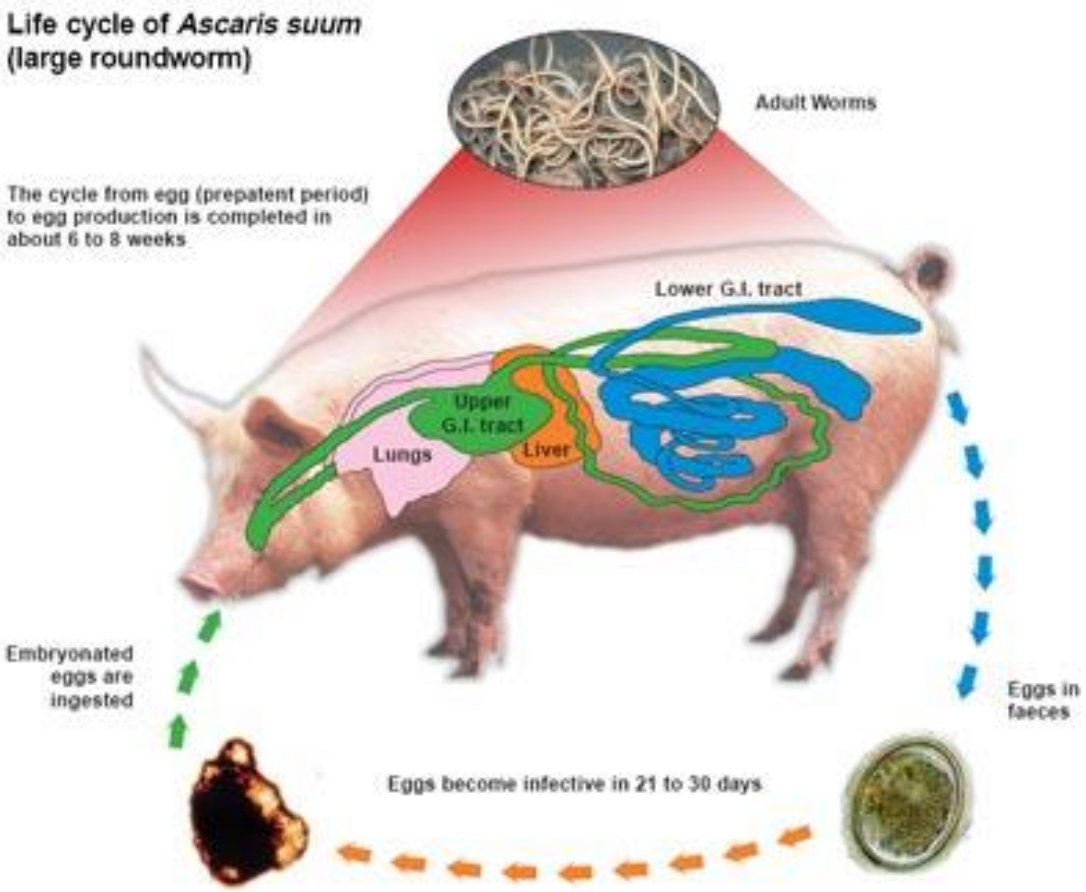
So the Butcher won't let you keep your pig livers…here's why

Your Animals are Infected with Large roundworms (Ascaris)

Most hogs have *Ascaris* infections during their lifetimes. These roundworms are usually found in greatest numbers in pigs up to 2 to 3 months of age with a few in older pigs. Sows usually are not clinically affected, but serve as carriers. Roundworms are long (6 to 12 inches), stout, pinkish worms, sometimes with curved tails. The adults live in the small intestine, grazing on the gut lining and ingesting particulate and liquid materials from digesting food.

The adult females deposit round, microscopic eggs. Each female lays thousands per day beginning about two months after the pig becomes infected. Eggs may survive for 10 or more years and are quite resistant to cold and disinfectants. They can be destroyed by high-pressure steam heat and sunlight. Because they are sticky, eggs are easily transported by cockroaches, beetles, flies, birds and workers' boots and clothing.

Eggs become infective after being outside the pig for one month. When another pig swallows them, they hatch in the stomach or small intestine. The tiny larva that emerges penetrates the gut wall and is carried to the liver through the bloodstream. In the liver, larvae migrate for one-half to one week and then are swept through the bloodstream to the lungs. From there, the larvae are coughed up, swallowed and returned to the small intestine, where they grow and mature within two months. Thus pigs may be 1-1/2 to 2 months of age before eggs can be detected in fecal samples, but immature adult worms may be passed earlier. The significance of this is that clinical signs may occur before eggs are detectable in feces.



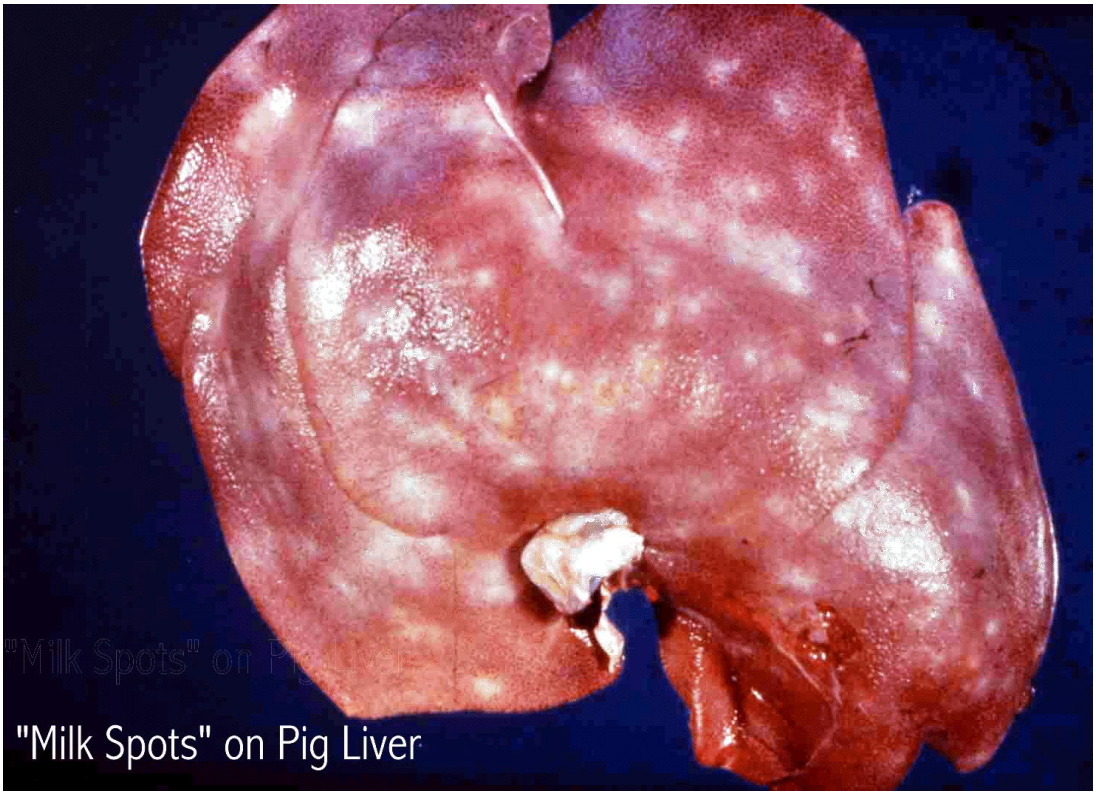
Several clinical events may occur in the infected pig. They include:

- Inflammation of the liver due to an allergic reaction to ascarid larva migration.
- "Milk spots" on the liver that usually disappear with time.
- Another allergic reaction occurs in the lungs as larvae move through the air spaces.
- The lung tissue becomes thick and wet, leading to inefficient respiration and "thumps." This process is made worse by dust, ammonia and bacteria.
- Colic or gut pain may result from worms in the small intestine grazing or nipping forcefully on the gut lining and stretching the gut wall as the worms grow.
- An impaction and even tearing of the gut may occur.
- Often most obvious to the producer is competition of the pig and its roundworm burden for nutrients, so that wormy pigs are set back and appear unthrifty.
- Otherwise healthy pigs with a low worm burden may appear normal, but performance as judged by feed conversion may be depressed.

A United States study in 1987 showed losses due solely to lowered feed conversion from low-level ascarid infections were $155 million. Certainly, losses were far greater when scarred livers and other infections are taken into account.

Your veterinarian can diagnose this infection by taking fecal samples for microscopic examination. Whenever a pig dies, your veterinarian should necropsy it to determine parasitic infections by presence of ascarids in the small intestine and by milk spots on the liver surface.

The presence of this parasite on a pig farm reduces its productivity in a number of direct or indirect ways. Perhaps the most obvious of which is the condemnation of the livers that are visibly affected by parasite migration. Whether the liver is trimmed or fully condemned evidently depends on the amount of white spots detected on the liver



Treatments for these Parasites (organic and non organic)

Whichever treatment you decided to go with it is best practice to obtain fecal counts before and after treatment. This will allow you access the success of the treatment and if you should investigate alternative methods of control.

Non Conventional

Trial One

Our subject animals have included pigs, sheep, dogs, ducks, chickens, guineas and cats. Some had obvious signs of worms in their stools prior to the start of each trial. Others didn't. In no cases were the sample sizes large enough to be considered significant – even our chicken flock is only around a hundred.

The animals love to eat the charcoal from our bonfires in the field so that gave a ready testing ground. Again the results were pro but not strong enough that I would pick the wood ash. However I think they might be getting minerals from it.

Diatomaceous Earth (DE – food grade) certainly works for keeping down the fly population, although chickens work better. For internal application I am not as convinced. More study is needed on it.

The garlic tests were astounding. First it is completely palatable to the animals – an important consideration. They just eat it right up with their feed (cottage cheese, milk or bread). We have not done enough tests to find what the dosage should be but a pound of dry garlic powder is enough for a month to keep a heard of pigs (52 at the time), pack of large guardian dogs, cats and sheep (6) all worm free after killing all the obvious worms that were present before the tests.

Cayenne pepper powder is almost as good as garlic but the animals do not like it nearly as much. Again we mixed it with cottage cheese, milk and bread. The younger piglets rejected it. The chickens accepted it. The larger animals including the adult pigs, sheep and dogs will eat it more readily but don't care for it. Its effectiveness appears to be close to that of garlic but I'll be doing more tests. It makes a good alternative.

The results have been excellent. Animals that clearly had worms in their stool samples prior to the trials were clear of worms after the trials with the garlic or cayenne pepper – less so with some of the other things. Furthermore the natural dewormers, especially the garlic, seem to act very quickly. One of the big pluses of the natural wormers is they seem benign to the soil life – the commercial dewormers tend to kill off microbial soil fauna, earth worms and even dung beetles.

Shooting Pigs: *For injecting pigs I like to use a repeat injector like this or this. A bit of overkill for just one or two pigs but it works slick. Oral dewormers work well and are easy to give in a hot dog bun or inside a cream donut… Pigs will do almost anything for a donut.*

Good grazing management also goes a long ways towards keeping the parasite population down but that is another topic. Our winters also are harsh on worms and other parasites because they break up the life cycle.

This has been a great homeschooling experiment and the subject of many discussions. I think it may contribute to the fact that our kids are quite willing to wash their hands. This may be a somewhat disgusting topic that you wish you had not read over breakfast but it is fascinating and good to know that there may be alternatives to the toxic commercial dewormers. Of course, natural substances also have toxic levels too so do your research.

One of the ways that I tell if I need to consider deworming an animal is if I see rough coat, bloat, loss of muscle or ill thrift. Then I check the gums and eyes for paleness which can be a sign of anemia induced by parasites bleeding the animal internally. This is a quick and easy first step in evaluating the animals and part of developing a keen eye.

Note that if you are starting with a strong worm problem then it may be advised to knock it down with something like Ivermec or Fenbendazole and then maintain your defenses against parasites with good managed grazing techniques, feeding garlic and other gentler practices. A veterinarian once told me the new method of better deworming is three days of Fenbendazole (Safeguard uses this) and then a shot of Ivermec which activates the worms and makes them susceptible to the second dose of chemicals. With an incoming new group of animals this is particularly well advised so you get a fresh start during quarantine down-hill, down-water, down-wind, down-chores.

Trial 2

Garlic has been used for thousands of years and it's medicinal properties have been exploited by people around the world, not only for animals, but many of it's curative properties can be used to treat humans as well. It was used during the Great plague of London not only as a cure, but as a preventative against the plague. Using garlic as a dewormer is a little more labor intensive, since you must mince it and mix it in the feed. Some pigs will eat the whole garlic head, but the majority of our pigs prefer it to be minced.

Rosemary is another great natural dewormer and is easily grown on any farm. I have seen Rosemary around homes that have literally grown into a hedge about 4 feet tall. By adding a handful of fresh Rosemary along with the garlic you can effectively control parasites in your swine. This mixture can also be used on other livestock but may need to be thoroughly mixed into the feed.

For the past 2 years we have used natural dewormers on our pigs with phenomenal results. Recently we took some stool samples to our veterinarian, with high hopes and some nervousness as to the results, and the tests came back negative for parasites. That's right "negative". The pigs diet of ground corn, soy, grain, vitamins, minerals, and pasture grass only needed the addition of diatamaceous earth and a once a month treatment of garlic and rosemary. Our pigs are kept outdoors on pasture where they forage and root in the dirt. The same place parasites like to hide. We do rotate pastures but it is a little pig farm, and the pastures don't get a complete year to rest and dispose of the parasites. I can tell you how excited we were when the tests came back negative. We spent a lot of time worrying and praying that we weren't killing the pigs by not giving them commercial dewormers. Even though they all appeared healthy and vibrant, we couldn't see what was going on internally until it was time for the test.

Test number 2 was during butchering. The time came to send 2 pigs to the butcher. Both were over 250 lbs and had never been given a single shot. Not even iron. These pigs were a cross between a Berkshire and what I lovingly refer to as a junk pig. An old sow we've had for years that was from so many crosses nobody could figure out what she was. She was a great mother pig, and produced good meat pigs, but she would have been classified USDA grade 4 on appearance. The big day came and I couldn't wait to see was going on inside the pigs. Sounds a little cruel putting it that way, but you never really know unless you take a look. I'll skip the

details and let you know that we inspected all the internal organs and found no signs of parasites. The organs looked great. Free from worms, vibrant in color, and healthy. I was amazed and a little giddy too, like a girl at her first prom sorta. Whatever, Brenda always laughs at my excitement. It worked, Holy Cow, it really worked. No parasites, healthy internals, and an overall healthy pig. And we didn't have to give them poison to achieve this.

The dirty little secret to this marvel and lack of modern medicine is real simple. We add 20 pounds of Diatamaceous earth to 1000 pounds of feed. If you are only feeding 1 or 2 pigs you probably don't want to buy 1000 pounds or more at a time. No worries, just mix 2 tablespoons of Diatamaceous earth in the pigs feed once a day. It takes almost 1000 pounds to get a pig from weaning to butcher weight so a 20 pound bag per pig from weaning to butcher. Once a month, for a 7 day period, add 2 tablespoons minced garlic and rosemary. It's that easy.

Conventional

Fast facts

Worm infections can negatively affect growth performance and decrease carcass value.

In-feed anthelmintics can be used for a successful deworming program.

Anthelmintics vary in efficacy and spectrum of activity.

An effective control program depends on the specific worm problem, stage of production, and type of production system.

Anthelmintics are classified as drugs and their use is regulated by the Food and Drug Administration.

Parasite control, in addition to control of viruses and bacteria, must be part of a comprehensive herd-health program in every swine production system. Gastrointestinal worm infections may result in significant economic losses. Signs of infection are general and not readily apparent, since worm infections rarely cause elevated mortality levels. Some worms commonly found in pigs are roundworms (*Ascaris suum*), nodular worms (*Oesophagostomum* species), intestinal threadworms (*Strongyloides ransomi*), whipworms (*Trichuris suis*),

kidney worms (*Stephanurus dentatus*), and lungworms (*Metastrongylus* species). Anthelmintics or "dewormers" are chemical substances that can be added to pig diets to control parasitic worms.

What are the consequences of worm infection?

Worms are parasites that deprive the pig of nutrients, negatively affecting pig growth and feed efficiency. Heavy infestation in some cases can lead to condemnation and loss of carcass value. An example is liver condemnation due to larval migration of *A suum*. During their development, the larval forms of this worm pass through the liver and create white scars known as "milk spots."

What products are available for use as anthelmintics in swine feed?

Dichlorvos. Dichlorvos is indicated to remove and control mature and immature forms of the most common pig worms. However, it is relatively ineffective in controlling early larval forms of roundworms. Two consecutive days of feeding is recommended when dichlorvos is added to pig diets. No withdrawal time is required when this product is used at the approved dose.

Fenbendazole. Fenbendazole has a relatively broad spectrum of activity. It is effective against mature and immature forms of common worms that infect pigs. However, fenbendazole has a higher activity when given at low doses for several days (9 mg per kg body weight with the dose divided over 3 to 12 days) than when single-dosed. No withdrawal time is required when this product is used at the recommended dose.

Ivermectin. Ivermectin is highly effective against immature and adult forms of most gastrointestinal roundworms, as well as against pig external parasites such as lice and mange mites. Ivermectin is available in an injectable preparation as well as in the premix form. The premix product is labeled to be fed for 7 consecutive days. A withdrawal time of 5 days is required when this product is administered in feed.

Levamisole. Levamisole is effective against mature roundworms, but only moderately effective against nodular worms. This anthelmintic has a negative effect on diet palatability. Thus, it is more commonly administered through drinking water to insure intake. When levamisole is administered in pig diets, withdrawal of regular feed overnight is recommended prior to feeding the medicated diet the following morning. Treated pigs should be fed the regular diet once the medicated diet is completely consumed. A withdrawal time of 3 days is required.

Piperazine. Piperazine has a relatively narrow spectrum of activity. It has good efficacy against roundworms and moderate efficacy against nodular worms, but is ineffective against other types of pig worms. This drug is more commonly available commercially as a water-soluble product, but it is also approved by the Food and Drug Administration for use as a feed additive. The main advantage of piperazine is that it is relatively inexpensive and is administered as a 1-day single treatment. However, a withdrawal period of 21 days is required.

Pyrantel tartrate. Pyrantel tartrate is fed for 3 consecutive days to remove large roundworms or continuously to prevent migration and establishment of roundworms and nodular worms. This drug is photodegradable and, hence, must be used immediately upon opening the package. It also should not be mixed in diets containing bentonite. A withdrawal time of 24 hours is required.

Additional detailed information on dewormers approved for swine can be found in the Feed Additive Compendium[1] or on the Food and Drug Administration (FDA) Web site.[2]

When is it necessary to treat pigs with anthelmintics to control worms?

Worm infections occur more frequently in pigs raised in outdoor lots than in conventional confinement facilities. Therefore, production design is one consideration in terms of determining how frequently pigs should be fed anthelmintics. Breeding stock should be given anthelmintics after arrival at the farm and before introduction to the herd. Sows are a common source of worm eggs for piglets and should be dewormed several days before farrowing and before moving to the farrowing room. Scrubbing the sow to remove the worm eggs attached to her body before transfer to the farrowing barn also can reduce exposure of baby pigs.

Knowledge of the specific parasites present in the herd and their life cycle is helpful in establishing an effective control program. Prepatent period (Table 1) refers to the period between the time when the infection occurs and when the adult worms begin shedding eggs. Some worms produce eggs several days after infection, while others take months to begin producing eggs. Most anthelmintics are not able to destroy the egg and larval forms that develop into adults after several days. The interval for repeating deworming can be determined on the basis of the prepatent periods. Deworming must be repeated before the minimum prepatent period to kill the adult forms and prevent them from laying eggs.

Table 1: Prepatent periods of common pig worms*

Type of worm	Prepatent period (days)
Kidney worm (*Stephanurus dentatus*)	180-270
Lungworm (*Metastrongylus* species)	30
Nodular worm (*Oesophagostomum* species)	23-60
Red stomach worm (*Hyostrongylus rubidus*)	20
Roundworm (*Ascaris suum*)	42-56
Threadworm (*Strongyloides ransomi*)	3-8
Whipworm (*Trichuris suis*)	40

* Adapted from Myers, 1988.[3]

Choosing the appropriate anthelmintic

Anthelmintics have different modes of action and vary in their effectiveness against different species of pig worms. Therefore, choosing the proper anthelmintic to be used in the feed will depend on the specific worm problem. The relative effectiveness and spectrum of activity of common anthelmintics are listed in Table 2. Brand names of products available in the United States are enumerated in Table 3. It should be noted that anthelmintics, like antibiotics, may require specific withdrawal periods (Table 4).

Table 2: Effectiveness (% of adult worms killed) and relative costs of in-feed anthelmintics against common pig worms*

Anthelmintic	Roundworm	Nodular worm	Whipworm	Lungworm	Threadworm	Kidney worm	Relative cost
Dichlorvos	99-100	95-100	90-100	0	60-80	0	++
Fenbendazole	92-100	99-100	94-100	97-99	Variable	100	++++
Ivermectin †	90-100	86-100	Variable	99-100	99-100	100	+++++

Levamisole	99-100	80-100	60-80	90-100	80-95	80-100	+++
Piperazine	75-100	50	0	0	0	0	+
Pyrantel tartrate	96-100	88-100	0	0	0	0	+

* Adapted from Myer and Brendemuhl, 2009.[4]

† Also highly effective against external parasites (mange and lice).

Table 3: Registered brand names of FDA-approved anthelmintic products*

Anthelmintic	Brand name	Manufacturer	Address
Dichlorvos	Atgard C Swine Wormer	Boehringer Ingelheim Vetmedica, Inc	St Joseph, Missouri
Fenbendazole	Safe-Guard	Intervet, Inc	Millsboro, Delaware
Ivermectin	Ivomec	Merial	Duluth, Georgia
Levamisole	Tramisol	Fort Dodge Animal Health	Fort Dodge, Iowa
Piperazine	Wazine Pig Wormer	Fleming Laboratories, Inc	Charlotte, North Carolina
Pyrantel tartrate	Banminth 48	Phibro Animal Health	Ridgefield Park, New Jersey
	Worm-Ban	North American Nutrition Co, Inc	Lewisburg, Ohio
	Purina Ban Worm	Virbac AH, Inc	Ft Worth, Texas

Source: Food and Drug Administration Center for Veterinary Medicine.[2]

Table 4: Withdrawal periods of FDA-approved in-feed anthelmintics*

Anthelmintic	Withdrawal period (days)
Dichlorvos	0
Fenbendazole	0
Ivermectin	5
Levamisole	3
Piperazine	21
Pyrantel tartrate	1 (24 hours)

* Source: 2008 Feed Additive Compendium.[1]

Addendum to Non Conventional

The best way to controll Ascaris is to treat the herd with Ivomectrin when you move them. Because the herd is organic, I had to move the pigs in batches to a "sacrifice area" to treat them before moving them on to the new field, those close to slaughter were not treated and remained on the old field until slaughtered out. With this system, the treated pigs are "clean" and must be fed and strawed etc first, and no traffic from the "dirty" field to the clean allowed, try to have seperate equipment if possible, otherwise pressure wash at the end of the day before going on the "clean" field in the morning. Remember ascaris suum eggs remain viable for 5 years in the soil so do not return to used fields for at least 6 years.

A Few Specific Questions

1. Is it possible for the butcher to trim the liver to remove areas with milk spots and retain as much of the tissue as possible.

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the larva of these roundworms frequently migrate through the liver and cause scarring on the livers surface. "Slight" scarring may be trimmed (spotting the liver). More than slight evidence of ascarids requires the liver to be condemned

Passage copied from USDA Animal Disposition/Food Safety: Post mortem Inspection

I spoke with a slaughter house and he let me know that it depends on the inspector but that most inspectors will just reject a liver for having even one spot and that it would be the inspector who would cut it off but it is very rare for them to do the extra work and or allow the liver to pass.

2. Why did your first batch of pigs get though and not the second batch. I would suspect it was one of two things. The life cycle of the worm. These

lesions become visible 7–10 days after infection and will regress within 1–4 wk; therefore, their presence indicates recent infection/reinfection. In resistant pigs, only a few larvae will reach the liver and the number of white spots will be low, despite continual reinfection. Therefore, the number of white spots and the liver condemnation rate are both poor measures of herd infection level.

The second and less likely explanation is that it was a different inspector but I would consider this less likely considering it is pretty much industry standard to reject livers that show evidence of infection.

References

USDA Animal Disposition/Food Safety: Post mortem Inspection
http://www.fsis.usda.gov/wps/wcm/connect/6d982860-3c8d-4685-8068-6cffd00ae9ec/PHVt-Post_Mortem_Inspection.pdf?MOD=AJPERES

The Pig Site (Internet Board)
http://forum.thepigsite.com/discussion/12736/control-of-internal-parasites-worms-in-organic-swine#sthash.zqHwl5g4.dpuf

Little Pig Farm (Florida)
http://littlepigfarm.com/natural-worming-for-pigs/

American Association of Swine Vetrinarians
https://www.aasv.org/shap/issues/v17n6/v17n6p330.htm

Sugar Mountain Farm Blog
http://sugarmtnfarm.com/2005/10/14/worms-au-natural/

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For questions for comments please contact Jason Detzel, jbd222@cornell.edu