Guide to Strategic Parasite Control for Swine using Safe-Guard®
(fenbendazole)

intervet
EXPECT MORE™

Intervet Swine Products

- Argus® SC/ST
- End-FLUence® 2
- MaGESTic® 7
- MaGESTic® 8
- MATRIX® (altrenogest)
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- MycoSilencer® BPME
- MycoSilencer® M
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- MycoSilencer® ONCE
- P.G. 600®
- ProSystem® CE
- ProSystem® RCE
- ProSystem® Pilimune
- ProSystem® Rota
- ProSystem® TGE/Rota
- ProSystem® TREC
- Rhinogen® BPE
- Rhinogen® CTE 5000
- Rhinogen® CTSE
- Safe-Guard® EZ Scoop® (fenbendazole)
- Sow Bac® CE II
- Sow Bac® E II
- Sow Bac® TREC
- Strep Bac®
- Taktic® E.C.

Average Feed and Maintenance Cost Due to Worm Damage*

Parasite	Light	Moderate	Heavy
	Level of Parasite Infection		
Roundworms	$1.92	$3.21	$ 5.56
Whipworms	$1.44	$4.31	$13.76
Nodular worms	$1.25	$2.09	$ 3.69
Kidneyworms	$3.16	$6.09	$13.39

Source: Dr. O.M. Hale, Dr., T.B. Stewart, Agri-Practice, April 1987.
*cost per pig: feed/maintenance

Most Damaging Swine Parasites

Major Parasites

- large roundworms
- Whipworms
- Nodular worms
- Kidneyworms
- Sarcoptic mange

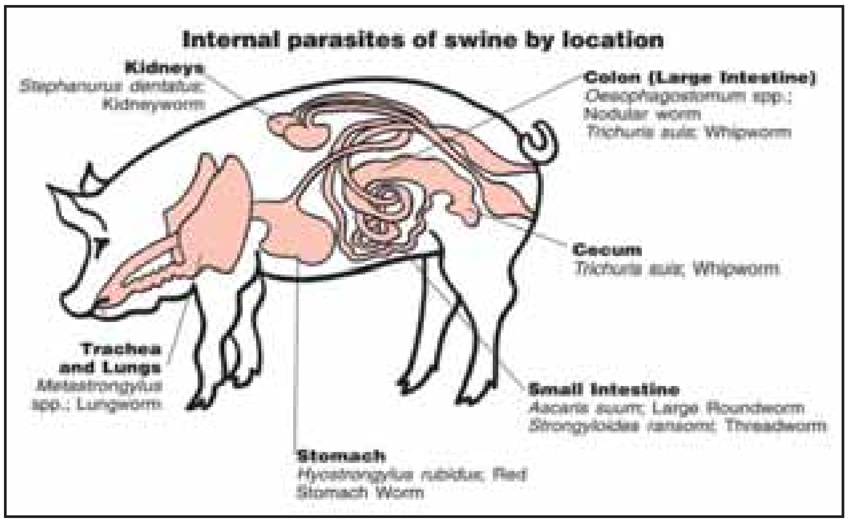
Minor Parasites

- lungworm
- red stomach worm
- kidneyworm
- threadworm
- louse

We want to thank Don Bliss, Ph.D.,
Mid-America Ag Research - Verona, WI 53593
for his input in developing this management control guide.

Gastro-intestinal Parasites Remain A Major Deterrent to Efficient Production In Swine of all Ages:

The large roundworm *(Ascaris suum)*, whipworm *(Trichuris suis)* and the nodular worm *(Oesophagostomum spp.)* are the primary parasites found in confinement swine operations today. Of these three parasites, the large roundworm remains the most prevalent. All other parasites such as kidney worm, lungworms, red stomach worm, and threadworm have all but disappeared in domestic swine raised in confinement and are only found, for the most part, in swine raised on dirt lots.



Even though parasite population shifts have occurred, the parasite species, which remain, are tough opponents and have adapted to surviving in confinement environments. These parasites are all deterrents to efficient production and are an important for the health of swine regardless where they are raised. With confinement raised swine, the prevalence of parasites has dropped significantly but their importance has not declined. Once roundworms infections are established inside a confinement facility, it is extremely difficult to eliminate them.

Parasites are tied to the efficiency of an animal. The more efficient an animal's performance is in terms of growth, feed conversion, or health status, the more important parasites become. It has been demonstrated that it takes fewer parasites in a highly efficient animal to disrupt this efficiency that it does in poor doing animals. Parasites have also been shown to affect the immune system of an animal predisposing the animal to other disease situations or reducing its ability to fight off disease problems.

Economic losses caused by parasitism in a swine operation are directly related to the production standard of the operation. Controlling parasites becomes a very important management tool to reduce or eliminate losses occurring within an operation and to prevent future infections from developing. Adult parasites primarily disrupt digestion. Having an excellent nutritional program but leaving parasites untreated greatly reduces the benefit of the nutritional program.

Parasites cause liver, lung, and intestinal damage, interfere with digestion and disrupt nutrient absorption in the intestine. Direct losses to a producer can be from condemned livers or carcasses at slaughter. Increased feed costs due to losses in feed efficiency, reduced rate of gain, and losses caused by disease outbreaks directly linked to parasitism also occur. These parasites also cause "mechanical" damage to the intestinal lining and lungs, leading to mixed infection.

Many factors determine the level of economic loss caused by parasitism to a swine operation. Economic loss will depend upon the age of the animals that are exposed to an infection. The severity depends upon whether an animal is being exposed to parasites for the first time and the level of environmental parasitic contamination present within a facility. The risk of an infection spreading throughout an operation may also depend on whether other disease problems are associated with the herd, such as mycoplasma, PRRSV and SIV. Swine parasites have been identified over the years to be responsible for millions of dollars of loss to the swine industry, however, the problem that exists today is locating where an infection exists in an operation, then attacking and eliminating the infection.

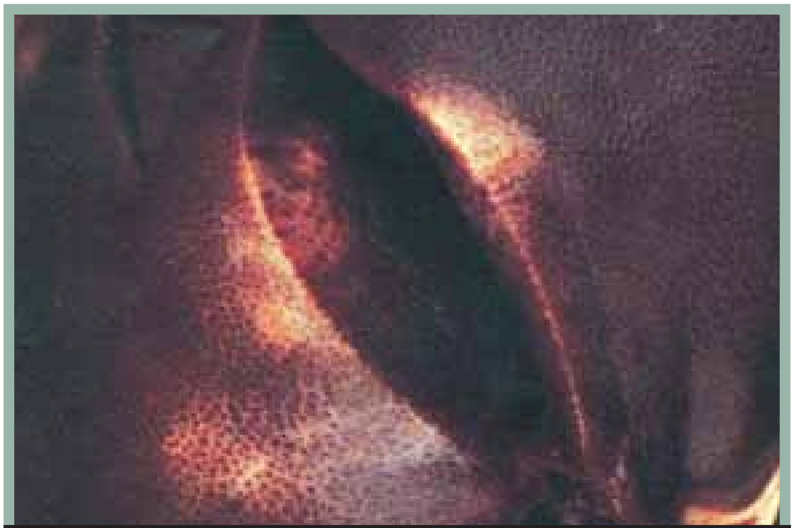
The most prevalent and economically important parasite of swine today is the Large Roundworm *(Ascaris suum).* Two other parasites routinely found in US swine operations are Whipworms *(Trichuris suis)* and Nodular Worms *(Oesophagostomum spp.).* All other swine parasites have become insignificant and almost extinct except in rare cases where hogs are maintained outdoors on dirt lots or other facilities where parasite contamination levels have been allow to build-up over the years.

Large Roundworms *(Ascaris suum)*

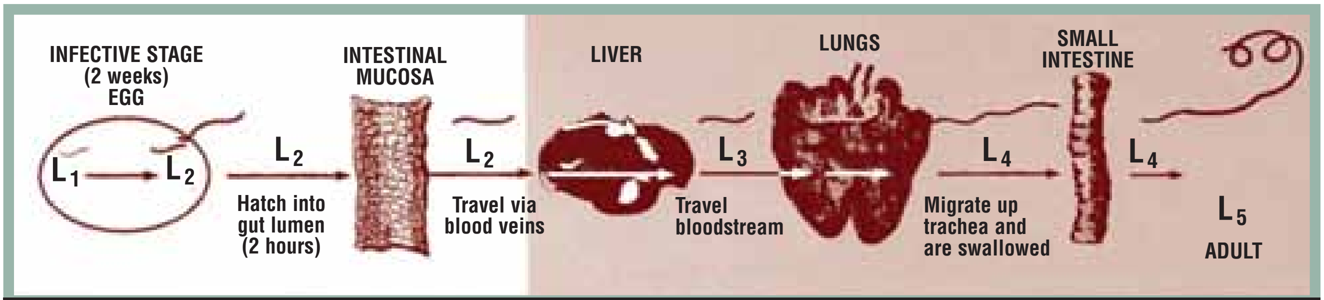
Large roundworms are the largest and most common internal parasite found in US swine operations today. This parasite is a very important pathogen because it causes damage at every stage of its development in the animal. The life cycle of the roundworm begins in an animal when it consumes embroynated eggs present in the pig's environment. This egg hatches in the gastro-intestinal tract and the emerged larva penetrates the mucosal wall and invades the blood stream where it migrates to the liver.

In a normal life cycle, the larvae then moves from the liver into the lungs in three or four days after invading the liver. These larvae continue their development and stay in the lungs for another four to five days. They are then coughed up and swallowed back to the intestine. Two weeks after an infection occurs, many of the larvae, which develop from ingested eggs, are back in the intestinal tract, which then develop into adult worms. The female worm begins laying eggs in the intestinal tract which are then passed out of the animal in the feces. The total development time in the animal is approximately 7-8 weeks (49-56 days).

Adult large roundworms in the small intestine of the pig



Milk spots caused by migrating roundworm larvae



Large Roundworm Life Cycle (7 – 8 weeks)

Large Roundworms Treatment

safe-guard® (fenbendazole) at the recommended rate of 9 mg/kg of body weight is highly efficacious against **all** developmental stages of this parasite when fed for three to twelve days (Table 1). Safe-Guard(fenbendazole) has been shown to kill roundworm larvae in the liver, lungs and small intestine as well as developed adult worm in the gastrointestinal tract.

The large roundworm lives in the intestine of swine where it lives off nutrient contents of the intestinal tract. One female roundworm can reportedly lay up to a million eggs a day. The eggs can remain viable for many years. The microscopic eggs are coated with a protein like material, which allow the eggs to stick in the rough edges of concrete material and are not easily removed even with high-pressure sprayers. Eggs are extremely resistant to chemicals or even physical destruction. The only known method to remove the eggs is by torching with fire. Numerous reports exist where heavy roundworm infections developed in young pigs placed in swine facilities, which have not had animals present for as many as 20 years.

Visual signs of a roundworm infection in swine are coughing followed by labored breathing. Coughing usually begins about seven to ten days after animals are placed in a roundworm-contaminated facility. When the animal's immunity to parasite challenge is low and infection levels are high, animals will become very inactive in one to two weeks after placement in the contaminated area. It is not uncommon for heavily infected animals to succumb to the infection by the third week after arrival, if not treated.

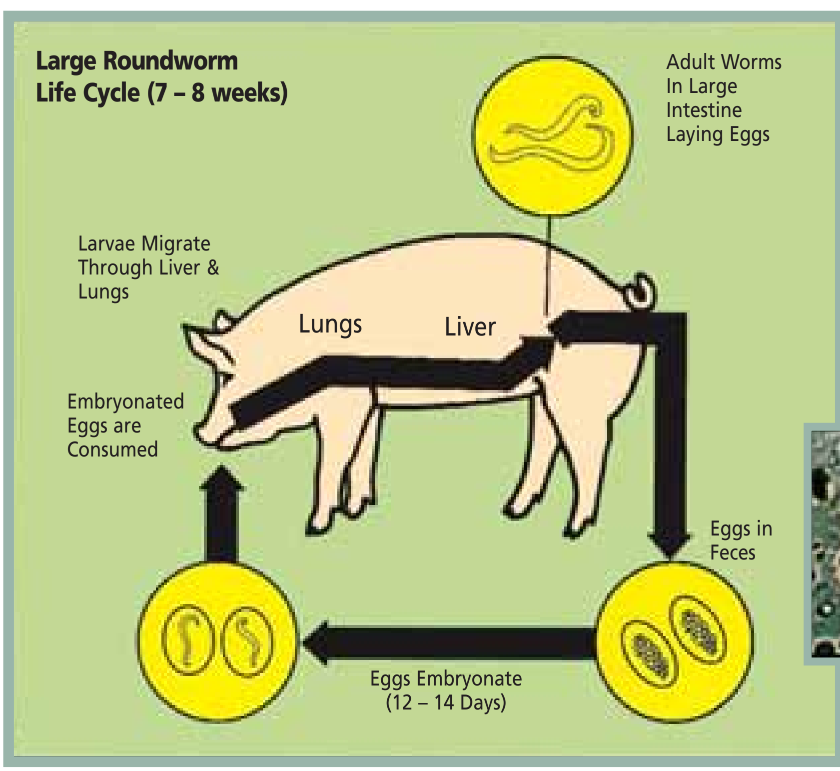
Table 1: Summary of worm larvae recovered at necropsy after exposure to embroynated Ascaris eggs* and percent efficacy following treatment with Safe-Guard (fenbendazole).

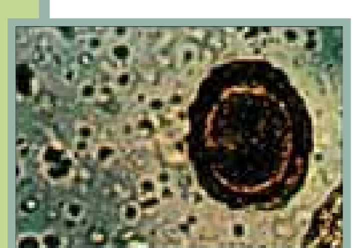
Days on Product	Larvae In Lungs	Percent Efficacy	Larvae in Intestine	Percent efficacy
Negative Controls	415.0	—	3,500	—
9mg/kg over 3-day	0	100%	0	100%
9mg/kg over 6-days	5.0	99.4%	0	100%
9mg/kg over 12-days	14.1	96.6%	0	100%

* Each animal orally inoculated with 20,000 Ascaris eggs.
** Trial conducted by MidAmerica Ag Research, Verona, WI

The major damage caused by large roundworms is due to larval migration through the liver and lungs. At slaughter, liver damage is evident as white scar tissue termed "milk spots." Large roundworm damage to the lungs may cause a soft moist cough in animals seven to ten days after embroynated eggs are ingested. Additionally, pigs become more susceptible to mycoplasma pneumonia, flu virus, and bacterial related problems as a result of the migration.

Livers 'milk spots' have been shown to heal and disappear approximately 30 to 35 days after an animal is moved away from the infection. Therefore, finding liver 'milk spots' at slaughter indicates an infection is occurring within 30 days of slaughter. Infections occurring on the grower floor, for example, may not be indicated as occurring either by the presence or the lack of 'milk spots' found at slaughter.




Ascarid egg

Whipworms *(Trichuris suis)*

Whipworms are probably the most damaging parasite in swine. It only takes a few whipworms to cause severe problems. Scour problems, from loose to bloody, are almost always detected when these parasites are present on a swine operation. The most common problems with this parasite occur in young growing hogs (40 lbs to 100 lbs).

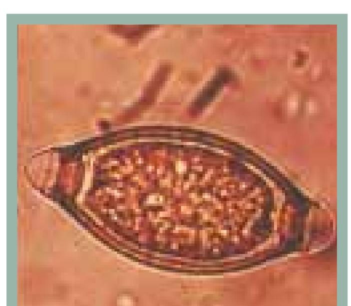
Adult whipworm in the cecum of the pig

Adult whipworms are approximately 2 inches in length and can be seen with the naked eye when examining an infected animal upon post mortem examination. The parasites live in the cecum in the junction between the small and large intestine. Visually the worms are white in color and are shaped like a whip.

Females lay eggs, which require about three weeks to become infective larvae. These infective stages are encased in the egg. Whipworms eggs are very hardy and even under adverse environmental conditions can remain viable for as long as ten years. The female worm is not a prolific egg layer like the large roundworm female and, therefore, contamination levels are much lower for whipworms. The eggs are not easily detected by microscopic fecal exam. Often only a small number of eggs can be found even with severely infected animals.

Once swallowed, the eggs hatch and larvae move to the small intestine and cecum to continue their developmental cycle. Both larvae and adult worms burrow into intestinal walls. The migration severely damages the intestinal lining and disrupts the nutrient absorption. - The development time from an invading larva until an egg-laying adult is approximately six weeks.

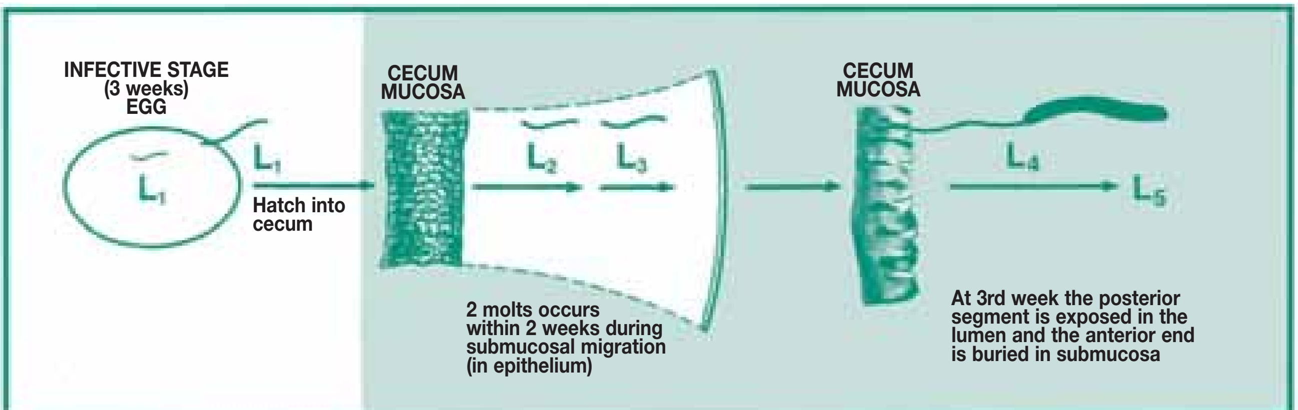
Even moderate whipworm infections can result in serious losses from scours, reduced appetite, reduce weight gain or weight loss, and even death. Because the parasite burrows into the mucosal lining and apparently is not a bloodsucker, it is refractory to most dewormers except Safe-Guard (fenbendazole).



Whipworm egg

Whipworms Treatment

safe-guard® (fenbendazole) when 9 mg/kg is fed over a period of three to six days has been shown to be highly effective in removing both immature and mature Whipworms (Table 2). Pigs heavily infected with whipworms will recover in just a few days following treatment with Safe-Guard (fenbendazole).



Whipworm Life Cycle (6 – 7 weeks)

Table 2: Summary of worms recovered at necropsy in young pigs that were naturally infected with Whipworm (*Trichuris suis*) and percent efficacy following treatment with Safe-Guard (fenbendazole).

Days on Product	Immature worms in cecum	Percent Efficacy	Adult in cecum	Percent efficacy
Negative Controls	901.0	_	861	—
9mk/kg over 3-day	0	100%	0	100%
9mg/kg over 6-days	0	100%	0	100%
9mg/kg over 12-days	158.0	81.8%	12.0	98.7%

* Animals were determined infected with Whipworms by fecal worm egg counts.

** Trial conducted by MidAmerica Ag Research, Verona, WI

Larval whipworm tunneling in the mucosa of the cecum.

Nodular Worms Treatment

safe-guard® (fenbendazole) has been shown to be highly effective when given at the recommended rate of 9 mg/kg fed over a period of three to twelve days. Treating sows just prior to farrowing prevents infections from developing in baby pigs.

Nodular Worms *(Oesophagostomum spp.)*

Nodular worms are most commonly found in adult swine and baby pigs. These worms measure about one inch long when adults. They live in the large intestine and the eggs are passed in the animal's feces. Under favorable weather conditions eggs will develop into infective larvae in just a few days. Nursing pigs can pick up infective larvae from the sows. Sows held outdoors with access to dirt lots during the gestation period are the most likely to become infected with nodular worms. Sows gestating in confinement seldom become infective with nodular unless the gestating area contains bedding where infective larvae can remain protected.

After being swallowed by pigs, larvae migrate to the large intestine where they mature and the cycle continues. Nodular worm larvae burrow into intestinal walls, forming abscesses or nodules. Upon post mortem exam these nodules are grossly visible and will lead to visceral and carcass condemnations at slaughter. Baby pigs born to sows carrying heavy infections of nodular worms will develop a gray sticky diarrhea at two to three weeks of age. Often several pigs out of each litter will succumb and the rest will demonstrate uneven growth rates.

Nodular worms in the large intestine of the pig

The Development and Build-up of Parasitism Within A Swine Operation Depends Upon Many Factors:

The most important factors that influence parasite development in a herd are:

Indirect Transmission:

Once a pen or area is contaminated, the level of parasite contamination continues to increase as time goes on. Both the roundworm and whipworm eggs have been shown to live for many years in the environment. The process of contaminating a pen or facility follows a set pattern. As facilities become contaminated, placement of new animals soon become infected resulting in further contamination. After these animals are treated or moved out of the facility, the infection remains in the facility. The cycle continues with each placement, amplifying the contamination level.

Once contaminated, it may take years to clean up a contaminated pen or facility.

Favorable Development:

If environmental conditions are favorable for the survival of parasites, a continuous parasite build-up will most likely occur in this facility over a period of years. Obviously, the age of the facility is important because the older the facility the greater the chance for parasite contamination levels to reach significant levels.

Type of Parasite Present:

If the dewormer used in an operation misses one or more parasite specie(s) or stages of the parasite present in an animal, then that parasite can thrive and multiply. The whipworm (*Trichuris suus*) is a good example, since pyrantel, piperazine, levamisole and avermectins have been shown to have no efficacy on this parasite, operations that deworm extensively with these products can still have production losses due to whipworm despite the fact they are using a dewormer.

Direct Transmission:

If a sow is infected and is shedding eggs during the farrowing period, the chances are high that this infection will pass on directly to her offspring through contact during nursing contaminating the grower/finisher floor later on in the production cycle.

Choosing the Right Dewormer:

Worms Controlled	CLASS II	CLASS I						
	Safe-Guard® (fenbendazole)	Ivomec® Premix (ivermectin)	Ivomec® Injectable	Dectomax® (doramectin)	Banminth®* (pyrantel tartrate)	Levasole®/Tramisol (levamisole hydrochloride)	Atgard® (dichlorvos)	Piperazine
Large Roundworm Adult	■	■	■	■	■	■	■	■
L_4 Larvae	■	■	■	■			■	
L_3 Larvae	■							
Whipworm Adult	■						■	
L_4 Larvae	■						■	
L_2L_3 Larvae	■							
Nodular Worm Adult	■	■	■	■	■	■	■	■
L_4 Larvae		■	■	■			■	
Kidneyworm Adult	■	■		■		■		
Larvae	■	■						
Red Stomach Worm Adult	■	■	■	■				
L_4 Larvae		■	■	■				
Lungworm Adult	■	■	■	■		■		
Administation	Feed	Feed	Injectable	Injectable	Feed	Feed/Water	Feed	Water
Withdrawal Period	None	5 days	18 days	24 days	1 day	3 days	None	None

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Levasole® and Tramisol® are registered trademarks of Schering Animal Health
Banminth® is a registered trademark of Phibro Animal Health
Dectomax® is a registered trademark of Pfizer Animal Health.
Safe-Guard® is a registered trademark of Intervet, Inc. or an affiliate.
Ivomec® is a registered trademark of Merial.
Piperazine® - active ingredient - various suppliers.

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, you need the product that's proven successful against the internal parasites that have the most potential to steal performance and profit.

Successful control of swine parasites require careful selection of the right deworming product. Swine parasites are different than any other domestic livestock species. Roundworm and whipworm eggs can live in the environment for many years. Because of this, deworming swine has two goals. One is to remove the current infection in a particular group to prevent or stop losses form occurring. The second goal is to deworm to stop egg shedding and further environmental contamination.

The product that has the broadest spectrum of activity against the most promotant internal parasites in swine is Safe-Guard® (fenbendazole).

The table above outlines each product label:

Safe-Guard (fenbendazole) - Intervet, Inc. is the only product currently on the market that controls third stage (L3) large roundworm larvae in the lung. Safe-Guard (fenbendazole) is the only product which controls the migrating L2 and L3 stages of whipworms in cecum. These tunneling stages of larvae migration cause the greatest amount of damage to the animal. Safe-Guard (fenbendazole) is a unique dewormer for swine because it is currently the most efficacious dewormer on the market and is extremely safe to use. There is no withdrawal period for Safe-Guard (fenbendazole).

Parasites cause production losses that are preventable through the use of Safe-Guard (fenbendazole). Many times a dewormer such as Safe-Guard (fenbendazole) can be used as an insurance policy to treat all incoming animals in order to make sure infected animals don't arrive in a facility and contaminate other animals and, of course, the facility itself.

Internal parasites may be found in many different ways. Infections may be limited to a few pens or to a certain location within an operation. The infection may be isolated to a particular building or facility such as a grower floor, or to a certain group of animals such as gestating sows, or incoming gilts. Identifying where these parasite "hot spots" are can save the operation money and time and allow the deworming efforts to be concentrated where the problem occurs.

Treatment To Control Parasitism and Reduce Parasite Contamination In A Facility Using Safe-Guard®: (fenbendazole)

Based on fecal worm egg count results, a preventative strategic control program can be designed. The results of fecal exams should provide a basis on the type and intensity of the parasite infection ongoing in an operation.

If the operation, proves to have a negative worm contamination level, a minimum preventative program can be set-up and followed to keep the premises clean. All new animals entering the facilities need to be treated with Safe-Guard (fenbendazole) for a thorough internal parasite control. Continued monitoring of the facility on an annual basis should be a part of the ongoing herd health program.

When worm egg contamination is found, it is important to stop this contamination as soon as possible. Timing the deworming around the worm life cycle is key to the success of preventing parasite contamination.

When a sow is dewormed prior to farrowing, the newborn pigs have little chance of becoming infected from the sow . The first time the pigs can become infected is usually on the grower floor or when these animals encounter a contaminated facility. Keeping the sow parasite free is key to keeping an operation parasite free.

For growing and finishing pigs, a Safe-Guard (fenbendazole) treatment should be given three to four weeks after transfer to the grower facility. A second treatment of Safe-Guard (fenbendazole) 4 to 5 weeks later is recommended to break the life cycle of any newly acquired worm infection after the first deworming. If fecal counts are negative, and the facility is determined to be parasite free, treatment is not necessary, but yearly fecal checks should be made. If parasite damaged livers are observed at slaughter, treatment timing is important to stop this damage. Treatment should be given in the feed to grower/finisher hogs approximately 4 - 5 weeks after they enter the contaminated finishing facility. This treatment should be continued until liver checks are negative. Conducting fecal worm egg counts throughout a swine operation is an excellent way to apply science to the deworming process.

Interpreting and recording the data is an important part of the process. This is especially important where heavy contamination rates are found and a treatment program is instituted to clean-up this parasitic infection.

Group Sow Housing

Group housing in gestation is also becoming more common in the USA. Again, animals are more at risk of parasite infection by virtue of the facility design. Fecal-oral contact is the route of infection and with solid or partially slatted surfaces or bedding, there is greater risk of contact/contamination. It's therefore important to identify these risks and to plan ahead using Safe-Guard® (fenbendazole), the only Class II dewormer available. These animals may be heavily infected, particularly if they are grouped by size which may include 1st litter gilts. If replacement gilts are not properly dewormed before entering the farm, they can contaminate the rest of the group with 1000's of eggs per day. The impact of parasitism in mid gestation depends on the severity but certainly feed utilization can adversely be affected.

Whole Herd Deworming with Safe-Guard® (fenbendazole)

Often times, due to management considerations, whole herd deworming is the most convenient, easiest to manage and can save labor especially on large operations. Whole herd deworming works the best when parasite levels are not too high and environmental contamination is not the number one concern.

For herds with very low level of contamination where only occasional parasitism is found either through fecal exams, slaughter checks or observing worms in the feces, a single whole herd deworming conducted once a year is adequate. Most whole herd deworming, however, is conducted twice a year approximately six months apart. Seasonal deworming is not as important in swine held in confinement as it is in with cattle on pasture, however, a late fall deworming is recommended because cool weather slows down egg development and retards contamination of the facilities. A second deworming in early summer helps reduce stress during hot summer months.

Strategic Deworming with Safe-Guard (fenbendazole)

Gestating sows that are treated with Safe-Guard (fenbendazole) just prior to farrowing will produce parasite-free pigs.

The first factor to determine is whether or not parasitism is present within an operation and, then secondly, to determine precisely where it is within the operation. If an infection is present, it is necessary to determine how the infection reached this particular production phase or location within the operation.

If an infection can be traced back to it's original source, the ability to control the infection becomes much greater. For example, did the infection come from the sows or maybe the animals brought it from another location? Usually, an animal needs to be present at a particular location longer than six weeks for the infection to be endemic to that location.

Controlling or reducing the contamination level of an infection is important. As the contamination levels increases, the chance for transmission to other parts of the operation also increases. Parasite levels and the subsequent damage is also often directly related to the production standards of an operation. Due to the vast improvement in genetics, management and nutrition over the past few years, the effects of parasites have become more pronounced. Even low levels of infection can be very important by limiting high producing animal's growth potential.

The efficient use of dewormers can be made in the swine industry if an operation can determine where an infection occurs through parasite diagnosis and then to devise an individualized, preventative, and strategic deworming program to control and eliminate this infection. The overall objective is for the producer to gain maximum treatment benefit for every dollar spent on control.

Parasites Have Two Main Objectives In Life: To Survive and Reproduce.

As swine confinement units have become increasingly more prevalent, the misconception has grown that parasites are eliminated because they cannot live indoors and treatment pressure has declined in many operations. Fecal exams and slaughter checks have demonstrated that many of these confinement units, especially those which have been left untreated, have become contaminated (some heavily) with parasitic eggs and larvae.

It is suspected that pockets of infection develop in a confinement building and that this infection eventually spreads throughout a unit depending upon management and movement of pigs within. It seems reasonable, therefore, that an infection, if left untreated, can work its way through an operation over time. Indoor environmental conditions have relatively high humidity and warm temperatures which are favorable for parasite development and survival. Infections levels can often build to a high level before being detected.

The contamination of a facility begins when an infected animal is transfered, thereby contaminating this environment and other animals. An example of this is when a sow is moved into a farrowing crate after it has become infected during the gestation period. This sow becomes a source of infection for her baby pigs once they're born.

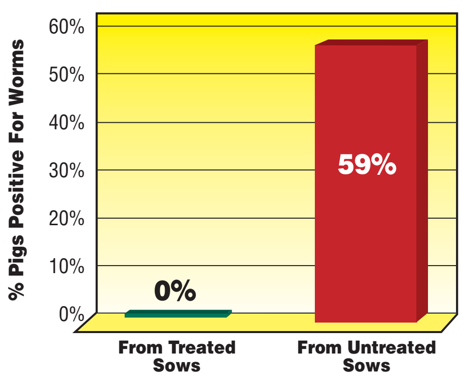
Once infected, the pigs then carry this infection until it reaches maturity when egg-laying adults are present and the animals begin to shed worm eggs back into the environment. This process takes approximately six weeks post-infection so by the time these animals are harboring patent infections they will be out of the nursery and on a grower floor. Here, they're often commingled with other pigs so the infections can spread throughout this pen of animals continuing the contamination process of the facility.

Treating the Breeding Herd for Internal Parasites

Strategic parasite control in swine begins with the sow. Due to their age and often constant exposure to parasites throughout their lives, sows are often parasitized and therefore are an important source of infection for young pigs. Breaking this parasite transmission link between the sow and her young pigs is key to successful parasite control throughout an operation.

Treatment of sows just prior to farrowing is the first step in strategic parasite control. The infection rate of baby pigs from treated and untreated sows studied in 13 Wisconsin swine herds, demonstrated the importance of deworming the sow at the time of farrowing in preventing parasite transmission to baby pigs as follows:

Parasite Prevalence in Pigs
Treated vs. Untreated Sows



Another important factor in strategic control is the class of dewormer used. It is important to use Safe-Guard®(fenbendazole), the only Class II dewormer which removes all stages of the parasites harbored by the sow at the time of farrowing in order to maintain the sow parasite-free throughout lactation. If only adult worms are removed and immature parasites continue development to maturity and then begin laying eggs while the sow is still lactating, the baby pigs are at risk of infection.

If a Class II dewormer is given to a sow just prior to farrowing, and if farrowing takes place in a clean farrowing crate or facility where the sow has restricted access to feces, the treated sow will remain parasite-free until moved to a parasite-contaminated area such as a breeding pen. This strategically timed deworming will provide control in terms of eliminating parasite contamination, since the sow will not become reinfected until after she is moved from the farrowing facility. A further six-week (or longer) period is required after infection takes place (based on the life cycles of the major swine parasites), before mature egg-laying adult worms are present in the animal.

When sows are gestated on contaminated ground or in contaminated facilities, a second deworming treatment during early gestation is warranted. This is done to keep the sows free from "egg laying adult worms" all year round. Thus, reducing or preventing further contamination of the facility or area and reducing the parasite burden on the sow.

Boars: It is important to maintain parasite-free boars both for optimum performance and to prevent the boars from becoming a source of contamination for the sows and gilts. Boars should be treated twice a year if held in total confinement; otherwise all boars should be treated at least every three months or less if they are held in a parasite-contaminated environment.

Gilts: If neglected, gilts can be a source of new infection for a sow herd. Animals selected to be included in a gilt pool should receive regular dewormings every six weeks until breeding if maintained in contaminated facilities. If the gilts are raised in total confinement, treatment at breeding is sufficient. Gilts sold for breeding stock are often treated with a Class I dewormer and then shipped to a producer who later finds that the purchased breeding stock introduced whipworms or other infections onto the operation. All breeding stock should be dewormed with a Class II dewormer before shipment or immediately on arrival at the new location (during quarantine).

Total Confinement

Unless confinement units have been contaminated over a period of time, maintaining a parasite-free environment is possible. Monitoring the herd for parasites on an annual basis is important to make sure a parasite-free status is being maintained. If parasites are found, it is important to identify the problem areas and set up a control program immediately to prevent a parasite build-up from occurring. Treatment of low-level infections can be conducted several ways. 1) Once a parasite problem is identified, treat all animals in the facility at the same time to break the parasite cycle or 2) Begin treating all sows and gilts at farrowing time, continuing to monitor the infections.

Treating Grower/Finisher Hogs for Internal Parasites

There are several objectives in treating grower pigs for internal and external parasites. Since young pigs are very susceptible to the effects of parasitism, the first objective is to use treatments in a preventive way to eliminate infections at an early stage prior to economic damage. The second objective is to prevent an infection from reaching maturity, thereby reducing the threat of future infection by preventing a build-up of parasite egg contamination in the facilities.

The time to use a dewormer depends on a number of conditions. The degree of existing parasite contamination on an operation is important as is the type of operation—whether farrow-to-finish, feeder pig or simply finisher. Also, the interval between treatments is important in terms of the length of the average life cycle of the parasites. If the treatment interval is too long, worm egg shedding will occur, contaminating the facility.

Wean to Finish: Changes in production methods can impact parasitism. Wean-to-finish barns are more and more common, replacing conventional nurseries and placing weaned 16-21 day-old pigs in finisher-like barns. The flooring type in these barns is typically concrete with additional comfort boards or partial slats, a prime surface for roundworm contamination. If sows are not dewormed prior to farrowing or if Class 1 dewormers such as dichlorovos (Atgard™), pyrantel (Banminth™) or piperazine are used, weaned pigs may become infected from the sow. A build-up of parasite eggs can occur in the wean-to-finish barn despite power washing, just as it does in commercial confinement finishers. Over time more and more young pigs are at risk of infection leading to serious liver, lung or intestinal damage. In these systems, one may need to change the timing by deworming a nursery-age pig 3 weeks after it is placed in these barns.

Feeder Pigs: For most operations that sell feeder pigs, treatment of the sows only prior to farrowing is sufficient. The pigs should be dewormed with a Class II dewormer at an early age (approximately 30 lbs.) only if farrowing takes place in a contaminated environment. Producers benefit from the early treatment through improved efficiency of the pigs, and also from the fact that the pigs they sell are "parasite-free," which greatly adds to the quality of their product.

Finisher Operations: For a finisher operation buying feeder pigs, knowing the source of the pigs can be very important as far as parasites are concerned. If the source of feeder pigs is known and the pigs have been dewormed with a Class II dewormer, the producer can wait three to four weeks after arrival before retreating the pigs. If the finisher facility is over two years old or is known to be contaminated, an additional treatment is necessary, to be given four to five weeks after the second treatment (first treatment after arrival at the finisher operation).

Recommended deworming schedule for a grower/finisher operation is as follows:

Grow/Finish Operation

Use Class II Dewormer:

- On arrival (if the treatment history of pigs is unknown or if a Class I dewormer was used previously)
- 3 - 4 weeks after arrival (90 – 110 lbs.)
- 4 - 5 weeks after first treatment if facility is heavily contaminated (150 – 170 lbs.)

Farrow to Finish: The deworming schedule for a farrow-to-finish operation is slightly less intense since the deworming history of each pig is known. As stated previously, deworming the sow at farrowing is the first step. The pigs will then remain parasite-free through the nursery period, usually first acquiring an infection after moving out of the nursery. Three to four weeks after transfer to the grower facility, the pigs should be treated (at about 50 to 70 lbs.). A second treatment to break the life cycle of any newly acquired worms is recommended four to five weeks later (or at about 100 to 110 lbs.). A third treatment at 150 to 170 lbs. is recommended *only* if pigs are raised on dirt or in a heavily contaminated environment. The recommended treatment schedule for a farrow-to-finish operation is as follows.

Farrow-to-Finish Operation

Use Class II Dewormer:

- Sows at farrowing
- Grower pigs—50-70 lbs.
- Finisher pigs—100-110 lbs.
- Finisher pigs—150-170 lbs. (if on dirt or heavily contaminated facilities)
- All incoming gilts, sows & boars treated on arrival
- Boars—2 times/year if in confinement; every 3 months if in contaminated environment

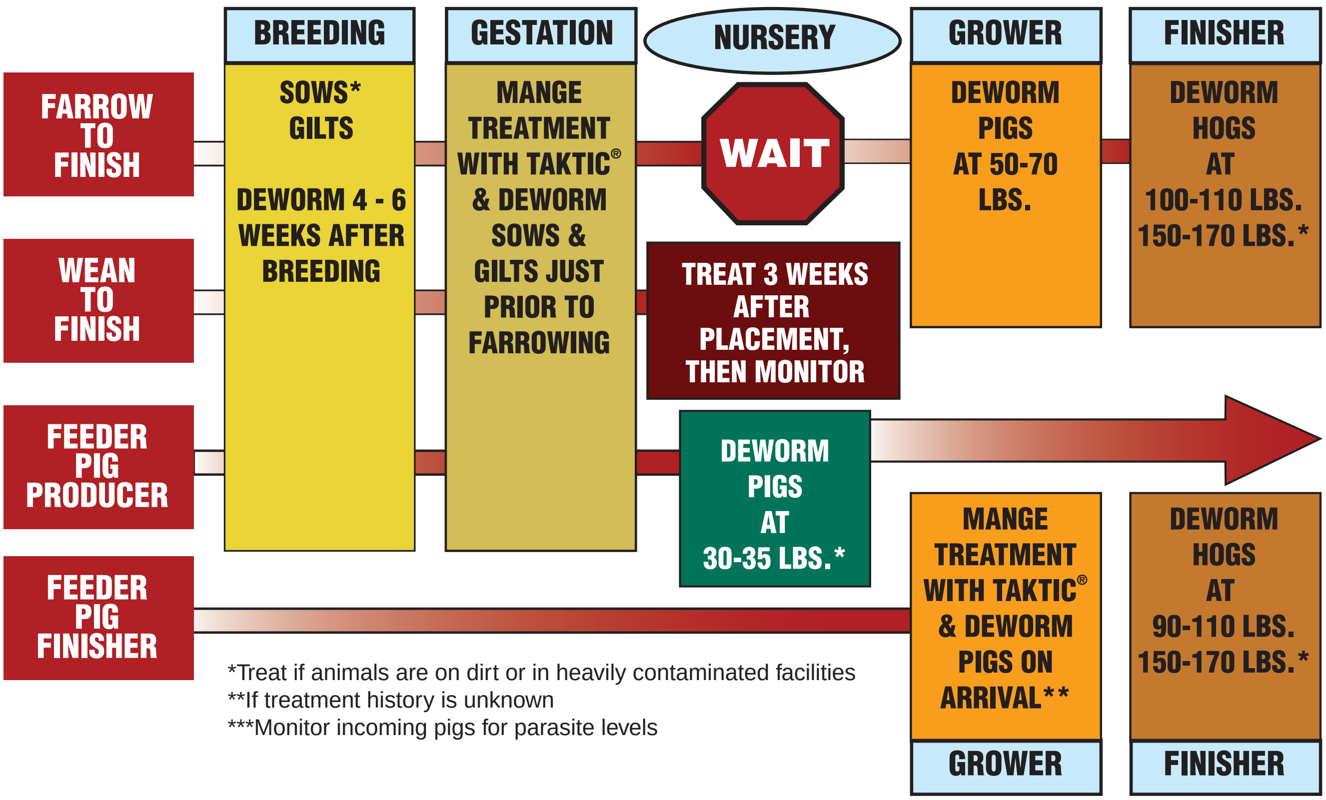
Confinement Facilities: A relatively high incidence of parasite infection has been recorded in total confinement hog facilities throughout the United States. This incidence seems to increase each year as confinement units begin to age. It appears that the survival of parasites in confinement is equal to survival outside; the main difference, however, is how parasitism spreads through the confinement units. Parasite infections will gradually spread from pen to pen. A high level of parasite contamination may be found in a certain pen and the pen adjacent may be parasite-free until an infected pig is transferred into the clean pen; thus the infection is spread throughout the facility.

Strategic Deworming for Swine

It is recommended to follow a strategic deworming program

1. Treat incoming gilts in isolation upon arrival
2. Deworm sows at or 1 week prior to farrowing.
3. Depending on your facility's age and design, treat pigs in early grower/finisher production phases as part of a strategic deworming program.
4. Monitor for internal parasite contamination.

GILTS - All breeding stock should be dewormed with safe-guard® (fenbendazole) before shipment OR immediately on arrival at the new location (during quarantine).



*Treat if animals are on dirt or in heavily contaminated facilities
**If treatment history is unknown
***Monitor incoming pigs for parasite levels

Technique for the Detection of Gastro-intestinal Parasite Eggs

Developing Parasite Data for a Swine Operation:

The fecal exam using the Modified Wisconsin Sugar Flotation Method is a highly sensitive diagnostic tool used to find internal parasites. It is important to use the Wisconsin Sugar Floatation method because of its sensitivity especially with parasites that are not prolific such as Whipworms which shed low numbers of eggs that are often hard to find.

There are a number of options available for conducting fecal sample analysis for swine operations.

1. The consulting veterinarian or veterinary clinic can set-up an "in house" fecal exam service for their clients.
2. Some clinics set aside one day each week that fecal samples are run.
3. A special "parasite awareness lab day", i.e., once a month, once a quarter, etc., where clients bring in samples for analysis the day of or a few days before the lab day.
4. Samples can also be sent to a parasite lab listed below that conducts the Wisconsin Fecal method. Intervet, Inc. pays for this service.

Data collected from the fecal analysis serves as permanent record for a veterinarian about the type, level and location of parasitism found within the operation. Once contamination levels are identified, a control strategy can be implemented and monitored.

Participating Labs are as Follows:

MidAmerica Ag Research 3705 Sequoia Trail Verona, WI. 53593	Dr. Gil Myers 3289 Mt. Sherman Rd. Magnolia, KY 42757

Materials and Methods for Fecal Sampling:

For best results, samples should be collected fresh then refrigerated. Samples can be taken rectally or picked up off the ground when freshly dropped. Refrigeration is important because heat causes worm eggs to develop and hatch while freezing can destroy some eggs; both will lead to incorrect diagnosis. Samples can be refrigerated and stored for long periods of time if needed.

The amount of fecal sample needs to be no larger than a teaspoon. Samples should be placed in plastic bags such as "Zip Lock®" bags, baggies or inverted rectal exam sleeves. Samples can be picked up easiest by using the plastic baggie like a glove and inverted over the hand.

After the samples is taken, the baggie can be re-inverted, sealed and marked with a pen to identify.

Samples should be carefully marked to identify animal sampled by group or pen number. Between 5% and 10% of the animals in a group or pen should be sampled. It is important to takes samples from different production levels such as nursery pigs more than six weeks old, growers, finishers, gestating sows, lactating sows, etc.

In large operations, sample from as many groups or pens of animals as possible. It is usually better to take one samples each from, say, 50 pens, than five samples from 10 pens since each pen has its own contamination level. One pen, for example, may show high levels of contamination while an adjacent pen may show little or no infection present.

Typically samples are based on confidence intervals. For Pseudorabies, 95-10 is used which is: 95% confidence to detect 1 positive with 10 percent prevalence. That equates to a sample size of 30. One could then take 30 samples over 40 pens. This is increased to 60 samples when samples are pooled, generally 2-5 samples per pen, then marking that sample as a "composite". Then make a homogenate of the sample and do 1 float per composite. The homogenate is the key to making this work accurately.

The Modified Wisconsin Sugar Flotation Method is the only reliable fecal worm egg count test that should be used for swine. It is a simple, extremely sensitive but rapid test. Depending on the size of the centrifuge, one batch of 12 samples will take approximately 20 minuets to run. An inexpensive centrifuge to use is the Modified Babcock Tester that runs at less than 1000 rpm.

The Modified Wisconsin Sugar flotation Method is the recommended technique for the detection of internal parasites in swine.

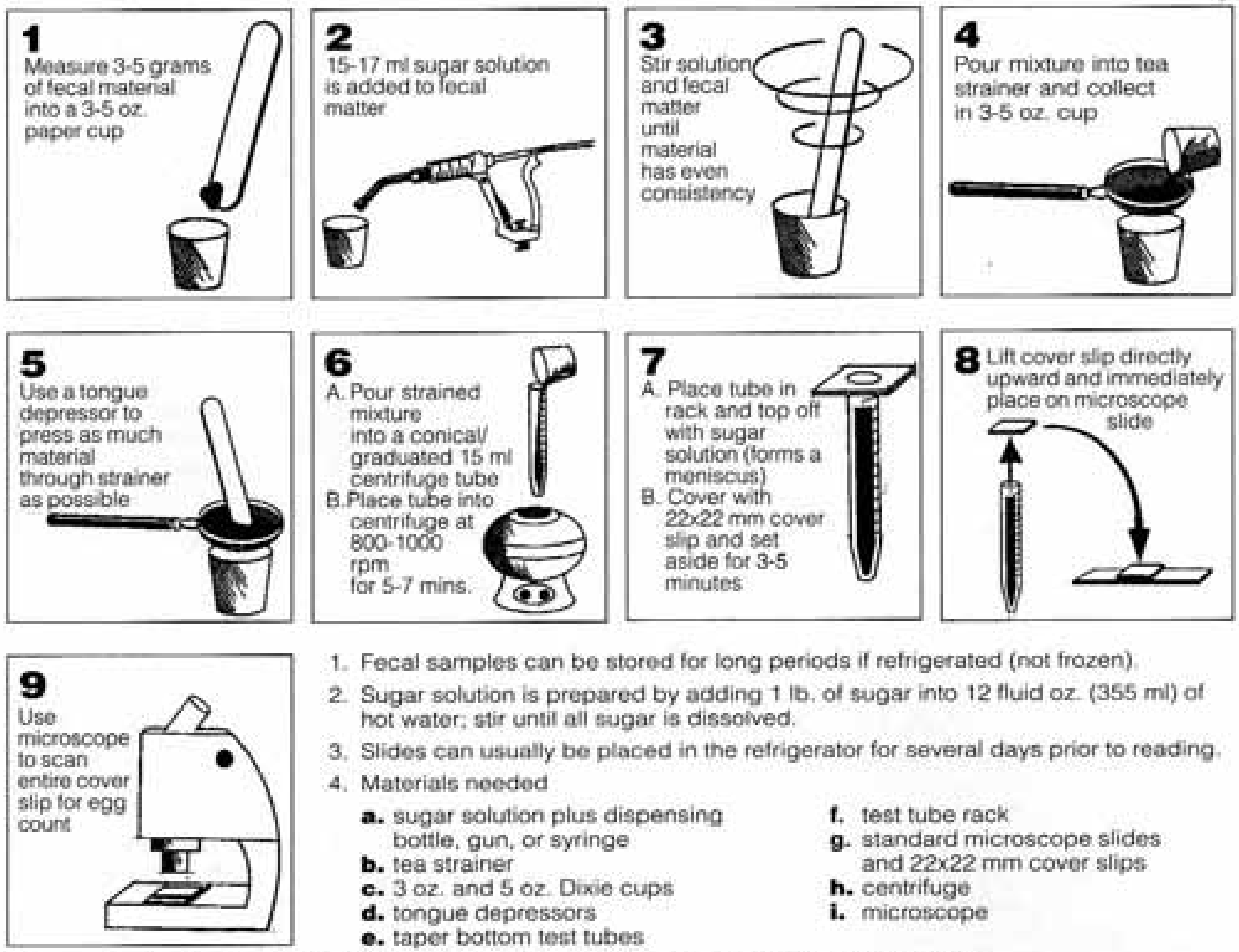


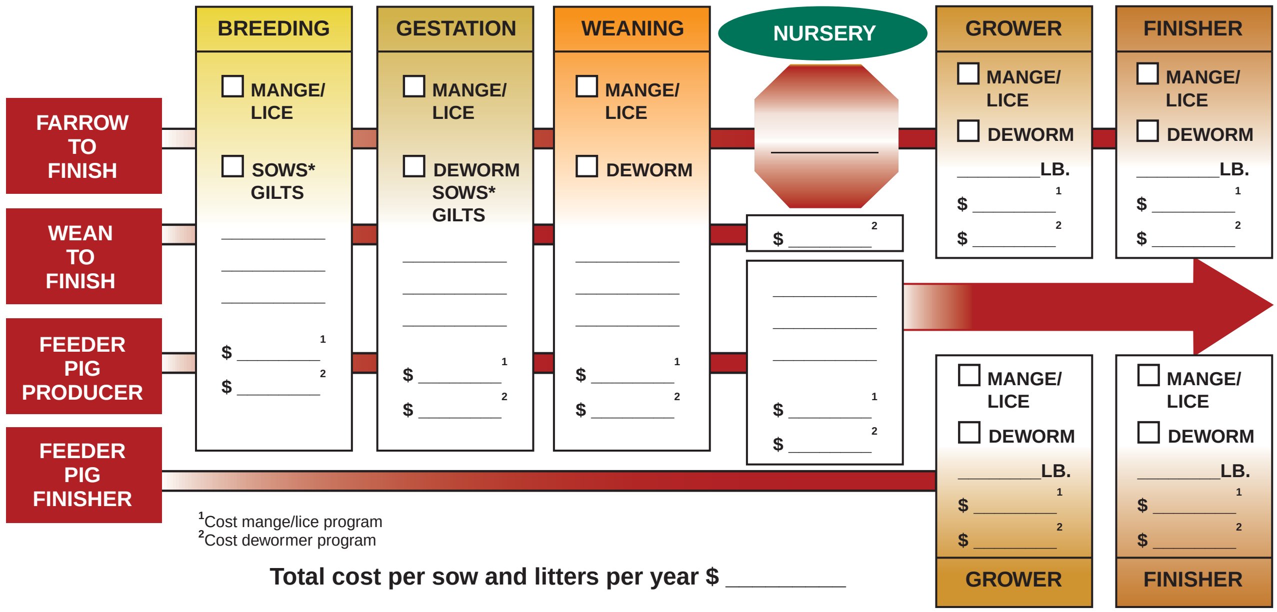
Diagram of method prepared by Dr. Bill Kvanisnicka, Extension Veterinarian, University of Nevada-Reno.

The Modified Wisconsin Sugar Flotation Technique is as Follows:

1. The sugar solution is prepared using 1 lb (454g) of sugar in 12 oz (355 mL) of hot water, stirred until a clear solution is formed.
2. Using a dispensing gun, 15 mL of the sugar solution is placed into a 5 oz. (100 mL) Dixie cup or beaker.
3. A 3 gm samples (thumb nail sized sample) of manure is placed in the cup and stirred thoroughly in the sugar solution.
4. The stirred sample is poured through a tea strainer and pressed with a tongue depressor. This fluid is then transferred into a tapered 15 mL tapered test tube and centrifuged at 700-1000 RPM for 5-7 minutes.
5. Following centrifugation, the test tube is filled to the top with sugar solution allowing the meniscus to rise above the top of the tube to hold the cover slip. The cover slip is allowed to set on the tube for 3-5 minutes.
6. The entire cover slip is searched for worm eggs. Eggs found are identified by worm type and then counted.

Producer's Worksheet

Existing Program

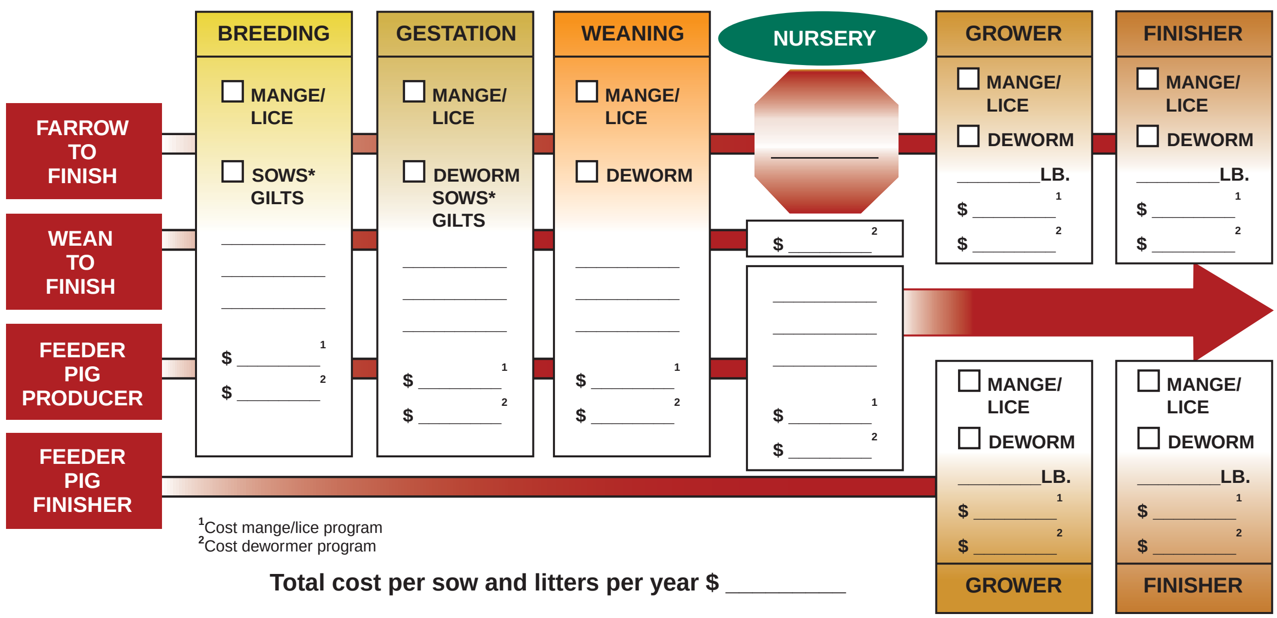


[1]Cost mange/lice program
[2]Cost dewormer program

Total cost per sow and litters per year $ __________

NOTES: ________________________________

Suggested Program



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Total cost per sow and litters per year $ __________

NOTES: ________________________________

29160 Intervet Lane • P.O. Box 318 • Millsboro, Delaware 19966 • www.intervetusa.com • 800.441.8272

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