is Foremost in the Economic Analysis

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

Each dairy herd or dairy operation is a special case in terms of economic losses they might be experiencing because of many influencing factors which 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.

The most complicated part of developing an efficient strategic deworming program for most dairymen is being able to understand the natural occurrence of these parasites in cattle. A producer also needs to know that differences occur between age groups and management conditions. Every operation has a different parasite profile. Some dairy operations may have severe parasite problems while the herd next door may have little or no problems. Herd management and production standards play a big role in influencing the amount of parasite damage or the amount of production loss due to parasites that occurs in a particular operation. Obviously, the higher the production standards are for an animal and the closer it is to maximum potential production the greater the damage parasites can cause. It takes fewer parasites, therefore, in high producing cows to cause economic loss than it takes in lower producing animals.

Gastro-Intestinal and Lung Parasite Infections Found 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 (the barber pole worm) is a blood-sucking parasite. This parasite is a very economically damaging parasite in cattle but is especially damaging in sheep and goats becoming one of the most important causes of death 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.

Ostertugia (brown stomach worm) is probably the most studied and prevalent parasite of cattle. Larval stages invade and destroy the gastric glands. Large number of parasites can significantly reduce digestion efficiency. Larval stages can undergo inhibition and remain in the glands for months before emerging into lumen of the abomasums to develop into an adult worm. Eggs are easily identified in a fecal exam.

Trichostrongylus (bankrupt worm). Sucks gastric fluids from mucosa, causes necrosis of the mucosa and therefore can be very damaging in large numbers. This parasite has a kidney bean shaped egg but most parasitology technicians don't distinguish this egg separate from Osterlagia and Haemonchus but rather group them together under the heading of "stomach worms."

Intestinal Nematode Parasites:

Cooperia (coopers 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 time's death in young calves and yearling cattle. Nematodirus is very pathogenic and older animals acquired a strong immunity against this parasite. The egg is very large and is easily identified in fecal exam.

Trichuris (whipworm) is another very damaging parasite in young cattle. Often time's symptoms are 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. Eggs are easily identified on fecal exam. Often these large eggs are in the 8 to 16-cell stage when passed.

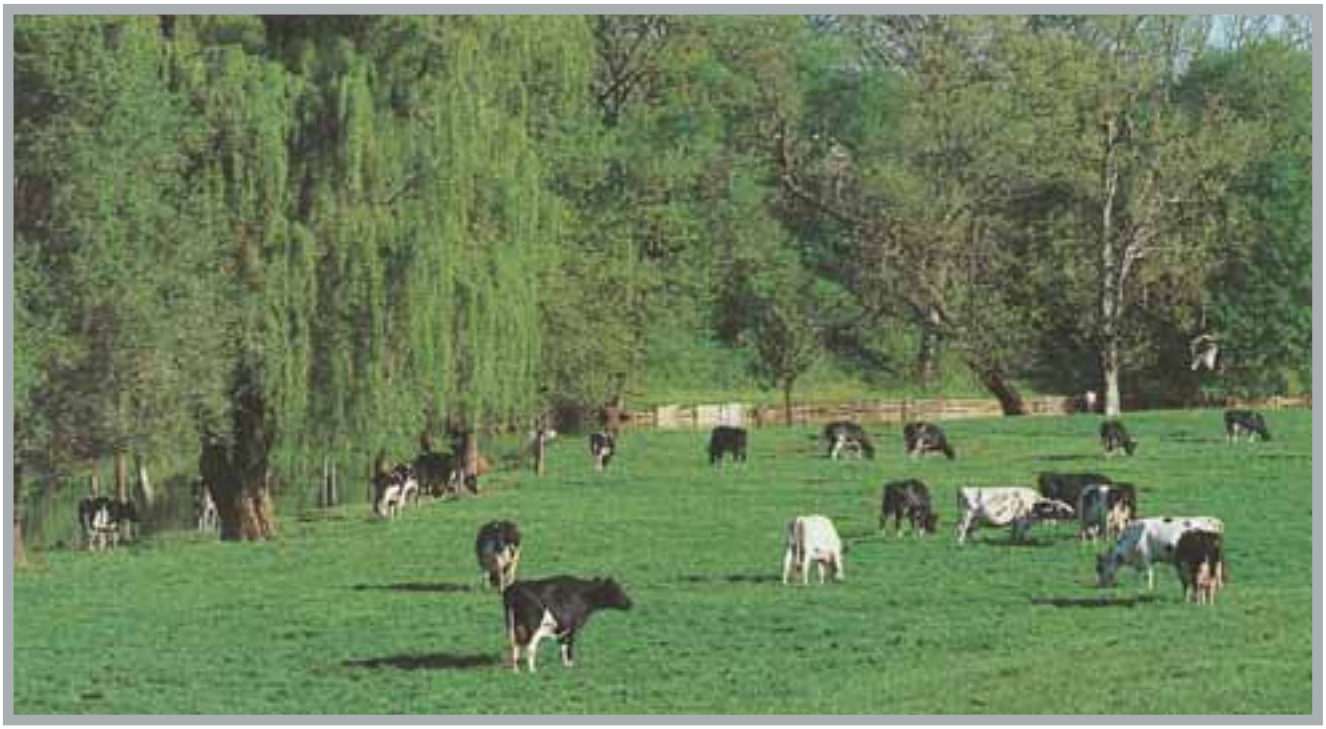
Oesphagostomum (nodular worm) is becoming more important because intestines are often condemned at slaughter if nodules caused by the nodular worms are found in large numbers. Parasites are associated with anorexia, depressed weight gain, and diarrhea. Most commonly found in adult cows and older yearling animals.

Intestinal Cestode Parasites (Cattle Tapeworms):

The tapeworm develops in the soil mite, which is ingested by cattle. The development time to reach an adult after ingestion is reported to be from six to eight weeks. The adult tapeworm lives in the small intestine and can grow to be 1 inch wide and six feet long. They absorb nutritions through their cuticle. In high numbers tapeworms can block the intestine. Tapeworm eggs are distinct and easily picked up on a fecal exam.

Cattle lungworm (*Dictyocaulus viviparous*):

Lungworms are acquired almost exclusive through grazing. Lungworm larvae are not very mobile and, therefore, 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. Lungworms are not pick up well in a fecal exam but rather the fecal must be subjective to a separate test called a "baermann test" to find lungworm larvae. Postmortem check for lungworms entails removing the lungs and trachea intact, filling with warm water and pouring the contents on a flat surface, lungworms are easily visible with the naked eye.

Trematodes Parasites (Liver flukes):

1. **Fascioloides magna** (deer fluke) found in the Great Lakes region is relatively untreatable in cattle. Diagnosis can be done accurately but only upon necropsy since this fluke is encapsulated in the liver and cannot release its eggs. Infections can be spread with deer with an intermediate snail host. Keeping cattle away from wet areas and streams where deer congregate is currently the only method of control.
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 and cattle become re-infected in the spring when grazing wet areas where infected snail habitat.

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. Coccidiosis often occurs when an animal becomes stressed. Cattle shedding high number of oocysts indicate cell damage is ongoing. 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. It 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.

Risk Factors and Production Losses Caused by Gastro-Intestinal Parasitism

How Many Parasite Are Needed to Cause a Problem?

Even a few parasites in a high producing lactating dairy cow can reduce production. With internal parasites, it 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 is magnifying the stress, which the cow is already undergoing and attacking her immune system. Parasitized cattle are harmed; not only by the parasites themselves but also by the indirect damage the parasites cause to the immune system. A recent feedlot study showed dewormed cattle had significantly fewer health problems compared to non-dewormed cattle. 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 8). 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., dewormings at 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 6.5# of milk per head per day.

The process whereby a 1,600 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. One, worm, Ostertagia, for example, completes it life cycle by spending time in a gastric gland. While this larva is in the gland it undergoes a molt growing and expanding within the gland. The parasite temporary mechanically destroys the gland 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 that the parasite contamination levels may be less than they were just 20 years ago, this is because of increased usage of better and more efficient dewormers. Economic loss caused by the parasitism is greater now because of increases in efficiency and higher production standards than was present just a few years ago.

Production standards have increased greatly over the past few years due to new technology such as the use of hormones, improved nutrition, improved genetics and numerous other management changes. A few parasites in a cow producing 25,000 pound 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 that needs protection.

Variation in parasites numbers and levels of contamination rates exists

Changes in weather, nutrition, management, immune status of the 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 parasite present and the numbers of parasites that are picked up by animals and develop within such animal. 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.

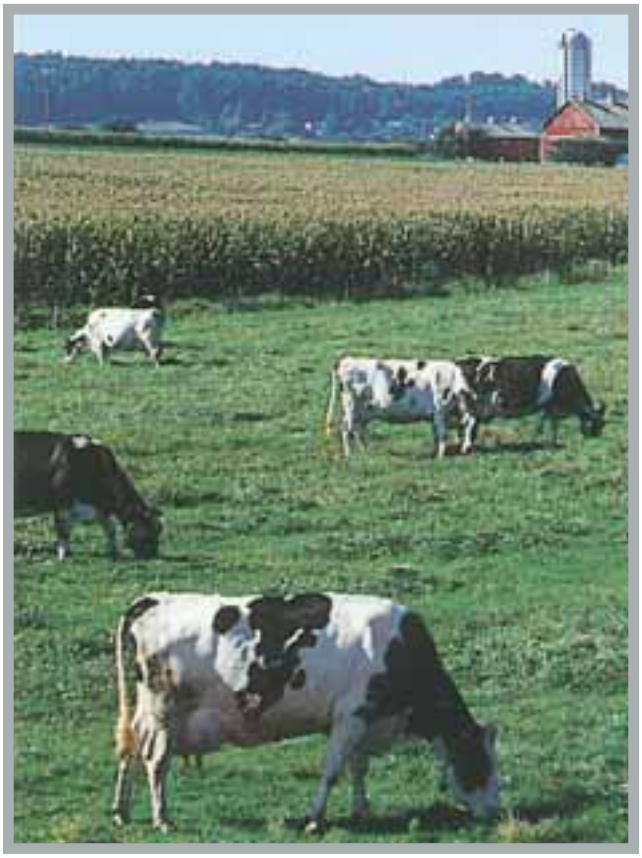
Shifts in parasite populations have been reported where the predominate parasites found early in the year may be different that those found later in the year. Dairy calves and heifers tend to have different parasite makeup than adult cows and develop higher numbers of parasites than adult cows. Also, the susceptibility of animals to parasites varies according to season of the year, age and immune status of the animals.

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 decreased until spring when exposure begins again. This is reflected in fecal worm egg counts when non treated adult cows have higher eggs in late winter to early spring than in summer to late fall when immune status of the animals 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 D Animals

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

The actual numbers of parasites found in adult cows is small in comparison to young cattle with the same exposure to parasites. A survey of cull cows from 54 Wisconsin herds demonstrated from 0 to 12,000 parasites were found while in a similar survey at ten locations across USA and Canada in 120 yearling cattle, from 0 to 265,000 parasites were recovered. The reason for this large difference between mature cattle and young animals is not fully know. Certainly, age resistance plays a role but whether it's due to an activated immune system of the cow due to parasite exposure or due to mechanical damage to tissues caused by parasites at an earlier age preventing larval development later on. Parasite numbers found in a animal may not be as important to production loss as is the immune status of the animal, production levels of the animal, stage of lactation, and degree of exposure to parasites.



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 with varying results. The results of these studies often depended upon how the studies were designed and how the studies were conducted. Since milk production is a highly variable trait greatly influenced by many environmental conditions as well as genetic, it is a very difficult trait to accurately measure 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 is 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" where dry intake cannot meet production needs and, therefore, the animals have to draw off their stored energy to meet this high demand. An average cow may lose up 200 lbs or more so after calving. If parasites are present in the animal or if she is being 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 gastro-intestinal parasites' affect on the animal's immune system. One benefit of deworming, which is often overlooked, is its impact on the effectiveness of vaccinations. Cows that are infected by parasites have compromised immune systems caused by the negative nutritional impact gastrointestinal parasites have on the immune system. In addition to this indirect impact, some parasites have a direct impact on the immune system though mechanical damage they cause to the animal itself.

Immuno-suppression occurs when parasites actively hinder one or more of the host's defense mechanism. For example, *Ostertagia* secrete substances that suppress the host's immune system. *Ostertagia* larvae damage the glands of the abomasum during development. They disrupt metabolism and are thought to affect development of immunity simply by reducing the necessary substances, such as 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 immuno-suppression interferes with the host's ability to respond to a vaccination, our most effective tool for preventing infectious disease.

Monitoring Dairy Herds for Gastro-Intestinal Parasite Infections

Every herd is different when it comes to internal parasitic infections

A need exists, therefore, for specific and adequately sensitive tests to detect the existence of a known subclinical disease, as well as, 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 parasitism within a herd. Once the presence of parasitism 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 what the parasite contamination level is for their herd. One method to determine contamination level is to use the general guideline for determining parasite exposure under different type of herd management. The key issue is that the more the cattle are exposed to outdoors pasture type conditions the more parasite exposure that 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 dirt dry lot only.

4. Extremely low parasite contamination level.

- Cows in total confinement on a concrete dry lot.

To scientifically determine where infections exist on an operation, the fecal exam is the most reliable and least expensive way to accomplish this task. Lactating dairy cows can produce close to 100 pounds 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 because the Wisconsin Sugar Flotation method is the only exam sensitive enough to accurately detected parasitism in lactation dairy cows. The fecal exam technique is listed in (Appendix 1).

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 the operation and find out exactly where the parasite infections are within the herd. They can determine whether the cows, heifers or calves are harboring internal parasites as well as the type of parasites present. You can then make an accurate assessment about the deworming strategy for each category of animal checked. Sampling approximately 5% of the herd is adequate. Samples should be taken from every major age group or category of animals on an operation. A "zip locked" baggie is the best collection devise to use by inverting baggie 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.

Production Losses 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[1]	22	1,003	Dewormed Once Avg 144 DIM*	+1.21b/day or +366lb/lactation
Wisconsin[2]	1	48	All cows exposed** To parasites Cows <90DIM 1# = 200lb/lact	 +6.4lb/day +1,280lb/lactation
Wisconsin[3]	12	488	Dewormed at Freshening	+ 423 lb/lactation
Vermont[4]	9	267	Parasite free First 90 days***	+ 5341b/lactation
Pennsylvania[5]	9	180	Parasite free First 90-days	+769lb/lactation
North Carolina[5]	5	160	Parasite free First 90 days	+1,0751b/lactation
England[6]	1	210	Parasite free First 90-days	+ 827.2lb/lactation
Australia[7]	1	58	Parasite free First 90 days	+338.8lb/lactation
Netherlands[8]	81	2,025	Dewormed prior To freshening	+ 292.41b/lactation
England[9]	9	268	Dewormed prior To Freshening	+ 380. 6lb/lactation
Overall	150 Herds	4,707 cows	One to three dewormings In early lactation	+ 628.6lb/lactation

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

Seasonal Control of Gastro-Intestinal Parasitic Infections in Dairy Operations Using Safe-Guard®/ Panacur®(Fenbendazole)

Establishing a Strategic Deworming Program

The economics of parasitism not only involves the development of parasites under pasture and 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 with lactating cows because their lactation cycles seldom match seasonal weather conditions. Strategic use of fenbendazole on a seasonal basis will reduce parasite challenge for the entire year by as much as 85%. The problem with lactating cows, keeping them parasite-free during the first trimester of lactation may require a slightly different program. Maybe the best program for lactating dairy cows is a combination of seasonal treatment with 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 a 98% efficacy against all-important internal parasites (including lungworm) and all stages of the parasite within the animal. This feature is important because a late fall deworming should remove all parasites in the animal at the time of treatment so that the cattle remains relatively parasite free until the following spring. The other feature is that the dewormer should work quickly especially with lungworms because if it takes two or three days to works animals may die from the infection before it is completely removed.

Safe-Guard®/Panacur®(Fenbendazole) has been shown to be the safest and most efficacious gastro-intestinal and lungworm dewormer. It has been to shown to destroy the worms within the first 12-hours after treatment. It can be used at any stage of lactation or gestation with no health problems and no milk withdrawal. It can be given in a single oral dose as a drench or paste. It can also be top-dressed, mixed in the ration or mixed in the TMR. For non-lactating animals such as replacement heifers, Safe-Guard®/Panacur®(Fenbendazole) can be administered in a medicated block or medicated mineral, which can be given free-choice to be eaten over a three to six 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 shown to be efficient in removing both immature and mature stages of the parasites. Deworming through the feed places the dewormer into the gastrointestinal tract exactly where the parasites are thus providing a higly effective method. For free-choice deworming with Safe-Guard®/Panacur®(Fenbendazole), the products dosage is cumulative in the parasite, so when the animal has consumed enough product to be lethal, the parasites are destroyed even if it takes several days for the animals to receive adequate dose. Pour-ons are only effective if enough product is absorbed in the blood, which must then travel to the gastro-intestinal tract to kill the parasites living there. Recent studies demonstrate that most pour-on dewormers lack adequate absorption into the bloodstream 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.

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.

Herd treatment – this treatment regime should be initiated in late fall with a follow-up deworming given four to six 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's parasite-free going into the winter. Feeding wormy animals during the winter is highly inefficient. The overall goal is two fold, first, to create a parasite-free animal for maximum overwintering 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 re-contamination of the pasture until it becomes reinfected by consuming infective larvae which have over winter on the pasture and until these parasites are mature egg laying adult parasites.

Individual or Group treatment – treat individual cows or use a feed through dewormer every two to three weeks in the pre-fresh group or individually at the time of calving. Ideally, deworming should be repeated six 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 deworming just prior or at freshening to make sure these cows are parasite free at the beginning of the lactation period.

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 Youngstock:

Replacement Heifer Treatment – Replacement heifers and other youngstock on the operation should be treated on a season basis depending whether they are turnout to pasture or not.

Pastured young stock – Treat all animals four and eight 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 four weeks apart in the spring eliminates pasture contamination by a high percentage 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 youngstock – Most calves raised in confinement or concrete yards are parasite-free unless housed on a manure pack or have access to dirt lots. If these animals are raised in total confinement, they should be checked for parasites at every six months. Otherwise, deworming should be given at breeding time and again just prior to the time they're entering 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 worm (Nernatodirus).

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 their cattle are treated at the proper time each year and they can 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 beyond treating just clinical disease.The treatment of parasitism should be aimed first at the elimination of the threat of economic loss and later at the reduction or elimination of the parasites as a potential future risk within an operation itself. Parasitism contributes nothing good to the animals they parasitize even if the animals are 1600 lb. dairy cows they need to be eliminated to prevent unseen production losses.

The “0-6” Individual Program for Adult Dairy Cows

After the treatment at freshening, the strategic choice for the second treatment is 6-8 weeks into lactation. Treatment at freshening and again after 6 weeks - the “0-6” program is based on the 6 to 7 week life cycle of gastrointestinal parasites in the adult cow. Deworming 6 weeks after freshening is timely because of the following:

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

The first step in designing a deworming program for lactating dairy cows is to determine the approximate level of parasite contamination animals are exposed to throughout the year.

General guide-lines for determining parasite exposure under different types of herd management

1. High parasite contamination level:

- Cows grazing on pasture during lactation without rotation
- When fast rotational grazing is practiced

2. Moderate to high-moderate parasite contamination level:

- Cows grazing pasture only during dry period
- Cows with access to an exercise lot (with some grass)

3. Low parasite contamination level:

- Cows with access to a dirt dry lot

4. Extremely low parasite contamination:

- Cows in total confinement
- Cows on a concrete dry lot

It is not recommended to deworm at dry-off. during the dry period, reinfection can occur and place milk production at risk during the critical post-calving period.

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

- Treatment is probably not needed. However, regular parasite monitoring is recommended.

The Seasonal Herd Treatment Program for Adult Dairy Cows

In dairy operations where individual cow treatments are impossible or inconvenient, parasite control can be achieved with seasonal herd deworming. Dairy cows that are exposed to moderate or high levels of parasites-grazing pastures or running on contaminated exercise lots should be dewormed as a complete herd in late fall after the first hard frost and again approximately 6 weeks after spring green-up or turnout. (Strategy Two)

Dairy cows exposed to low levels of parasites need to be treated as a herd only once a year, preferably in late fall.

Deworming Strategies

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 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.

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 in the 2000's 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 outweight 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	–	3 (30)	1.0

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