

PED MANUAL

A Practical Guide in the
Diagnosis and Management of
Porcine Epidemic Diarrhea

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Disclaimer: The authors, contributors and editor do not guarantee completeness of information regarding PED. This manual is only a guide, if PED is suspected in the farm, consultation with your veterinarian is recommended



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FOREWORD

Great moments are highlighted by positive outcomes emanating from the meeting of great minds. Positive outcomes are ignited by the passion and dedication of tireless people willing to make a difference.

The Philippine College of Swine Practitioners (PCSP), a collegial body of pig veterinarians dreams to constantly make that difference - to set up a venue for learning thru exchanges of ideas, experiences, and insights, knowing fully well that the strength of the swine industry is fortified by our faith in our skills. The triumph of our pig industry is by uniting all of us, to seek answers that find the solutions to threats such as Porcine Epidemic Diarrhea or PED.

PED has been a huge problem affecting pigs of all ages with very high mortality among suckling piglets. Hence, in a partnership with the Philippine Veterinary Drug Association (PVDA), the PCSP members shared their experiences to come out with a guideline on the management and control of PED.

I'm very happy to share with you this manual for another great Pinoy Pork Challenge moment!



Dr. Zoilo M. Lopus
PCSP President

PED IN THE PHILIPPINES

PORCINE EPIDEMIC DIARRHEA (PED) IN THE PHILIPPINES

PED is an emerging disease caused by a coronavirus, characterized by watery diarrhea and emaciation affecting all ages of pigs. PED first appeared in the United Kingdom (Wood, 1977) and Belgium (Pensaert and de Bouck, 1978) in the early 1970s.

In the Philippines, the first report of the presence of PED virus was in 2005. Montenegro M, presented, during the 72nd PVMA Scientific Conference and Annual Convention, an outbreak of PED using differential ELISA performed at the Central Veterinary Laboratory, Weybridge, in the United Kingdom. In 2006, Cruz M (unpublished data) was able to isolate the PED virus from 3 samples out of the 11 cases (27%) of piglets with diarrhea submitted from April to May of 2006, to the Bureau of Animal Industry. The following year, Morales R et al reported during an OIE Conference that PED caused heavy mortalities in the Philippines with approximately 60,000 dead piglets in 2006 and 2,179 dead piglets in 2007.

From then on, local pig farms have been experiencing PED like outbreaks but are not reporting it for fear of being closed down. These farms confirm the disease through private diagnostic laboratories, which in turn have no responsibility of reporting this to government.

For 2014, while there are anecdotal accounts of PED to have been affecting several piggeries by some swine practitioners and members of the Hog Raisers group, there are no official reports received from the field veterinarian (Local Government Units and Regional Field Units). Hence, the Bureau of Animal Industry (BAI) at this stage cannot determine the magnitude and scale of the problem.

At the regulatory side, the BAI will (only allow importation of breeders from source free of PED) ensure that the breeder pigs introduced to the country will be sourced from PED free farms, likewise feed ingredients (plasma protein) of pork origin.

PED: THE DISEASE

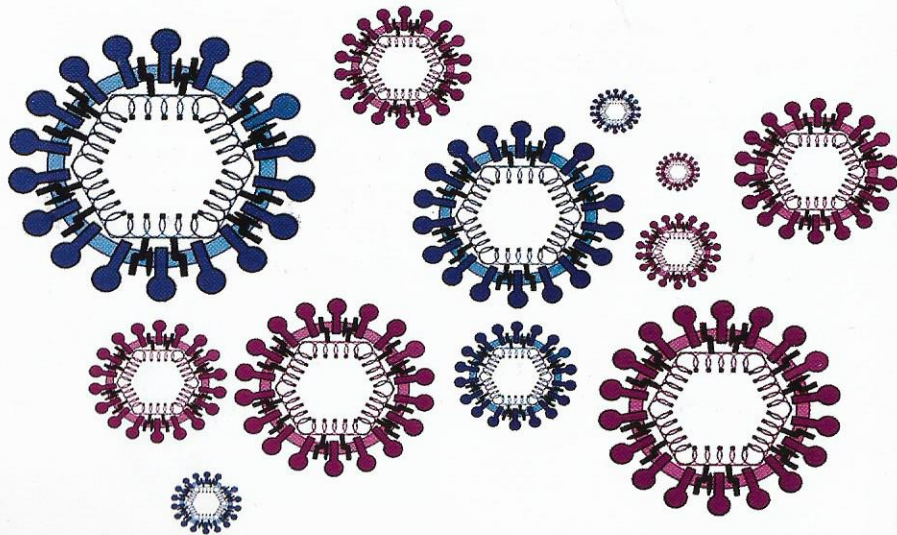
THE VIRUS

PED virus is a large enveloped, single strand RNA virus, belonging to the genus Alphacoronavirus within the family Coronaviridae. Coronaviruses exist worldwide and infect a number of birds and mammals.

Generally, coronaviruses are stable and with minimal possible changes occur during replication. Nevertheless, PEDV is believed to undergo slow process of mutations necessary for adaptation and survival.

There is only one serotype of PED that has been documented. However, it has been suggested based on phylogenetic studies, 2 genetically distinct groups: Group 1 the Classical and Group 2 the field epidemic or pandemic.

- Group 1 includes vaccine strains, cell-cultured adapted strains, and new variants from China, USA, South Korea and in some European countries.
- Group 2 includes isolates from the recent outbreaks or pandemics in North America and Asia.

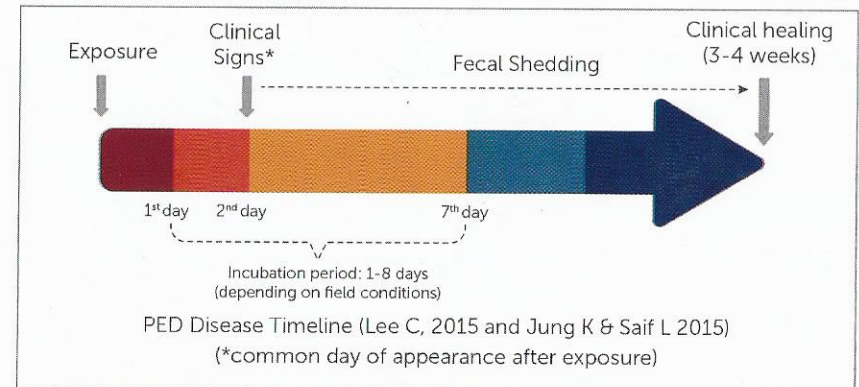


PED: THE DISEASE

CLINICAL SIGNS

All ages can be infected by PEDV, causing watery diarrhea, vomiting and reduced feed intake. The severity of the disease and mortality rates might be inversely associated with the age of the pigs.

In piglets, infections of up to 1 week of age are manifested with explosive and severe watery diarrhea (a) with vomiting (b) for 3–4 days which is followed by dehydration (c) leading to death. Mortality rate may approach 100 % for piglets less than 3 days old and decreases to 10 % from then on.



In weaner to finisher pigs, clinical healing is expected within 7 days after the onset of the disease. Although mortality is unlikely, it may affect the growth performance.

Diarrhea may not show among infected breeding animals, instead depression and reduced feed intake.



(a)



(b)



(c)



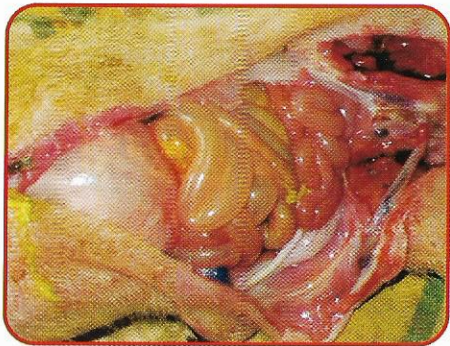
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PED: THE DISEASE

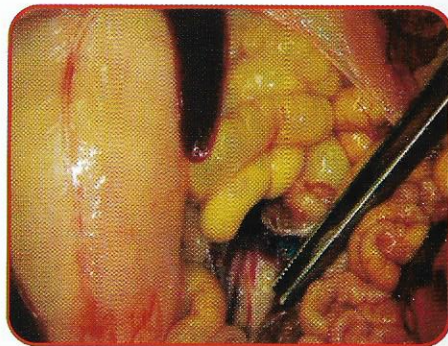
GROSS LESIONS

PED infected pig's gross lesions are restricted in the stomach, small intestine down to the large intestine. The stomach is usually distended (a) and filled with curdled milk (b) probably due to reduced intestinal movement. The intestinal walls are thin and almost transparent with accumulations of yellowish fluid (c).

Just like with other disease affecting the gastrointestinal tract, one may observe congestion of the mesenteric vessels and swollen (d) or enlarge mesenteric lymph nodes.



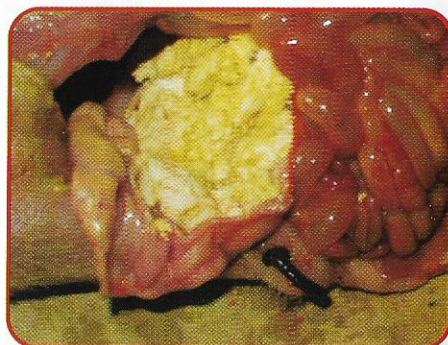
(a)



(b)



(c)



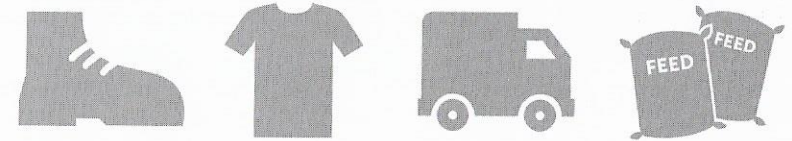
(d)

PED: THE DISEASE

TRANSMISSION

Feco-oral route is the primary means of transmitting PED virus (PEDV). Transmission can come from direct exposure to diarrheal feces or vomitus or indirectly from contaminated fomites such as:

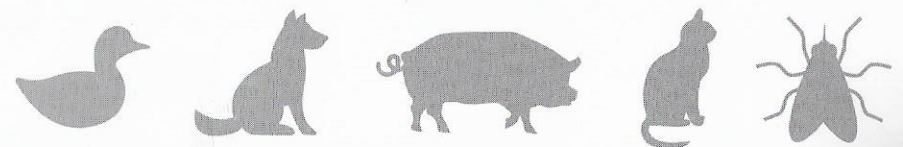
- Transport vehicles and equipment
- People (clothing and footwear)
- Feeds, feed additives and other food items



Under certain condition, airborne transmission (aerosolized PED) has been documented to have a potential role in the virus spread.

Reservoir or carriers of the virus may include dogs, cats, birds (ducks), and older pigs with subclinical infection. Fly has been suggested to potentially transmit the virus.

Following an outbreak, the PEDV may disappear completely in the farm, or it may remain in the farrowing unit due to poor cleaning and disinfection process waiting for the next batch of susceptible pigs. Also, it may persist in the older pigs spreading subclinically which might cause mild post weaning diarrhea. This circulating virus may serve as the source of new outbreaks as it may infect piglet with insufficient levels of protection - from sows with incomplete immune response from poor feedback technique or vaccination, or have suffered from mastitis or agalactia



DIAGNOSING PED

The clinical signs and lesions of PED are almost similar with the epidemic form of TGE and other porcine coronavirus infection, thus diagnosis cannot be made purely on these bases.

Although some practitioners may argue that specific diagnosis may not be necessary for Coronavirus diseases in pigs as management strategies are usually the same, it is still vital to identify which of these viruses is currently affecting the farm especially now that vaccines are becoming more relevant. Therefore laboratory diagnosis must be conducted. There are two current ways in identifying the presence of the virus: 1) PED virus detection and 2) PED virus antibodies detection thru serology.

A variety of PED virus detection methods are available locally. These are:

- PED Virus isolation
- Reverse transcription polymerase chain reaction (RT-PCR) techniques.
- LAMP Test*
- PED Ag Detection Kit*



Serological assays for detecting PEDV antibodies are available locally, however not commonly done. These include ELISA and virus neutralization (VN) tests.

* these are rapid detection kits that can be used in the field.

** sample collection (sample tissue volume) may vary depending on the test to be used. Coordinate properly with your veterinarian or Laboratory.

DIAGNOSING PED

GUIDELINES ON THE COLLECTION OF SAMPLES FOR PED DIAGNOSIS**

A. PED Virus Detection

1. For increased sensitivity of the procedure, samples (intestine: ileum and jejunum) must be taken best within the first day of the onset of (diarrhea) clinical signs. Usually, pigs day-old to (7 days) 10 days are most affected. Samples maybe frozen, chilled, or fresh and must be submitted to the nearest diagnostic laboratory.



2. Intestinal swabs can also be taken among pigs of these ages. Transport media (no antibiotics) are available from the laboratory.
3. Fecal samples must be obtained from several pigs from the affected litter/s. These must be sent immediately to the nearest laboratory.

B. PED Virus Antibody Detection

1. Blood samples of affected and co-mingled piglets are taken on the onset of clinical signs. A paired sampling is done 2 weeks after.
2. Milk from the sows may also be tested for antibodies.
3. In both instances, Enzyme-linked Immunosorbent Assay (ELISA) can be used.

Contact your veterinarian if PED is suspected.

MANAGING PED

Different farms have different PED herd infection status. Thus, management will differ depending on the status.

1. PED Free Farm (Naive Herd) - farm that has no history of PED outbreaks. The primary objective is to keep it free from the disease. This can be achieved thru the following:

- A. Vigilant implementation of BIOSECURITY which is the key to preventing the entry of PED into the farm.
- B. Introduction of GENETICS only from known PED negative source farm. A single source is ideal.
- C. Introduction of new GENETICS should be in an ISOLATION barn at least 200m away from the main herd. Feces of the pigs should be tested for PED by PCR not more than 3 days after arrival. (OPTIONAL: PCR of feces for PED may be repeated and immediately done before introduction into the breeding herd).
- D. The pigs should be observed daily & kept in ISOLATION for at least 30 days.
- E. Prevent contamination of the feeds from bird droppings. Rodent and fly control must be in place. Do not use re-cycled feed bags.
- F. Avoid using animal proteins in the pig diet.

2. Herd with PED Outbreak - farm's first PED outbreak (epidemic outbreak)

The objective for control is to establish herd immunity quickly by exposing or infecting all animals as soon as possible (sows, replacement gilts, boars). The sooner ALL pigs are infected, the sooner the herd will develop immunity and minimize the risk of PED Virus becoming endemic.

Contact your veterinarian on how to spread or augment NATURAL INFECTION intentionally to rapidly develop herd immunity. Screen all incoming gilts by testing the feces using Polymerase Chain Reaction (PCR) or reverse transcription loop-mediated isothermal amplification method (LAMP) test.

MANAGING PED

- A. Daily disinfection of the farrowing barn and waiting stalls (from ceiling to floor, preferably twice daily). Use disinfection safe for animals and raise pH to at least 11.
- B. Restrict personnel traffic by allowing access only to persons assigned in the affected house. Piglets suffering from watery diarrhea with vomiting should be condemned immediately and disposed of properly. Disinfect affected pens. If all piglets are condemned, force weaned sows by bringing them to the dry sow area for medication against secondary infection.
- C. Stabilize the temperature and make it warmer. Placing 6-9 cans of lightened charcoal to warm the affected building especially during night time is suggested. For non-affected and surviving piglets, supplement with electrolytes. Manage curtains to further control temperature. All entry and exit points should be provided with foot bath and hand wash with appropriate disinfectant.
- D. Use a broad spectrum disinfectant in a dedicated knapsack sprayer to affected pens and houses, canals, pits and alleys preferably twice a day.
- E. Suspend all activities including processing of piglets (i.e. castration), especially on the first 14 days of piglet life to minimize stress. Insure proper identification and inventory of affected and surviving piglets.
- F. Supplementation of non-affected and surviving piglets with Yoghurt/quick start and weaned at 42 days of age enhances their livability.
- G. Clean vacated pens/buildings immediately. The pens/buildings should remain vacant/rested for 2 days, and disinfected before use. Basically the process will last for 5 – 7 days to ensure removal of bacterial/viral load. (a detailed pen cleaning and disinfection can be found in the Biosecurity section).

MANAGING PED

- H. Oral antibiotics may be administered to piglets that survive the infection.
- I. IgY antibodies can also help alleviate losses when given to all piglets born alive before they suck colostrum.
- J. Emaciated/survived piglets may be supplemented with water soluble electrolytes.

3. PED Recovered (or Endemically Infected) Herd

- A. Vigilant implementation of BIOSECURITY is the key to prevent RE-ENTRY of PED into the farm.
- B. Screen feces of recently farrowed sow and litter every 2 months to detect presence of the virus by PCR.
- C. Screen gilts feces by Polymerase Chain Reaction (PCR) and reverse transcription loop-mediated isothermal amplification method (LAMP) test before introduction in to the farm.
- D. Stimulate colostral immunity by 'feedback' or vaccination of gilts.
- E. Prevent contamination of feeds with bird droppings. Control rats and flies. Do not use re-cycled feed bags.
- F. Avoid use of animal proteins in the pig diet.
- G. Manage pig flow to prevent overcrowding in all stages of production.

PREVENTION AND CONTROL STRATEGIES

BIOSECURITY

The most important measures in preventing PED outbreaks is the STRICT BIOSECURITY implementation which aims to impede the entry of the virus into the farm. This includes the following:

- Limiting flow of traffic (people and equipment) into the farm
- Enforcing a minimum 3 day downtime requirements when possible
- Quarantine of newly arriving animals and pursuing veterinary discussions about animal health at the herd of origin
- Provision of shower facility if possible and changing into clean boots and coveralls
- Thorough cleaning and disinfection

Below are specific cleaning and disinfection program that might reduce the entry and re-emergence of PED:

Pig Pen Management

1. Empty feed lines, empty, clean and disinfect all contents of feeder, refrigerators and supply areas. Discard what cannot be cleaned and disinfected.
2. Soak buildings, ceiling to floor (including curtains) and all moveable equipment, load out, office area, entrance using detergent per label use and apply with foamer head.
3. Pressure-wash all areas of the animal house.
4. Empty pits again and replace pit plugs when empty.
5. Wipe down all lights, controllers and heaters with effective disinfectant or diluted bleach solution.
6. Flushing and descaling of water system with chlorine (pump through lines purging every nipple drinker, and let sit overnight, then flush to clear chlorine from lines).
7. Implement effective rodent and fly control.

PREVENTION AND CONTROL STRATEGIES

8. Scrape up all shavings and manure in loading chute, clean perimeter of the house, under bins and entrance. After cleaning, apply lime*.
9. Have a 3rd party audit the cleaning and rewash as necessary.
10. Disinfect using effective disinfectants especially those with oxidizing agents or cationic polymeric compound such as PHMG and apply using foamer head.
11. Dry with heat if required for several days.

Manure Pit Management

1. Pit chlorination using 12.5% chlorine bleach with a pre-calculated volume: $L \times W \times \text{Depth} \times 28.3 \text{ L/ft}^3$
2. Use 1 liter 12.5% chlorine bleach per 2900 liters of pit volume. Part of this can be used to chlorinate houses and equipment.
3. Continuous fan operation to allow drying and dissipation of dangerous chlorine gas
4. Use of chlorine meter (0.5 ppm target)

Updates on disinfectants:

A major step in the strategy to prevent and control acute PED outbreaks is to establish a strict biosecurity measure. This measure minimizes the introduction of PEDV from any material or persons harboring the virus. This is accomplished by proper disinfection of all farm items, personnel and external visitors who may be contaminated by the PEDV. Most virucidal agents inactivate PEDV. The PEDV RNA, however, has been shown to still be detected by RT-PCR even after using many commercially available disinfectants. Hence, a crucial evaluation of the contents and administration procedures must be made. Thorough cleaning by high pressure washer of transportation equipments and infected premises and pig houses is the first step prior to the application of the appropriate disinfectant. Then, dry the disinfected area overnight. Avoid human traffic between units particularly farrowing and growing out houses. Disinfectants used for drinking water are chlorine at 2ppm and (Polyhexametidine guanidine Hydrochloride) PHMG, a Cationic Polymeric Compound given at 4ml per 100 liters for 5-7 days.

*Lime is also used in some cases- applied previously on *Brachyspira* but not PED

PREVENTION AND CONTROL STRATEGIES

VACCINATION

Immunization against Porcine Epidemic Diarrhea (PED) is indeed a challenging one.

When to vaccinate, whom to protect, what vaccine to use is truly a hard choice to make. Regardless of the condition, the following principles would help guide farms in protecting their herd. It is important to note that vaccination should be coupled with proper biosecurity hygiene and sanitation and colostrum management.

Before implementing a vaccination program, it is advisable to determine some key points:

1. What is your objective?
 - A. Reduce clinical and productive impact of a PED outbreak
 - B. Protect your herd ahead of a new PED infection
 - C. Eliminate the infection
2. What is your current status?
 - A. Negative to PED
 - B. Positive endemic infection (low to moderate mortality, sporadic diarrhea, light weaning weight)
 - C. Positive acute infection with severe diarrhea, high mortality.
3. What are your system constraints?
 - A. Source of gilts
 - B. Closeness to other farms
 - C. Continuous flow growing or All in all out

Principles of PED Control

Maximize immunity-minimize exposure is the objective. Therefore, if you would like to control PED, you need to combine vaccination and immunity management with excellent all in all out flow, high level cleaning and disinfection and ensuring that piglets receive a high dose of colostrum in the first 6 hours of life.



PREVENTION AND CONTROL STRATEGIES

The scientific literature indicates that it is crucial to generate high levels of IgA in colostrum to prevent severe diarrhea and mortality in suckling piglets. This can be achieved with natural exposure to PEDV or with vaccines. Various vaccines are available globally, both killed and Modified Live. Modified live vaccines are delivered either intramuscularly or orally.

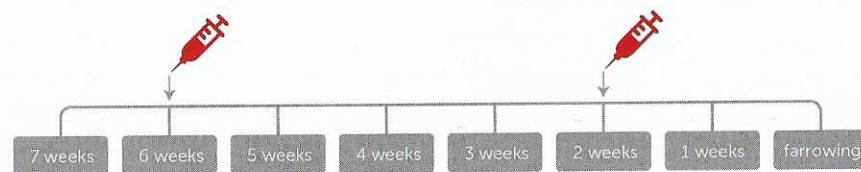
Solid independent data supporting the benefits of vaccination are limited in the literature and the challenge model for PED in piglets has considerable problems with variability and managing the severity of the challenge dose. Some studies have shown a benefit of a IM MLV vaccine in terms of piglet mortality and weight at weaning (Montenegro et al 2015, Korean government study 2014).

The benefit of MLV vaccines in endemic herds is that it allows maintaining herd immunity while stopping continuous exposure to wild type virus to the gilts and breeding herd, which poses a significant risk of preserving the infection and causing re-breaks.

Sows

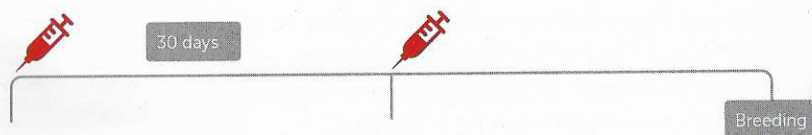
Working Theory: Mass vaccinate initially creates a homogenous immunity within the herd and reduce shedding to other sows

Maintenance*:



Gilt

Mass vaccination 30 days apart before breeding



PREVENTION AND CONTROL STRATEGIES

FEEDBACK: PREPARATION & APPLICATION

Before initiating a Feedback program, it is recommended to seek veterinary advice first. Your veterinarian will discuss with you the pros and cons of conducting Feedback and whether it is workable in your farm.

As conditions and practices differ significantly from farm to farm, no one can accurately predict how the clinical manifestation of PED infection will be over time. To date, there has been no published "Herd Exposure" formula that would consistently provide successful elimination of PED. Thus, the following Feedback Program is based on actual experiences and logical discussions from some veterinarians. Its application should be taken with consideration on the farm situation and on its practicability.

The primary objectives to achieve with Feedback are:

1. To establish herd immunity to minimize the period of piglet mortality by infecting and recovering all sows and gilts in the shortest possible time.
2. To ensure all sows and gilts have the same level and time of immunity and period of shedding of PED virus within the population.

To quickly achieve herd immunity, it is important that all sows and gilts on the farm be exposed to develop active immunity.

Therefore, a swift and consistent whole-herd exposure to virus is a must to assure infection and immunity.

PREVENTION AND CONTROL STRATEGIES

FEEDBACK EVERY WEEK



A. PREPARATION & APPLICATION



Collect intestines of sacrificed piglets 7 days old and below. The more the material you collect, the better. Or collect feces from scouring piglet; take feces with tissue paper.



Mix with milk (milk powder without antibiotics); 1 kg milk + 6 ltrs of water (distilled or tap water is ok).



Incubate during 24 hours. (mind flies and mix from time to time; at least 3 to 4 times.



After 24 hours, extend to wanted quantity (again 1 kg milk + 6 ltrs of water).



Put spotlight with 100 watts on top of the container during incubation time. To attain 37-39°C temperature. Stir time to time.



Give to the sows with dose of 200ml/head.



Get at least 1/2 liter for every preparation and store it in a freezer. To be mixed for the next preparation.

PREVENTION AND CONTROL STRATEGIES

B. OBSERVATION (after Feedback)

1. After feedback, observe pregnant sow, dry sow and replacement gilt for the signs of diarrhea, vomiting and reduction in feed intake.
2. Sows and gilts that did not show diarrhea should be given feedback again following the same process. Some parity 3 and older sows may not show diarrhea.
3. For sows and gilts showing diarrhea and vomiting, it means that the feedback is effective and the animals will recover in 2-3 days.
4. Chlorine or any drinking water antiseptic should NOT be applied for half day during feedback.

C. SANITATION

1. Cleaning and disinfection measures must begin immediately following feedback in preparation for the recovery phase.
2. Reducing viral load in the premises is crucial as exposure to high concentration of virus may overwhelm the protection provided by the milk.

(*adapted from Schwartz K et al 2015)

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MESSAGE FROM THE PHILIPPINE VETERINARY DRUG ASSOCIATION

"If you want to go fast, GO ALONE; If you want to go far, GO TOGETHER" - African Proverb

Porcine Epidemic Diarrhea (PED) continues to continually be Philippines' most-economically-damaging swine disease. From its onslaught of pocket outbreaks growing into regional epidemics a couple of years ago, its current challenge is that it has become chronic and recurring in not a few farms. Not completely aware of the problem and how to collectively work against the disease pose a far greater challenge for the many affected farms whose production targets continue to hurt profitability amidst global and regional pork demand growth.

As an industry, we need to act in a progressive and forward-thinking manner. Hard times cannot be used as an excuse for failing to seek out and act upon new opportunities to increase knowledge or foster cooperation and renewed relationship to move forward as a united industry.

The Philippine Veterinary Drug Association (PVDA) is honored to partner with the Philippine College of Swine Practitioners (PCSP) in the printing of the first and most intensive PED Primer; and be instrumental in making this available to our Philippine farmers and producers. As your ally, we will remain steadfast in our support and commitment to the industry we all serve.

Cheers and congratulations to the joint and united forces of the PCSP and the PVDA!



E. Mende
Eugenio P. Mende DVM MSc
President (2015)
Philippine Veterinary Drug Association

Greetings to All!

My warmest "CONGRATULATIONS" to Philippine College of Science Practitioners for the successful launching of PED Primer.

The PED Primer which is the initiative of PCSP through the cooperation of the Philippine Veterinary Drug Association is a show of full force and support to Philippine Swine Business.

The coming ASEAN integration will bring changes into the way we do business, very particularly in the field of Agriculture. And this tool will somehow boost the confidence of our swine farmers in this challenging period.

I would like to thank PVDA and its past leaders for giving me an opportunity to lead and continue all the collaborations with the allied associations like PCSP, and to be of service in this industry that we love.

I wish that PCSP and PVDA continue to work hand on hand and be successful as well on all future endeavors.



Corazon
Corazon Policarpio - Occidental, D.V.M.
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