



Training manual

Herd health management training manual for animal health care workers

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Training report

1. Background

1.1. Importance of pig farming in the Ugandan economy

Pig farming is gaining popularity among Ugandans mainly due to their high fecundity, high growth rate and good feed conversion and relatively small capital needed in the initial buying of the starting stock (Nsadha 2013). This makes pigs easy to acquire livestock by communities, including those who often find it hard to start up livestock keeping business like women and youth. The per capita consumption of pork has been on the rise providing a large market for pork. This results in household income to many actors along the value chain especially women and youth farmers, traders, feed millers, etc. For example, in the past 50 years, pork consumption has grown from an estimated annual per capita consumption of 0.14 kg in 1962 to 3.37 kg in 2013 where it now comes in second after beef in the annual per capita meat consumption in Uganda, to which a steeper rise is projected to be registered by 2030 (FAO 2023).

Pig farmers face a wide range of herd health challenges some of which include diseases such as African swine fever, porcine circovirus type 2 (PCV2), P. reproductive and respiratory syndrome virus (PRRSv) as well as parasitic infections such as gastro-intestinal helminths and cysticercosis.

Pig farmers are also constrained by poor quality feeds, inferior genetic potential with slower growth rates, high costs of inputs and rudimentary husbandry skills exacerbated by inadequate animal health services and limited access to production technologies (Dione et al. 2014; Muhangi et al. 2014).

1.2. Role of pig farming in food and nutrition security

The price of pork is lower than that of other meat like beef, mutton, fish or chicken in many parts of the country. This makes pork a cheaper source of high quality protein particularly for poor households. It, therefore, plays a crucial role in household food and nutrition security in Uganda (Roesel et al. 2019).

Pork is a good source of protein and essential nutrients, such as iron, zinc and vitamin B12, which are often lacking or in low amounts in the diets of many poor households in Uganda (Murphy and Allen 2003; Craig 2010; Oh et al. 2021). This highlights the importance of pig farming in meeting the protein needs of the population.

Furthermore, pig farming offers employment opportunity alternatives, particularly for women and youth, in both urban and rural areas along the value chain (Ouma et al. 2014; Roesel et al. 2014). This helps to alleviate poverty and improve the livelihoods of communities. It has also been observed that pigs are a shortcut to money in some parts of Uganda where farmers sell them with ease in case of financial emergency (Arvidsson et al. 2022).

Pig farming has the potential to contribute significantly to income, food and nutrition security of communities in Uganda. Reducing disease outbreaks in pig farms and improving market access, veterinary services and herd health management approaches will contribute towards attaining this goal.

1.3. Objectives of the manual

- i. To provide farmer trainers/facilitators with relevant knowledge and skills to identify and manage pig diseases, pests/parasites for improved productivity and marketing of pigs and pig products.
- ii. To refresh trainers' and farmers' knowledge and skills to diagnose and manage important animal diseases, pests/parasites affecting pig productivity.
- iii. To provide trainers with knowledge and skills on safe handling and use of veterinary drugs, vaccines and acaricides to ensure food safety and environment conservation.
- iv. To enable trainers, appreciate the interrelationships between herd health, pig welfare and productivity.

1.4 Herd health management and its importance in pig production

Herd health management in the context of pig farming refers to the concerted practices for the health and wellbeing of all the pigs in a farm, rather than just concentrating on the individual health of each pig. This means focusing on the health of the entire herd through practices that prevent the introduction and spread of diseases, as well as promote general health and productivity of pigs (Dione et al. 2021).

Herd health management refers to the comprehensive and systematic approach taken to ensure the health and wellbeing of a group or population of animals, typically livestock (Båge et al. 2020). It involves implementing various strategies, protocols and practices to prevent, control and manage diseases and other health related issues within a herd. The goal of herd health management is to optimize the overall health, productivity and welfare of the animals while minimizing economic losses and risks to public health.

Herd health programs in pig farming are a blend of preventive measures, such as vaccination, biosecurity protocols and good nutrition, as well as monitoring and management practices to

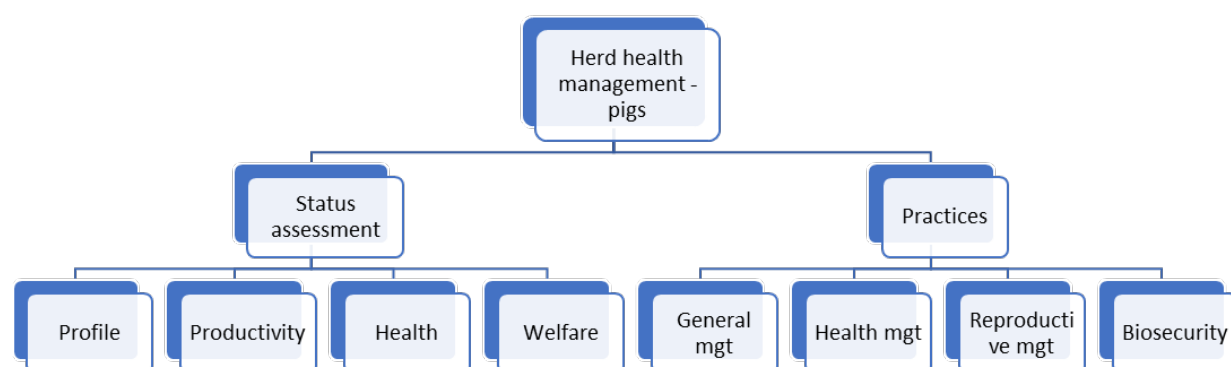
detect and address any health issues that may arise (Dione et al. 2014). These practices aim to ensure that pigs remain healthy and productive, while also minimizing the use of antibiotics and other medications.

In addition to the health benefits for the pigs themselves, maintaining herd health is also important for the overall profitability and sustainability of the pig farming enterprise given that expenditure on veterinary services and drugs is reduced. Poor herd health can lead to decreased productivity, increased mortality rates and higher veterinary costs, all of which can have a significant impact on the profitability of the farm.

1.5. The herd health management framework

Figure 1 shows a schematic view of herd health management framework comprising two key components: status and farm practices assessments.

Figure 1: A schematic view of herd health management framework.

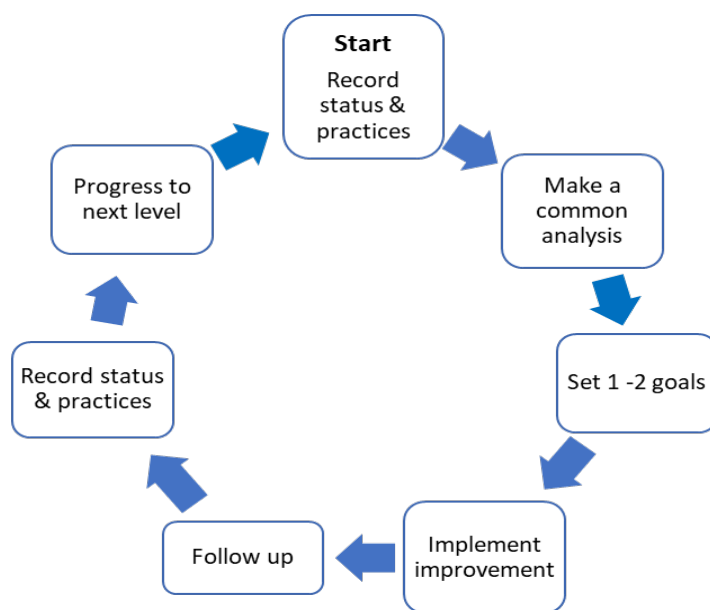


Båge et al. (2020).

1.6. Herd health management process

Figure 2 shows a cyclic process of how to conduct herd health management in a farm.

Figure 2: A schematic view of herd health management process done over time.



Båge et al. (2020).

1.6.1. Part I: Status assessment

To assess the status of a farm, record the following:

1.6.1.1. Profile of farm:

- The breed kept (e.g. exotic, local or mixed breed)
- Who takes care of the pigs (do they have workers, is it family members, are children involved in the care and management of pigs?)
- The goal of the farm (breeding, fattening? or mixed)
- What informs the decision to sell or slaughter pigs (e.g. age, a certain size, whenever there is a need for money? Or when they are sick)
- Main challenges/problems faced on the farm
- Plans for future improvement

1.6.1.2. Productivity and production assessment:

- Number of pigs (specify numbers for sows, gilts, boars, castrates and piglets)
- Number of piglets born/sow/year (number born alive; number born dead)
- Age at slaughter or sale; average live weight at slaughter
- Litter/farrowing index, farrowing interval, etc.
- Piglet mortality/survival rate
- Weaning age
- Dry period (days)
- Culling rate of sows and average parity at culling.

Sows, time from weaning until first heat (dry period), age at first farrowing.

1.6.1.3. Health status assessment

In the context of herd health management on a pig farm, this process involves assessing the health of the herd over the past 6–12 months or since the last veterinary visit. This evaluation comprises two main components: direct observations made by the veterinarian and information gathered from reliable sources such as farm personnel or records. During each visit, the veterinarian conducts thorough and comprehensive clinical examinations or observations of the pigs. The examination aims to identify any herd health issues or abnormalities and, if possible, confirm diagnoses. Adequate clinical examinations and history taking are crucial in ensuring accurate diagnosis and appropriate management of the herd's health conditions. These include the following,

1.6.1.3.1. Respiratory system

- Ask about or look out for any signs of respiratory distress: Inquire if the pig has been showing any symptoms such as coughing, sneezing, difficult or laboured breathing etc.
- Gather information on nasal discharge: Ask and examine for any discharge from the pig's nose and note the colour, consistency and duration of the discharge.
- Inquire about changes in breathing patterns: Ask if there have been any changes in the pig's breathing rate, such as rapid or shallow breathing.
- Determine if there was exposure to other pigs: Ask if the pig has been in contact with other pigs that have shown respiratory symptoms as mentioned above.
- Ask and observe about environmental factors: Inquire about the pig's housing conditions, including ventilation, temperature and air quality, as these factors can impact respiratory health.
- Gather information on vaccination history: Ask if the pig has been vaccinated against respiratory diseases, such as swine influenza or P. respiratory disease complex (PRDC).
- Inquire about any recent travel or introduction of new pigs: Ask if the pig has been moved or introduced to new environments recently, as this can increase the risk of respiratory infections.

1.6.1.3.2. Digestive challenges

- Ask about any signs of digestive challenges, such as diarrhoea, constipation, bloating or abdominal discomfort. Inquire about the frequency, duration and consistency of the faeces. Cause a defecation reflex and observe the faeces of the problematic pigs.
- Vomiting or regurgitation: Inquire about episodes of vomiting or regurgitation, which may indicate issues in the upper digestive tract.
- Weight loss or poor growth: Assess if there have been any changes in the pig's bodyweight or growth rate. Inquire about any recent weight loss, stunted growth or failure to thrive. Also, carry out a body condition score for weaners, growers and sows (sample about 2 pigs/pen per group).
- Feed and water intake: Inquire about the pig's daily feed consumption, including the type of feed, feed quality and any recent changes in feed or water sources. Assess if there have been any changes in appetite, reduced feed intake or increased thirst.

1.6.1.3.3. Skin abnormalities

- Inquire about and observe any changes or lesions on the pig's skin, such as rashes, lumps, scabs, hair loss, redness, swelling or wounds. Ask about the location, duration and progression of these skin lesions.
- Assess if the pig shows signs of itching or scratching excessively, which may indicate external parasites such as mites.
- Look out for the presence of external parasites such as fleas, ticks, mites or lice. Assess if the pig has been treated for parasites and if there have been any signs of infestation.
- Ask if the pig has a history of allergies or sensitivities to certain feeds, bedding materials, medications or environmental factors.

- Inquire about any previous skin conditions or infections the pig has experienced, such as dermatitis, abscesses or wounds.

1.6.1.3.4. Reproductive issues of sows, gilts and boars

- Determine the age of the pig and inquire about its reproductive history, including previous pregnancies, farrowing experiences and any complications encountered during previous reproductive cycles.
- Ask if the pig has experienced any reproductive disorders, such as low litter sizes, vigour of piglets, infertility, abortion, stillbirths or difficulty in farrowing, reproductive tract discharges, etc.
- Check for evidence of mastitis and lactation issues in sows.

Reproductive issues of the boar

- Assess the boar's libido, which refers to its sexual drive and interest in mating. Inquire about any changes in libido, mating behaviour or difficulties in mounting or ejaculating.
- Examine the boar and ask if there have been any observed abnormalities or changes in the size, shape or consistency of the boar's testicles. Inquire about any history of testicular infections, injuries or wounds.
- Inquire and observe about any reproductive disorders or abnormalities experienced by the boar, such as erectile dysfunction, persistent fibrous tissue on the ventral side of the penis, abnormal penile discharge or difficulty in ejaculation.

1.6.1.4. Welfare aspects assessment:

- Housing conditions: Inspect the pig's housing environment, including the type of housing, space availability, ventilation, temperature, bedding material, predisposition of housing for easy cleanliness and access to clean water and appropriate nutrition.
- Behavioural observations: Assess the pig's behaviour, including signs of abnormal behaviour such as aggression, excessive vocalization, tail biting or bar biting. Note any changes in the pig's behaviour, such as lethargy, withdrawal or abnormal social interactions.
- Feeding and water intake: Collect information about the pig's feeding practices, including the type of feed provided, the feeding schedule and any signs of inadequate or excessive food consumption. Inquire about the availability of clean water and the pig's water consumption patterns.
- Environment: Assess if the pig has access to environmental enrichment, such as rooting materials or opportunities for social interaction. Inquire about the provision of a comfortable resting area or bedding that allows the pig to exhibit natural behaviours.
- Space allowance: Gather information about the space provided to each pig, ensuring that it is sufficient for the pig's size and allows for normal movement, exploration and social interactions.
- Handling and transportation: Inquire about the pig's experiences with handling, transportation and any potential stress inducing events. Assess if appropriate handling techniques and procedures are followed to minimize stress and ensure the pig's welfare.
- Veterinary care: Determine the frequency of veterinary care provided to the pig, including routine health checks, preventive measures and prompt treatment of any illnesses or injuries.
- Sow welfare for breeding sows, assess the management practices related to gestation, farrowing and lactation, including the provision of appropriate nesting materials, access to a safe and comfortable farrowing area and the prevention of common issues such as sow lameness or mastitis.

- Evaluate house structures for piglet management such as the creep space and the guard rails that prevent the sow from crushing the piglets as it sleeps.
- Observations of the pig's appearance. Assess the pig's overall physical appearance, body condition, hair coat quality and signs of any injuries, wounds, lameness or health issues.

1.6.2. Part II: Farm practices assessment

1.6.2.1. General farm management

- Housing type, tethered, free range, floor type, quality, roof, space/pig, etc.
- Nutrition: Body condition score, feed type and quality, water supply system used, frequency of supply, etc.

1.6.2.2. Health management

- Assess health monitoring routines such as deworming, spraying, antibiotic treatments, vaccinations, access to advisory services, etc.
- Review the pig's medical history and look out for any previous illnesses or injuries. Check any recent veterinary visits or treatments.

1.6.2.3. Reproductive practices management

- Breeding practices: Gather information about the boar's breeding practices, including the number of sows it has been bred with, the breeding methods used (natural mating or semen harvest for artificial insemination) and any reproductive interventions performed.
- Pre and postpartum care: Inquire about the management practices before and after farrowing, including the care of the sow, piglets and management of postpartum complications.
- Reproductive interventions: Gather information about any reproductive interventions performed, such as heat synchronization protocols, hormonal treatments or pregnancy diagnosis techniques.

1.6.2.4. Biosecurity practices management

- Fencing—observe type of fence, integrity, etc.
- Disinfectant use—gather information on type used, frequency of replenishments.
- Isolation during stocking/pig replacements.
- Visitor (entry) control to pig sheds, etc.

Analyse the information collected, propose and agree with the farmer what priority improvements need to be made.

1.7. Users of the manual

Agricultural extension workers: Government employed or non-governmental organization (NGO) extension workers who provide agricultural advice and support to farmers. They can use the pig training manual to enhance their knowledge and provide accurate and up-to-date information to the pig farmers they work with.

Agricultural training institutions: Agricultural schools, colleges and vocational training centres that offer agricultural training programs can incorporate the pig training manual into their curriculum.

This will help students studying animal husbandry and related fields gain practical insights and skills in pig farming.

Agricultural NGOs: NGOs working in the agriculture sector, especially those focused on livestock and small-scale farming, can use the pig training manual as a resource to train and support pig farmers within their programs and projects.

Research institutions: Agricultural research institutions involved in pig farming studies and projects can use the training manual as a reference tool. It can serve as a basis for designing research studies, providing a standardized approach to pig farming practices.

Government agencies: Government agencies responsible for the development and regulation of the livestock sector, such as the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), can distribute the pig training manual to field officers and farmers as part of their extension services.

Livestock cooperatives and associations: Pig farming cooperatives and associations can use the training manual to educate their members and promote best practices in pig production. It can serve as a guide for their training programs and workshops.

Veterinarians and animal health professionals: Veterinarians and other animal health professionals involved in providing veterinary services to pig farmers can use the manual to enhance their knowledge and share relevant information with their clients.

Agribusinesses: Agribusiness companies engaged in the pig farming sector, such as feed manufacturers, pharmaceutical companies and equipment suppliers, can distribute the training manual to their customers as a value added resource. It can help farmers understand the best practices and requirements for pig farming.

Development agencies and donors: International development agencies and donors involved in supporting agricultural and livestock development initiatives in Uganda can use the pig training manual to enhance their capacity building efforts and ensure that pig farming practices align with international standards and guidelines.

It is important to distribute the pig training manual widely among these user groups to maximize its impact and promote sustainable pig farming practices in Uganda.

1.8. Information and instructions to the trainer

Familiarize with the manual: Prior to conducting any training sessions, thoroughly read and familiarize yourself with the content of the pig farmers' training manual. Understand the structure, objectives and key topics covered in each section. This will help you deliver the material in a clear and organized manner.

Plan the training sessions: Design a training plan that outlines the sequence of topics, activities and time allocation for each session. Ensure a logical flow of information and consider the participants' learning needs and abilities. Prepare visual aids, handouts and any other materials necessary for effective training delivery.

Engage participants: Create an interactive learning environment by encouraging participants to actively engage in the training. Incorporate group discussions, case studies, practical demonstrations and hands on activities to reinforce their understanding of the concepts and skills being taught. Encourage questions and provide clarifications when needed.

Adapt to participants' needs: Recognize that participants may have varying levels of knowledge and experience in pig farming. Adapt your training approach to accommodate different learning styles and cater to their specific needs. Be patient, supportive and encourage participation from all participants. Encourage the quiet one to contribute to the discussion.

Provide practical demonstrations: Pig farming is a practical field and participants will benefit greatly from hands on demonstrations. Organize farm visits or practical sessions where participants

can observe and practice essential tasks such as feeding, housing, health management and breeding techniques. Ensure their safety and provide clear instructions during practical sessions.

Encourage good animal welfare practices: Emphasize the importance of animal welfare and ethical practices throughout the training. Teach participants about proper pig handling, hygiene and housing conditions that promote the wellbeing of the animals. Highlight the benefits of implementing good animal welfare practices, both in terms of animal health and productivity and the owner's ease of management and satisfaction.

Address disease prevention and biosecurity: Dedicate enough time to discuss disease prevention strategies and biosecurity measures. Stress the significance of biosecurity to protect pig herds from infectious diseases during farm visits.

Evaluate learning progress: Regularly assess the participants' understanding and progress throughout the training. Conduct quizzes, group activities or practical assessments to gauge their knowledge and practical skills. Provide feedback and reinforcement to help them improve and build confidence in their abilities as pig farmers.

1.9. Training delivery method

In this manual, the trainer is the public or private district veterinarian who provides health care to livestock as well as extension knowledge to farmers. They are referred to as herd health champions (HHC). This manual will serve as a guide for HHC to help deliver effective training sessions to pig farmers. The role of the HHC is vital in shaping the future of these pig farmers. Through their expertise and guidance, they can empower farmers with the knowledge and skills necessary for successful pig farming.

Effective training is essential for imparting knowledge and skills to pig farmers and promoting good herd health practices. For each session, we recommend 15–20 farmers. The presentation methodology outlined in this section will guide trainers in delivering engaging and impactful training sessions on pig herd health in Uganda. Follow these guidelines to ensure an effective and interactive training experience.

Clear learning objectives: Begin each training session by clearly stating the learning objectives. This will provide participants with a clear understanding of what they will learn and achieve during the session. Ensure that the objectives are specific, measurable, achievable, relevant and time bound (SMART).

Visual aids and materials: Use visual aids such as PowerPoint presentations, posters, charts and models to enhance the learning experience. These visual aids should be clear, concise and visually appealing. Prepare handouts or training materials summarizing key points and practical guidelines for participants to refer to later.

Engage participants: Encourage active participation from participants to create an interactive learning environment. Use interactive techniques such as group discussions, case studies, roleplays and practical demonstrations to facilitate learning. Incorporate real-life examples and scenarios relevant to the local context in Uganda to increase participant engagement.

Practical demonstrations: Whenever possible, include practical demonstrations to enhance participants' understanding of herd health practices. Organize on-farm visits or arrange hands-on activities where participants can observe and practice various procedures, such as vaccination techniques, proper hygiene practices and proper housing.

Question and answer sessions: Allocate time for question and answer sessions to address participants' queries and concerns. Encourage participants to ask questions and provide clear and concise answers. If a question requires further elaboration, offer to discuss it during break times or after the training session.

Case studies and group exercises: Present case studies or scenarios related to pig herd health issues in Uganda. Divide participants into small groups and assign them specific tasks or questions to discuss and present their findings. This fosters collaboration, problem solving skills and application of knowledge in practical situations. Farmers learn better from each other!

Participatory assessments: Incorporate quizzes, interactive quizzes or hands-on assessments to evaluate participants' understanding of the topics covered. These assessments can be conducted individually or in groups, providing an opportunity for participants to apply their knowledge and receive immediate feedback.

Recap and summary: At the end of each session, summarize the key points and important takeaways. This recap reinforces the main concepts and ensures that participants have a clear understanding of the material covered. Provide participants with a summary handout or reference guide to review the session's content.

Evaluation and feedback: Implement an evaluation mechanism to assess the effectiveness of the training program and gather feedback from participants. Use evaluation forms or surveys to measure participants' satisfaction, identify areas for improvement and collect suggestions for future training sessions.

Continuous support: Emphasize the importance of continuous learning and support for pig farmers. Provide participants with additional resources, such as contact information for veterinarians, extension services or relevant organizations in their communities, to seek guidance and assistance beyond the training program.

By following this presentation methodology, trainers can deliver comprehensive and engaging pig herd health training sessions in Uganda. It ensures active participation, practical demonstrations and an interactive learning experience, ultimately equipping pig farmers with the knowledge and skills needed to maintain healthy pig herds and promote sustainable pig farming practices.

2. Parasite control

Just like other livestock, pigs can be infected by both internal (endo-) and external (ecto)- parasites. Internal parasites live mostly in the gastro-intestinal tract and include protozoa (*Isopora suis* being the most dangerous to pigs), flatworms (pork tapeworm) and roundworms (especially *Ascaris* and whipworms). On the other hand, ectoparasites include ticks, mites and lice which attack the skin of pigs.

Infections of worms, mites and lice very rarely cause early death in pigs, but they can each severely impact grow rate/feed conversion, behaviour and external appearance.

2.1. Signs and symptoms of major endoparasites in pigs

Therapeutically, endoparasites can be overcome, but to achieve this, it is important for the personnel that handle animals, from animal health professionals to farmers to be able to recognize the symptoms. Tables 1 and 2 show signs and symptoms of endoparasites and ectoparasites in pigs.

An emaciated and depressed pig infested with endoparasites



Photo credit: ILRI/Peter Oba.

Table 1: The signs and symptoms of major endoparasites in pigs

Nematodes (roundworms)	Cestodes (tapeworms)
Unthriftiness	Poor growth and weight gain
Failure to gain weight	Unthriftiness
Rough hair coat	Malaise
Distended and pendulous abdomen	Decreased appetite
Chronic paroxysmal coughing	Mild neurological signs such as a slight head tilt
Dyspnoea (thumping)	

2.2. Signs and symptoms of ectoparasites in pigs

Table 2: Signs and symptoms of mange and flea infestation in pigs

Mange	Swine flea
Shaking the head or ears due to irritation of the ectoparasites	Scratching or rubbing against objects
Excessive rubbing or scratching	Mild skin irritation
Scabs on skin	Intense itching and biting of skin
Thickened and scaly skin	Hair loss
Pimple like bumps on skin	Skin infections
Hair loss	Hoof wall erosions
Patches of hair loss	Hoof oedema and deformities
Red inflamed skin	
Rust discoloration on skin	

2.3. How to control parasites

2.3.1. Controlling internal parasites

Implementing hygiene and biosecurity measures is key to reducing the chances of a parasitic infection of pigs which in turn reduces reliance on excessive use of anthelmintic drugs. This can be done through the following:

Regular deworming: The veterinarian is encouraged to establish and follow a deworming schedule. Follow the recommended dosage and administration guidelines by the manufacturer for each deworming product. The recommended frequency of deworming has been provided in this manual in Table 4.

Treating new animals: Quarantine new pigs in a separate area for two weeks, conduct thorough faecal examinations and administer appropriate deworming treatment, if necessary, as informed by the laboratory results.

Hygiene and sanitation: Regularly clean and disinfect pens, removing any manure or bedding that may harbour parasite eggs or larvae. Always provide fresh water and remove any stale or contaminated and overstayed feed from the feeders. Keep feed troughs elevated to prevent contamination with faeces and provide drinking nipples.

Faecal examination: Through a veterinarian, conduct regular faecal examinations to monitor the presence and level of internal parasites in the herd. This can be coupled with routine veterinary inspections of the pig herd for any signs of internal parasite infection.

Vaccination: Vaccines are available for pork tapeworm (*Taenia solium*).

2.3.2. Deworming regimens

Implementing effective deworming protocols is essential for controlling and preventing parasitic infections in pigs, ultimately ensuring their optimal performance and welfare as shown in Table 3.

Table 3: The impact of parasite infestation on pigs and the benefits of routine deworming

Impacts of parasite infection among pigs	Benefits of regular deworming in pigs
Reduced feed conversion	Improvement in feed conversion ratio
Low weight gain	Improved average weight gain
Secondary infections e.g. pneumonia	Reduced susceptibility to pneumonia
Reduced response to vaccination	Better overall health and welfare of pigs
Losses at slaughter due to condemnation	Reduced number of liver condemnation
Reduced general productivity (pigs have longer stay on the farm)	Increased productivity
Zoonotic potential especially pork tapeworm	Minimized contamination of the pig environment with worm eggs and reduced zoonotic risk

2.4. Impact of parasite infections and benefits of regular deworming in pigs

The specific deworming regimen, including the timing and frequency of treatments, can vary depending on factors such as the age of the pigs, the parasite pressure in the environment and the specific deworming product being used.

Deworming regimens typically involve a combination of strategic treatments which aim to treat the entire herd at specific intervals, regardless of individual pig's parasite load, to control parasite populations and interrupt their life cycles as well as the administration sites as shown in Tables 4 and 5.

Table 4: Deworming regimen for pigs on the farm by age category

Pig category	Deworming schedule
Piglets	A week after weaning
Fatteners	Every 3 months after the 1 st treatment post weaning
Gilts	Every 3 months after the 1 st treatment post weaning and 2 weeks before service
Sows	2 weeks before farrowing and after weaning
Boars	Every 2 months

Table 5: Dewormers and the helminth species they are effective against in pigs

Endoparasite	Drug generic name					
	Sulfonamides	Benzimidazoles	Levamisole	Ivermectin	Piperazine	Praziquantel
	Oral	Oral	Oral	Subcutaneous	Oral	Oral
<i>Ascaris spp</i>						
<i>Trichuris spp</i>						
<i>Strongyles</i>						
<i>Strongloides spp</i>						
<i>Metastrongylus spp</i>						
<i>Coccidia</i>						
<i>Fasciola spp</i>						
<i>Taenia spp</i>						

2.5. Controlling external parasites

Strategic treatment with Ivermectin is the most effective intervention against mites in pigs. Spraying using molecules that have both acaricide and insecticide properties is crucial in controlling external parasites (acarines and insects).

2.5.1. Spraying

Treating and controlling pig ectoparasites can be achieved given that the parasites live on the skin surface and some can survive only a few days away from their host. There are several registered therapeutic agents that can be applied to the pig in the form of sprays, pour on and injections. Spraying as a control method for ectoparasites can be achieved through the following:

- Prepare and maintain the concentration of acaricide in the spray unit as recommended by the manufacturer.
- The acaricide/insecticide container should be of known capacity to allow for the correct ratio by volume of the acaricide/insecticide agent to water and that the amount prepared is adequate to complete the treatment.
- The acaricide/insecticide is measured accurately before being added to water in the spray container/pump.
- It is important you supervise the addition of the acaricide/insecticide into the water to avoid inconsistencies.

2.5.2. Care for the spray equipment

Spray pump, hoses and hand pieces should be maintained in good working condition. Make sure that there are no leaks from the handpiece, hoses or pump.

We advise that the pump delivers a low pressure high volume output and the handpiece must be able to be adjusted to control the required flow dependent on the need.

Stir properly before the spraying is commenced. This can be done by using the handpiece to remix the reconstituted acaricide back into the spray pump.

Keep detailed records of the following information:

- date of spraying.
- volume of water and acaricide/insecticide added into the spray pump.
- number of pigs sprayed.

2.5.3. How to spray

It is in the best interest of the farmer that the pigs are correctly and adequately sprayed. To ensure this is the practice, it is advisable that the pigs are sprayed as described below:

- Start by aiming the nozzle at the pig's feet and bring the spray on as a fine spray at first, gradually increasing the volume output.
- Move up the front leg to the topline of the animal; work the acaricide into the coat of the animal by directing the spray horizontally across the body, leaving the head dry, until the underline is reached.
- Inspect the animal to ensure that the rump and tail have been thoroughly sprayed.
- Inspect under the front shoulder, the udder area and the flank to ensure these areas have been thoroughly sprayed because many ectoparasites tend to hide there.
- Repeat the above steps on the opposite side of each pig.
- Commence spraying the head by standing either directly in front or slightly to the side of the pig; this should be first done as a fine spray, gradually increasing the volume output to thoroughly wet the area.
- Special attention should be paid to the ears and under the jaw to ensure that these areas have been thoroughly sprayed.
- Complete a thorough visual inspection of the whole animal to ensure no areas have been left untreated with the acaricide/insecticide; watch as the animal moves to ensure all hard to access areas have been treated.

2.6. *Rational use of dewormers and acaricides to avoid resistance*

Rational handling and storage of livestock therapeutic agents can protect pork from contamination from drug residue. It is imperative that appropriate storage facilities are used because not only does the practice ensure medications remain effective but also helps reduce potential errors in products and treatment.

2.6.1. Storage

The ideal location for a storage unit is a clean, dry, frost free area, such as a farm office or utility room. Animal drugs should also be protected from changes in temperature, sunlight, dust, moisture, animals, insects and wrongful hands.

Different medications require different temperatures for them to retain potency up to their supposed date of expiry. Most of the drugs are heat label when a certain temperature threshold is exceeded. It is therefore imperative that these therapeutic products are stored at temperatures recommended by the manufacturer to remain potent.

Light sensitivity: Some products decay when exposed to light. Manufacturers package these products in light resistant containers. Such products should be stored away from light for them to retain their potency.

Organized storage: To avoid errors and mix ups of the different classes of products (antibiotics, vaccines, dewormers and acaricides) or formulations for different species should be kept on well-labelled independent shelves.

Safety/security: Always keep drugs under lock and key to avoid access by children and individuals who may misuse them such as unqualified personnel at the farm through theft.

2.6.2. Reconstituting acaricides and spraying frequency

The recommended concentration of acaricide should be maintained during spraying process by ensuring the following:

The total capacity of the spray container is precisely calculated so that the exact ratio by volume of acaricide to water are added to attain the desired concentration. This requires that the spray tank is calibrated so that the amount of acaricide and water prepared is correct to complete the application on the pigs.

Measure the amount of water and the corresponding amount of acaricide using well calibrated measuring tools; mix thoroughly. Repeat the same procedure when adding the new quantity of water and acaricide to the spray tank. Do not top up.

Spray every 2 to 3 weeks or as recommended by the manufacturer.

3. Pig pen hygiene

Good pen hygiene is an integral part in the control of diseases related to improper hygiene.

- Reduces subclinical infection which would cause poor growth thus better growth.
- Reduces sickness hence reduction of antibiotic usage.
- Good pen hygiene reduces the operational costs and other losses through treating sick animals.
- Pig pen hygiene reduces the risk of zoonoses from animals to man and vice versa.
- Proper pen hygiene enhances the quality assurance of the final pig pork product.
- Pen hygiene is essential in pig welfare. This is because it reduces the risk of diseases and the pathologies that come from disease.

Key practices to emphasize to maintain good pen hygiene:

Proper construction of the pig pens which allows easy cleaning and effluent flow from the pen.

Regular cleaning: Remove accumulated waste and soiled bedding materials every day, paying attention to areas where pigs tend to defecate. Thoroughly clean the pen preferably daily using appropriate cleaning agents such as soap to eliminate bacteria and parasites.

Proper waste management: Minimize bad odours and prevent the build-up of harmful pathogens. Collect and dispose of waste in designated areas (manure pits), ensuring it is properly contained and removed from the pen. Consider composting or proper disposal methods to handle the waste effectively.

Bedding maintenance: Provide clean and dry bedding material in the pig pen. Regularly check the bedding for moisture or signs of contamination and replace it as needed. Maintaining dry and clean bedding helps absorb moisture and provides a comfortable resting area for the pigs.

Drainage and flooring: Proper drainage systems, with easy to clean/disinfect flooring, prevent accumulating stagnant water or mud. Adequate drainage helps maintain a dry and clean environment, reducing the risk of bacterial growth.

Proper ventilation: Controls air quality and reduces moisture levels in the pig pen. Good airflow removes stale air, reduces ammonia levels and prevents the build-up of foul odours. Ensure the ventilators are positioned well to function effectively.

Water and feed management: Ensure clean and fresh water is readily available to the pigs. Regularly clean water tanks to prevent algae growth and contamination. Additionally, practice proper feed management to minimize spillage and prevent accumulating feed residues, which can attract pests and promote bacterial growth. Feed troughs should be cleaned whenever feed sticks on the sides of the feeder.

Biosecurity measures: Implement biosecurity protocols to prevent the introduction and spread of diseases in the pig pens.

- Control access to the pig area premises
- Have biosecurity fence around the piggery
- Control access to the pen by limiting entry to authorized personnel only
- Provide footbaths at the entrance to prevent the transmission of pathogens. Also, maintain strict hygiene practices when handling pigs or equipment.

4. Biosecurity (Bio-management and management of specific pathogens, disinfectant use)

Effective biosecurity on a swine farm requires practices and procedures to reduce the spread of disease between pigs, people and other swine farms. This requires a biosecurity plan which is a set of written guidelines that consistently describe how employees, service personnel, visitors, equipment and pigs should enter, act while at the farm and leave the farm.

4.1. The importance of farm biosecurity

Excellent farm biosecurity has many benefits among which is a reduced animal disease incidence which in turn:

- Reduces costs of treatment/prevention of illness, including time and labour expenses.
- Reduced stress on the pigs resulting in enhanced animal welfare.
- Improved productivity and performance.
- Reduced risk of transmission of diseases that can spread to humans, e.g. *Salmonella* spp, *Escherichia coli*, *erysipelas* etc.
- Export markets are protected due to reduced disease incursions.

4.2. What are the potential sources of biosecurity breaches?

- Bringing in pigs of unknown disease profiles.
- Sharing equipment with other pig farms.
- Sharing boars between farms.
- Biosecurity ignorant veterinary para- and professionals.
- Swill feeding that is not precooked.
- Contaminated pig feeds.
- Unrestricted entry into the farm by visitors, traders and roaming animals including stray pigs and dogs.
- Poor/wrong attitude of the farm workers and other enterprise personnel.

4.3. How to setup a farm biosecurity protocol

When setting up a biosecurity plan, the following must be done:

- Location of pig farm: In backyard pig farming, it is critical that the farm structure is set up in a part of the home that is secluded and not easily accessible by unauthorized visitors. Where possible set up farm premises where there is a low concentration of pig farms. This makes it easier to prevent the entry of some diseases into the farm.
- Introducing new pigs: Due diligence must be paid to prevent pigs from markets or from farms with unknown disease profiles. It is key that pigs are acquired from a farm with high health status and possess a sound disease control program.
- Quarantine: New animals into the farm must be first quarantined to give ample time to detect any latent infection before introducing into the farm. Newly purchased pigs should be kept separately from the rest of the herd for a period of 3 weeks in a shed situated away from the main herd/herds where they can be observed for any signs of disease or endo/ectoparasites. After which, their blood tested for antibodies to diseases such as brucellosis, PRRS, PCV2 and African Swine Fever (ASF) infections or any diseases of concern.
- Pig traders: Do not allow pig traders and brokers into the pig house or if required, they must follow strict biosecurity measures to prevent entry of pathogens into the farm as described in another section.
- Visitors: The access of the pig house by visitors should be restricted to the greatest extent possible. At the minimum, they should follow the biosecurity measures described in

another section. Provide a sign in log that records the last time visitors had contact with pigs.

- Fencing: The pig farm should be fenced off, possibly using simple chain linked fence to keep out people, stray pigs and other animals such as dogs.
- Workers should be made to understand the importance of the biosecurity measures put in place on a farm. They should not bring any human food into the pig house. Gumboots should be provided for all the workers on the farm. When doing chores or checking your herd, move from the healthiest to least healthy to decrease incidence of disease spread. Also move from the youngest or the most vulnerable pigs to the oldest pigs during daily tasks.
- Within age groups, work with sick or ill pigs last or after working with healthy pigs.
- Isolation pens: Farmers are advised to have a special pig house for sick pigs, away from the rest of the herd. Here, sick pigs can be isolated to prevent the disease from spreading to other pens on the farm. It is also advisable that sick pigs in the isolated pens are attended to last and then gumboots dipped in a disinfectant or desiccant as one leave that pen. Wash your hands and change your clothes and boots after.
- Equipment: Farmers are encouraged to have different farm equipment for each pen to prevent cross contamination of pens and the quick spread of pathogens between pens. Disinfect facilities and equipment after use. Clean equipment and vehicles prior to arrival, particularly tires and undercarriage so that pathogens do not hitch a ride onto the farm.
- Signage: 'Do Not Enter' or any other signage restricting should be posted around the perimeter buffer area entry point and at all pen entry points.

4.4. *Disposal of pig slaughter waste*

Proper disposal of pig slaughter waste is crucial in preventing the spread of ASF. It is key that slaughterhouse operators dispose of pig slaughter waste effectively and safely, including blood, manure and other potentially infectious materials, to minimize the risk of ASF transmission. Below are the guidelines on how to dispose of pig slaughterhouse waste safely to prevent spreading ASF.

4.4.1. *Blood disposal*

- Collect and contain blood from slaughtered pigs in a designated and leak proof container.
- Avoid spillage or leakage during collection and transport to prevent environmental contamination.
- Do not dispose of blood in open areas or water bodies. The collected blood should be properly treated or processed according to approved methods to ensure inactivation of ASF virus (e.g. through heat treatment or burying).

4.4.2. *Digesta disposal*

Collect and store pig manure in a designated area or container at the slaughterhouse.

- Consider composting the manure to destroy the ASF virus before being used in the open fields. Consult with agricultural experts for guidance on effective composting methods.
- Alternatively, consider using manure for biogas production or other safe and approved agricultural practices which do not support spread of the ASF virus.
- Do not spread uncomposted pig manure on agricultural fields or areas where pigs are present as this can result in an ASF outbreak.
- Other slaughter waste disposal:
- Dispose of other potentially infectious slaughter waste, such as carcass parts, organs and tissues, in a controlled manner.
- Avoid indiscriminate dumping or improper disposal that may lead to scavenging by pigs or other animals.

- Burning is an effective method for destroying infectious material. Consider using a licensed incineration facility or consult with local authorities on safe and approved incineration options.
- Burial is another option, but it requires careful consideration of location, depth and appropriate covering to prevent access by scavengers and potential contamination of groundwater sources.

4.4.3. Biosecurity measures

- Implement strict biosecurity measures at slaughter facilities to prevent the introduction or spread of ASF.
- Designate separate areas or facilities for pig slaughter, waste collection and disposal.
- Provide adequate training and supervision to slaughterhouse workers on proper handling and disposal of slaughter waste. This can be provided by the administrative unit's veterinary department.

Regularly clean and disinfect slaughter facilities, equipment and vehicles used for waste transport to minimize the risk of contamination.

4.5. What are the recommended locally available disinfectants?

Disinfectants are not effective if the surfaces they are supposed to work on are covered with dirt or any organic matter. It is important that surfaces of items to be disinfected be cleaned using water. Disinfectants can be used at the entrance of the farm premises and the pig house. It is also important to disinfect equipment and vehicles which access the farm.

Disinfectants vary in effectiveness against different pathogens as shown in Table 6. It is therefore imperative that a selected disinfectant is effective across a wide spectrum of pathogens under the conditions in which it will usually be used.

Table 6: Commonly used disinfectants and their working concentration

Disinfectant	Working concentration	How to dilute to make 10 litres of disinfectant
5% Sodium Hypochlorite (NaOCl) (Jik™)	0.5%	Measure 1 litre of Jik™ (bleach) dilute to 10 litres of solution
Potassium Peroxymonosulfate and Sodium Chloride (i.e. Virkon™ S)	1%	Add 100 grams of Virkon powder and add clean water to make a 10 litre solution

Disinfectants must also have enough contact time with the surfaces to which they are applied to enable them to destroy pathogens with which we are of concern.

4.6. Pig welfare

4.6.1. What is pig welfare and why is it important?

Pig welfare is the physical, physiological and mental needs of pigs. The needs of pigs will depend partly on their production phase, but there are also common welfare issues that can affect all pigs. Animal welfare considers the physical health, nutrition, behaviour and environment of pigs and how these impacts their experiences. Pig welfare is important as it influences the health of pigs and hence their productivity.

4.6.2. Safe handling

Pigs should be handled gently in all circumstances. Loud noises, unpredictable management and rough handling scare pigs. A scared pig is more erratic to handle, making it more difficult and unsafe for both the pig and the handler.

Poor handling can also affect short-term performance (milk production for lactating sows) and compromise reproductive success at critical times. In the long-term, poor animal handling can become a chronic stress factor leading to reduced performance, reduced immune function and poor meat quality. Electric or physical goads should never be used to move pigs. Touching sensitive areas including the udder, face, eyes, nose, ears or anus and genitals regions should never be used to move pigs. Instead, pig boards (also called a sorting board or herding board), a solid wooden or plastic board that acts as a physical barrier can be used to move pigs by applying gentle pressure at their rear or blocking movement from the front. Pig boards are a very useful and safe for both the pigs and the handler.

Remember to be patient because the pig does not understand the reason why they are being handled. Rough handling includes extreme handling such as kicking, throwing, dropping, walked on top of the pigs, holding or pulling by one front leg, ears or tail etc. Physical pain, fast movements, chasing, shouting, hitting and banging all cause fear in pigs and ultimately make them more stressed, more susceptible to disease and harder to handle.

4.6.2.1. Handling pigs to minimize stress

Psychological restraint is a crucial skill for farmers to handle and restrain pigs while minimizing stress and essentially ensuring animal welfare safely and effectively. Here are steps involved in psychologically restraining pigs, promoting low stress handling practices and improving the overall management of pig farms:

Approach and environment:

- Approach pigs calmly and quietly, avoiding sudden movements or loud noises that may startle them.
- Ensure the handling area is well designed, free from sharp objects and has enough space for the pig to move comfortably.

Pig handling techniques:

- Understand pig behaviour: understand pig body language and cues to anticipate their reactions and respond appropriately. This takes time through frequent and gradual interactions with the pigs.
- Apply gentle pressure: use a combination of physical and verbal cues to guide the pig's movements without causing harm or distress. This is where a pig board or herding board is particularly useful.

Sorting and moving pigs:

- Sort and move pigs in small groups or individually, ensuring a calm and controlled process.
- Use a herding board to guide pigs without physical contact, minimizing stress and avoiding aggression.
- Remember to avoid excessive hitting or shouting, as these actions can increase stress and fear in pigs.

Training and familiarization:

- Regularly expose pigs to handling and restraint procedures from a young age to familiarize them with the process.
- Gradually introduce pigs to various handling techniques and equipment.
- Involve farm personnel in training sessions to ensure consistent and effective handling practices throughout the farm.

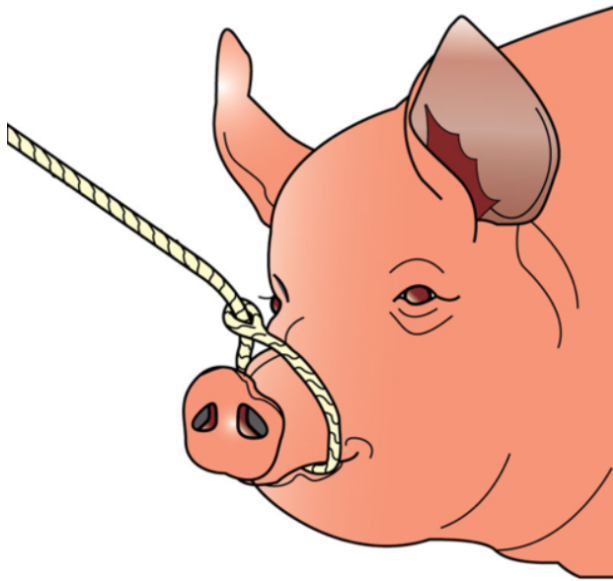
4.6.2.2. *Physical restraint of pigs*

Restraining pigs should only last for as long as it is required and this should be done in a safe way for the pig and the handler, during a procedure and using appropriate devices. Immediately after the procedure is completed, the pig should be set free.

- For piglets:
 - Lift the pig by a back leg, taking care not to 'swing' it as you lift.
 - Have your other hand under the chest to provide support if treating, inspecting or moving piglets over longer distances.
 - Alternatively, after lifting, place the piglet over your forearm with the chest in the palm of your hand and the legs hanging either side of your arm.
 - When lowering, ensure both front legs have contact with the ground then gently lower front legs.
- For larger pigs:
 - Pick an area that is large enough to perform the task safely but small enough to restrict movement.
 - Ensure the pig cannot move forward.
 - Apply gentle pressure with the pig board/your leg to the hindquarters and flank of the pig to keep them still.
 - If you need to restrain the pig for a long time, restraining with a snare may be necessary as shown in Figure 3. If this is the case, follow the same 3 steps as above, then:
 - ⇒ Place the snare loop in the mouth and over the top jaw and snout of the pig.
 - ⇒ Have the loop far back in the mouth.
 - ⇒ Release the pig as soon as possible by smoothly loosening and releasing the snare.

Never move the pig by pulling by the snare or tie them up by the snare.

Figure 3: Illustration of a pig snare in use.



Source: Quizlet.

4.7. Castrating piglets

Castration is a common practice performed on male piglets to control reproduction and improve the management of pig herds. Castration is also done to reduce boar taint in pork, which develops when boars attain the age of puberty, usually from 8 months. This subsection of the manual focuses on the castration procedure and the importance of prioritizing piglet welfare throughout the process. It is crucial to ensure that the procedure is carried out in a manner that minimizes pain, stress and potential complications, promoting the overall wellbeing of the piglets.

Castration of piglets is beneficial because it prevents unwanted breeding, makes the boars less aggressive and improves meat quality (eliminates boar taint).

While there are management benefits to castration, it is a painful practice that causes distress to piglets, can negatively impact their growth, immune function, production and behaviour during the recovery period and creates a wound that is at risk of haemorrhage, excessive swelling and risk of infection. It is therefore important that this is done in the most welfare friendly way possible. This can be done through the following:

Age of castration: It is recommended to perform castration at the earliest age possible, ideally between 1 to 7 days after birth. At this age, piglets display less distress than piglets castrated at an older age.

Anaesthesia and pain relief: To minimize pain and discomfort, the use of appropriate anaesthesia and pain relief is highly recommended during castration.

Sterile environment: Maintaining a clean and sterile environment during the castration procedure is essential to prevent infections. Ensure that all instruments and equipment used during the procedure are properly cleaned and disinfected. Adhere to proper hygiene protocols to reduce the risk of complications and promote healing.

Proper restraint and technique: Correct handling and restraint techniques are crucial for minimizing stress and injury to the piglets during castration. Train personnel on proper handling methods and ensure that individuals performing the procedure are skilled and experienced. This has been described in another section.

Cutting of spermatic cords is better than tearing: Tearing increases the amount of tissues removed, causes more distress (due to pain) and might cause intraabdominal damage to the remaining tissues and vessels compared to cutting. Tearing as a castration technique should not be performed.

Monitoring and post castration care: After the castration procedure, closely monitor the piglets for any signs of pain, discomfort, infection or any other complications. Provide a clean and comfortable recovery area with appropriate bedding. Ensure that the piglets have access to water and a balanced diet to support their recovery and wellbeing. If any issues arise, seek veterinary assistance promptly.

4.8. *Signs of good pig behaviour and management*

Knowing the normal behaviour of pigs is important in the welfare perspective during commercial production since this can improve the wellbeing of the pigs.

4.8.1. Boar

Aggression: Boars may display aggressive behaviours, especially during breeding season or when encountering other boars. This can include head butting, mounting or fighting.

Scent marking: Boars have specialized scent glands that they use to mark their territory. They may rub against objects or urinate to leave their scent behind.

Vocalization: Boars can produce various vocalizations, including grunting, roaring or barking, to communicate with other pigs.

Boars are easily sexually aroused by the smell from the females. If the boar pen is near the pen of gilts that are at puberty, the boar will be in constant sexual arousal and it may fail to eat. It is therefore important to have the boar pen far from the female pens. And only the female for mating is brought to the boar.

For good fertility, the boar must serve a limited number of females in a certain period. Therefore, the proper ratio of boars to females on a farm must be maintained so that each boar at every insemination gives the viable volume of sperms that can cause the right conception for the best fertility of the sow.

4.8.2. Sows in heat

Restlessness: Sows in heat may appear restless and exhibit increased activity levels, pacing or searching for a mate.

Vocalization: Sows in heat may vocalize more frequently, producing loud, high pitched sounds to attract the attention of boars.

Lordosis reflex: When pressure is applied to the back of a sow in heat, she will exhibit the lordosis reflex, which involves arching her back and standing still, indicating receptiveness to mating.

4.8.3. Sow in late pregnancy

Nest building: Sows will engage in nest building behaviour by rooting, gathering bedding materials and arranging them to create a comfortable nest for farrowing.

Decreased activity: As the pregnancy progresses, sows tend to become less active and spend more time resting and preparing for farrowing.

Increased appetite: Sows may show an increased appetite during late pregnancy to meet the nutritional demands of farrowing and lactation.

Sows in late pregnancy are prone to stress. Stress will make the pig produce hormones of fear which can lead to disturbances in the physiology of the pregnancy which can lead to abortions of premature births.

4.8.4. Farrowing sow

Nesting behaviour and attendance: Prior to farrowing, sows exhibit nesting behaviour by rooting, rearranging bedding and creating a secure and comfortable area for giving birth. Sows tend to become more protective and stay close to the nest during farrowing, showing maternal instincts and attentiveness to piglets. In a natural environment, sows will lay down for the whole birthing session and for a long period after. Allowing sows to do this can make delivery safer and faster and reduces the risk of piglet overlay.

Grunting and vocalization: Sows may vocalize with low, grunting sounds to communicate with their piglets and establish bonding.

4.8.5. Piglets

Suckling: Piglets will actively seek the udder and nurse from the sow, exhibiting vigorous suckling behaviour shortly after birth.

Exploratory and social behaviour: As they grow, piglets will start to explore their surroundings, engage in play behaviour and interact with littermates. Piglets display social behaviours by engaging in gentle nudging, rooting and playing with each other, promoting social bonds within the litter.

It is important to note that behaviours can vary between individual piglets and can be influenced by factors such as genetics, environment and social interactions. Observing and understanding these normal behaviours can help farmers assess the wellbeing of their piglets and provide appropriate care and management practices.

Reduced eating activity, where the piglets eat less than what it is expected to eat, may indicate sickness or stress.

4.9. *Behavioural restriction and abnormal behaviours*

4.9.1. Nest building behaviour in farrowing/lactating sows

Farrowing sows and gilts are highly motivated to perform nest building behaviour, which is linked with positive maternal behaviours during farrowing. The behaviours performed during nest building accompany changes in hormone production that facilitates a smooth farrowing and developing good maternal behaviours. There are positive effects on colostrum and milk production which is vital for piglet survival. Adequate farrowing environments with enough space for sows to move, lie down and inspect piglets and deep bedding can reduce risk of piglet crushing and contribute to suckling success for piglets.

4.9.2. Adequate space for sows

Extremely limited space for sows can create welfare challenges. Pigs without enough space to move or turn around often experience the following challenges:

- v. Shoulder injuries from repeated pressure on the same location.
- vi. Inactivity, leading to poor cardiovascular fitness and leg weakness.
- vii. Lack of opportunities to engage in natural behaviour, including exploration, foraging and social behaviours, may result in oral stereotypes including bar biting, sham chewing and over drinking.
- viii. Aggressive maternal behaviour towards piglets or towards other sows resulting in injury and chronic stress, increasing piglet mortality.

4.9.3. Growing pigs

Mixing of unfamiliar pigs after weaning, abrupt weaning and barren pens with little space are all welfare issues that can create behavioural problems in growing pigs.

4.9.4. Abrupt weaning

Early and abrupt weaning involves various welfare challenges for piglets, such as the removal from the mother, change in feed from milk to solid and an introduction to an unfamiliar environment with littermates or mixed with other litter of piglets.

In natural conditions, young piglets spend significant amount of time suckling and massaging the sow's udders to stimulate the milk production and let down by the sow. In the absence of the sow (e.g. either due to an artificial rearing or early weaning), these behaviours are redirected to pen mates or objects in a pen and this may result in behavioural problems such as persistent belly nosing and chewing of other piglets or objects. This behaviour can persist after weaning and there is a direct link between the extent of these behaviours and the age at which abrupt weaning occurs. Belly nosing and chewing behaviours are driven by the motivation for feed. The practice can be mitigated by the provision of feed and enrichment materials.

4.9.5. Barren environment

Ear and tail biting are a behavioural problem associated with barren housing conditions. It causes painful injuries to the pigs and economic losses associated with this behaviour is a serious issue in the industry. When extreme, biting causes the amputation of the tail and can cause spinal abscesses.

Tail biting is considered an abnormal behaviour since it is rarely reported under extensive or seminatural environments. At first, this behaviour can be a redirected exploratory behaviour where one pig gently holds the tail of another pig in its mouth without causing damage. However, this behaviour can cause severe tissue trauma when a pig's tail is seized and bitten forcefully. Tail biting is commonly seen when confined pigs are unable to access desired resources, such as food, but is also a sign of frustration. In severe cases, some pigs may become obsessive tail biters, which spend significantly more time performing this behaviour, negatively impacting their growth. Bitten pigs are usually less reactive due to pain caused by tissue damage and are more susceptible to diseases.

The most important risk factor for an outbreak of tail biting is the lack of straw or other environmental enrichment in confined systems, although high stocking density, competition for feed and water and poor air quality also play a role in the prevalence of tail biting.

4.9.6. Benefits of environmental enrichment for piglets' behaviour from birth to weaning

Piglets reared with straw, logs and branches spend more time interacting with the materials and less time nudging and tail biting littermates and manipulating pen floor and walls, compared to piglets in pens without added materials.

For pigs reared in slatted or partly slatted pen floors (where adding straw and branches are not feasible), giving shredded papers on the floor (minimal distractions with the manure removal system) or ropes suspended on the walls was found to reduce damaging behaviour towards pen mates (tail or ear biting).

4.10. Safe transportation of pigs

Transporting, especially loading and the subsequent journey present one of the biggest pig welfare issues such as stress and trauma. Pigs may experience a range of stressing moments during this period such as rough handling, strange environment, scary situations, group stress (e.g. regrouping with new pigs, which may lead to aggression), crowding, extreme temperatures, changes in acceleration and vibration due to motion.

Other than physical injury to the pigs, transporting may cause severe stress that they experience physiological consequences that become apparent in meat quality changes, which may drive down the pork demand. Such include glycogen depletion of muscle due to fatigue rendering the meat

dark, firm and dry. There could also be rapid muscle acidification due to preslaughter stress leading to pale, soft and exudative meat.

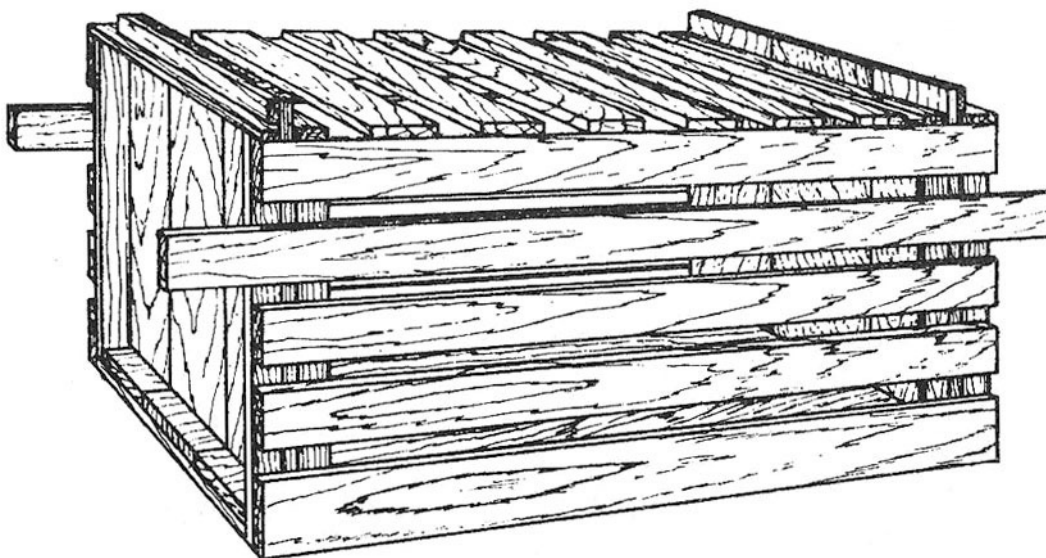
To reduce suffering of pigs during transportation, the following should be done:

Transport the animals in suitable vehicles which have nonslip surfaces, are well aerated and comfortable for the pigs. Avoid the use of bicycles and motorbikes for transporting pigs unless they have been specifically modified for the same use.

During loading, provide a ramp that is not steep otherwise, a steep one would cause high heart rate and more time to climb hence more stress. A 20% slope on the ramp would be adequate for minimizing stress in pigs while loading. When affordable, farmers are advised to employ loading crates shown in Figure 4. These crates are specialized containers used to transport pigs safely and efficiently, are well ventilated and comfortable for pigs.

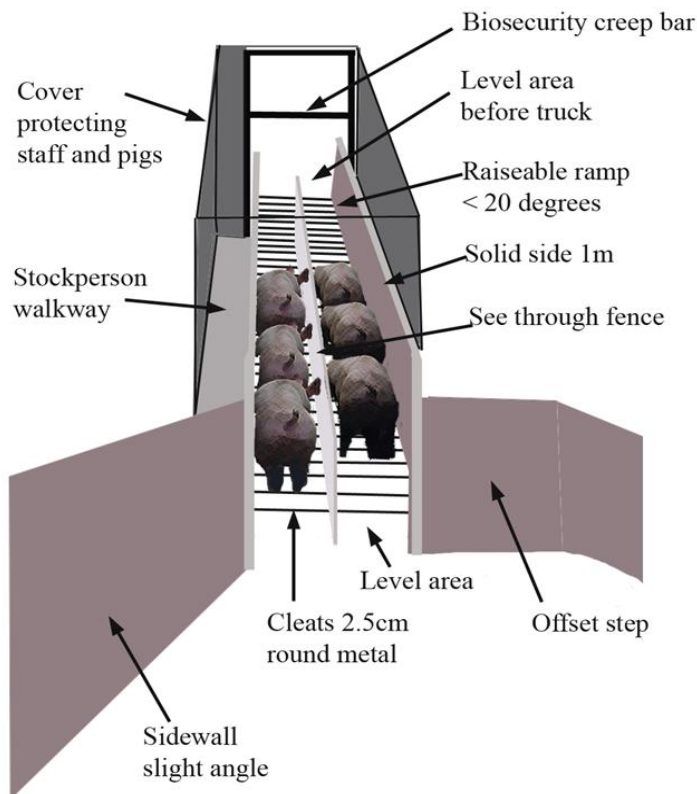
Climbing a loading ramp is more difficult for pigs compared to other farmed animals. Steeper ramps cause an elevation in heart rate and require more time to climb. This increases risks to short-term stress from a steeper climb, as well as increasing the risk of injuries and falls. During loading, provide a ramp that is not steep as shown in Figure 5.

Figure 4: A wooden loading crate for pigs



Source: (Wooley and Rickets, 1942).

Figure 5: Pig loading ramp



Source: CARRS consulting.

Try to separate pigs from different herds in the same compartment since this causes fighting, leading to injuries.

Load pigs slowly, quick loading may lead to mortalities due to stampede and/or fights.

Withhold or limit water and feed for 24 hours in preparation for transporting pigs to slaughter. This helps to reduce vomiting due to motion sickness, to reduce the risk of puncturing the intestines during evisceration, to avoid deaths because pigs that have full stomachs are more likely to die during transport and to reduce feeding costs.

During transit, caution must be taken by the driver to avoid abrupt braking and acceleration. Sudden breaks and acceleration cause a lot of discomfort to the pigs through stress and injuries due to falls.

Pigs require ambient temperature for them to function normally. Although the current Uganda animal health act of 1964 does not allow night transportation of animals, the best time to avoid heat stress during transportation is night. There are efforts to amend the bill to make it lawful in Uganda to transport the animals at night.

Very low temperatures are also grave for the pigs during transportation. Avoid rain from falling on the pigs during transportation because, this combined with windy chills maybe fatal for the pigs in a moving truck.

4.11. Assisted farrowing

Farrowing, the process of giving birth to piglets, is a crucial and often challenging phase in swine production. While many sows can handle farrowing unassisted, there are instances where intervention becomes necessary to ensure a safe and successful delivery. This intervention process,

known as assisted farrowing, plays a vital role in monitoring and safeguarding the health and wellbeing of both the sow and the piglets.

Monitoring sow health: The attendant should closely observe the sow's ability to farrow. If a sow appears weak, disoriented or unable to complete the farrowing process on her own, intervention may be required. This may involve manipulative delivery.

Caring for weak piglets: Identify and care for weak or underdeveloped piglets. The caring can be done in several ways, e.g. removing mucus, cutting umbilical cords and ensuring they receive adequate colostrum from the sow. Strong piglets should be separated from weaker ones, ensuring that each piglet receives proper care and attention.

The piglets are then placed in a safe and warm environment (creep box). This protects the vulnerable piglets from being accidentally crushed or injured by the sow's movements.

5. Water strategy (safe drinking water)

Water is an essential ingredient in pig farming although given its abundance and low price, sometimes pigs do not receive enough of it. In practice, drinking water for pigs should be provided ad lib.

Water is required for tissue maintenance, body growth, foetus development or lactation, the pig needs water to fulfil several other physiologically significant functions, such as thermoregulation, mineral homeostasis, excretion of metabolites and/or antinutritional substances, achieving satiety and behavioural purposes. A pig can lose most of its fat and half its body protein without dying and up to 10% without affecting performance, but if it loses as little as 10% of its water content, death quickly follows.

5.1. Water requirements by age group

Water is an important element in the nutrition and overall health of pigs. Adequate water intake is essential to maintain proper hydration, support digestion, regulate body temperature and promote optimal growth and development. However, pigs' water needs vary according to age, physiological stage and environmental factors as shown in Table 7. By understanding and addressing the water needs of pigs at different life stages, farmers can promote healthy hydration and contribute to the overall success of their pig industry.

Table 7: Water requirements of pigs by age group and physiological status

Pig category	Daily water needs (litres)	Remarks
1–28 days (suckling piglets)	0.1–0.35 litres	Water intake during the nursing period may prevent dehydration and promote survival of piglets with low milk intake
Weaner piglets (4–8 weeks)	0.5–1 litres	Water can be unlimitedly provided to the piglets. The water intake to feed ratio is between 2:1 and 3:1.
Grower piglets (8–12 weeks)	1–2 litres	
Finisher pigs (12–24 weeks)	2–4 litres	Providing ample access to clean water is essential to support their growth, metabolism and overall wellbeing since they are nearing market weight
Gestating sows, adult pigs	10–20 litres	Restricted fed sows consume most of the water between meals and there is no relation between water and feed intake
Lactating sows	17–35 litres	Water consumption is helpful in encouraging feed consumption by lactating sows

6. Caring and managing piglets (newly born, pre and post weaning)

Proper care and management of piglets has a big effect on the number of piglets that are weaned and how well they perform in later stages of production. Starvation is one of the main causes of piglet mortality, along with stillbirth, crushing by the sow, hypothermia and disease. Many of these causes interact. For example, a piglet might become chilled, fail to drink enough colostrum and become too weak to move away from the sow as it changes posture leading to crushing.

Newly born piglets have certain physical characteristics which make them very reliant on proper management and care such as low skin hair cover which makes them unable to easily regulate their own temperature once it exceeds certain thresholds.

Furthermore, piglets are born with low antibody protection, their bodies contain fat energy for about one day of life and they cannot regulate internal body temperature well until they are a few days old. Thus, anything that may lead to a reduction in milk production or consumption, such as chilling or exposure to disease organisms, compromises the health and wellbeing of newborn piglets.

6.1 Navel cord care

The umbilical cord of a newborn piglet should not be severed immediately after farrowing. Doing so would create a conduit for infection. It is advisable not to sever the navel cord unless it is very long or damaged, but in case it is necessary, apply tincture iodine after. Sometimes, a piglet may bleed from the navel, in such cases, stop the bleeding by tying clean string around the cord approximately 1 inch from the body after which, disinfect the navel cord.

6.2 Teeth clipping

When born, pigs are equipped with sharp canines, they can inflict wounds on siblings during teat fights or on the sow's teats and udder. If there are enough teats for all the piglets, a teat order where everyone has their own teat, is established quite quickly. However, when litters are very large or lots of piglets are moved between litters during fostering, fighting can persist. Teeth clipping involves clipping or grinding the tips of the corner or needle teeth. This is done to reduce the chances of injury. It is a stressful procedure and, if the operator is not well trained, they can clip too much, break the teeth and injure the tongue and lips. Tooth surgery can be avoided if litter sizes are better managed and any fostering is performed before a teat order is established. With effective management solutions, tooth surgery should not be a routine practice. If it needs to be done, grinding is a preferable method as there is less risk of accidental injury to the piglets.

6.3 Colostrum feeding

Newborn piglets acquire immunity passively from the mother through colostrum. Efforts should be made to ensure all piglets suckle the dam immediately after birth to easily absorb immunity factors since this is usually lost after 36 hours postpartum.

Due to the extreme importance of colostrum for piglets' welfare and survival, actions that can be taken to increase colostrum access, particularly for low bodyweight piglets include:

- Piglets can be placed manually close to the udder shortly after birth, helping them to find a teat more promptly.
- If other sows are farrowing, weaker piglets can be supplemented with colostrum recently milked from sows from the same herd (higher immunoglobulin levels).

- 'Split suckling or split nursing' (withdrawing the larger piglets or those that have already taken colostrum for a short period of time) can guarantee colostrum intake by the weaker piglets.
- Administering colostrum replacers available in the market.

6.4 Splay leg



A piglet with splay leg after correction by taping the hind legs (photo credit: Albert Kerbl GmbH, Germany).

The legs may appear to be normal until they attempt to stand, that is when their hind legs and sometimes, the front legs, are noticed to be extended outwards, a condition called splay leg. The condition is thought to be congenital but slippery floors can lead to the same.

The mortality rate in piglets where only the back legs are splayed can be reduced by taping the legs soon after birth to prevent them from extending sideways. Use either elastic wrapping tape, adhesive tape or duct tape. Cut the tape in $\frac{1}{2}$ to $\frac{3}{4}$ inch strips. Apply tape to the rear legs allowing a two inch gap between legs so the piglet can stand properly. Avoid wrapping the tape too tightly to restrict circulation of blood and be sure to remove the tape a few days later. Piglets that are splayed in both their front and back legs often are not worth trying to save, instead consider euthanasia.

6.5 Creep space/brooder box for piglets and creep feeding

6.5.1 Brooding area for piglets

Piglets need a higher environmental temperature compared to sows. The ideal brooder temperature for piglets is from 30°C to 32°C. This can be achieved using a brooder box which also serves to protect the piglets from being crushed by the mother as shown in Figure 6. How the piglets feel about the environmental temperature is shown by their behaviour. If they stay close to the sow or in the brooder area/creep space or huddle together, then temperature is too low. If piglets are evenly distributed in the pen and in the brooder, then the temperature is just right. It is important that the brooder or creep area is kept warm, dry and clean. The following are the ideal requirements for a creep box.

Size: The creep space should be large enough to accommodate the growing piglets comfortably. A recommended size is approximately 0.5 m (width), 1 m (length) and 0.5 m (height). This can be adjusted according to the number of piglets which are here, it is advisable to use the spacing of 0.11 m² as shown in Figure 6.

- Ventilation:** Proper ventilation is crucial to maintain good air quality and prevent heat stress. The creep space should have adequate airflow to remove moisture, odours and ammonia gases, while still providing a draft free environment.

- ii. Insulation: The creep space should be well insulated to regulate temperature and protect the piglets from extreme cold.
- iii. Flooring: The flooring of the creep space should be made of durable and nonslip material for easy cleaning and to prevent injuries. Concrete, plastic or metal flooring with adequate drainage are suitable options.
- iv. Lighting: Enough natural or artificial lighting should be provided in the creep space to promote piglet activity and growth. A combination of natural light during the day and artificial light during darker hours can be beneficial if a farmer can afford it.
- v. Feeders and waterers: Adequate and easily accessible feeders and waterers should be installed in the creep space to ensure a continuous supply of fresh creep feed and water for the piglets. These should be designed to minimize wastage and contamination.
- vi. Hygiene and cleaning: The creep space should be designed for easy cleaning and disinfection to maintain good hygiene. Smooth surfaces, removable partitions and proper drainage systems can aid in effective cleaning practices.
- vii. Accessibility: The creep space should be designed for easy access, allowing farmers to monitor the piglets, provide necessary care and perform routine management tasks without difficulty.

Figure 6. An illustration of an ideal creep box for piglets

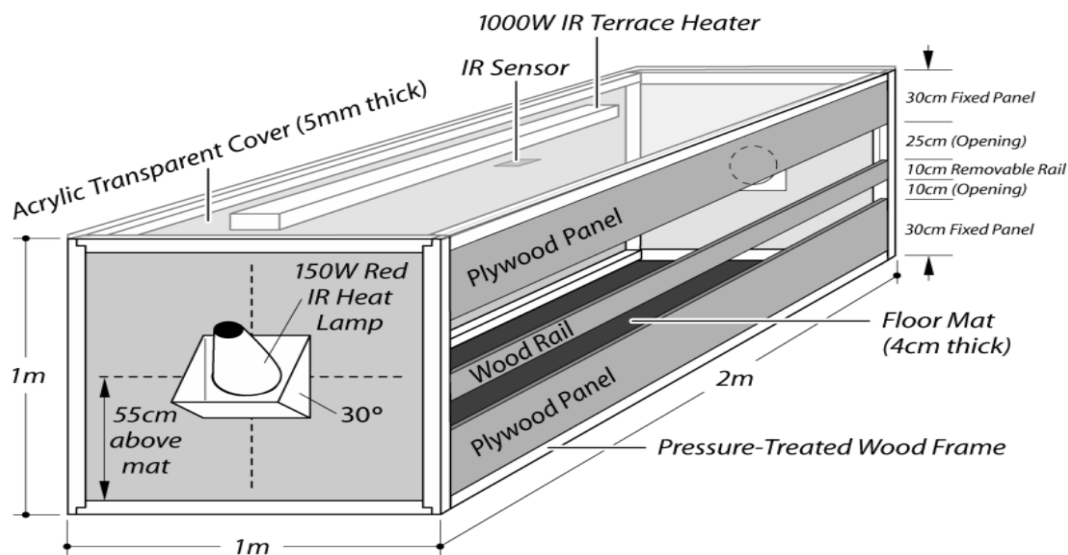


Photo credit: Wheeler et al. 2008.

6.5.2 Creep feeding

It is necessary to supplement milk from the sow with creep feed especially when a litter size is larger than the milk output from the sow. Creep feeding is the practice of feeding solid feed to piglets while they are suckling the sow from the 2nd week of age. Creep feeding initiates and promotes developing both digestive system and digestive enzymes enabling them to digest nutrients from feed sources other than that of milk. This helps the piglets to transition to solid feed easily after weaning for quicker growth.

When providing creep feed to piglets, the following should be considered:

- Fresh and clean creep feed should always be provided to piglets away from dam.
- Creep feeding should be started at 10–14 days of age or at least 10 days prior to weaning.
- Offer creep feed when sows are feeding and always remove the uneaten creep.

- Do not overfeed the piglets, always fed to appetite. Introduce small troughs or top up the trays more often if the piglets are eating well. A feeding scheme is shared in Table 8.
- Ensure adequate supply of clean fresh drinking water.
- The creep feed bags should be stored in a cool place and closed properly to prevent feed taking up foul odour or becoming rancid.

Table 8: Feeding scheme for piglets and weaners

Age of piglets (weeks)	Amount of feed/head per day (grams)	Type of feed
2	100	Creep feed
3	150	Creep feed
4	200	Creep feed
5	300	Creep feed
6	400	Creep and grower feed
7	500	Grower feed
8	600	Grower feed
9	700	Grower feed
10	800	Grower feed

6.6. Piglet anaemia prevention

Piglet anaemia brought about by iron deficiency often called nutritional anaemia manifests as loss of appetite, slow growth, poor hair and skin condition which cause 'sluggish impression in piglets', emaciation, paleness, restlessness and hard breathing (thumping). At birth, the piglets have about 50 mg of iron reserves in their body. This amount of iron is not adequate to allow the piglet to grow to its maximum potential at weaning.

This can be prevented by providing iron supplements to piglets. Iron is an important mineral necessary for the formation of oxygen carrying molecules, haemoglobin found in the red blood cells. Piglet requires about 7 mg of iron per day during the first week and about 10 mg at 3 weeks. From the sow's milk, the piglets get only 1–2 mg of iron. Therefore, if piglets are confined with no other source of iron except via milk, serious losses from anaemia may occur.

Injection is the preferred route of administration; however, iron can be given orally (iron paste, iron solution). In both circumstances, consult with your veterinarian to administer the required treatment.

6.7 Preventing piglet diarrhoea/scours

- Health wise, scours are the most common challenge of piglets and therefore it is important to know the causes and how to prevent or control their occurrences. Piglets are prone to scours particularly because of their naive digestive system.
- Scours lead to malabsorption of nutrients leading to reduced weight gain, emaciation and even dehydration and subsequently death in severe cases. Production performance of the herd is reduced due to piglet deaths, retarded growth and secondary infections such as pneumonia. Animals weakened by scours tend to be susceptible to future disease challenges.
- There are different germs that cause scours and these include: bacterial (E. coli, Salmonella spp and Campylobacter spp), viral (Rotavirus, reovirus, transmissible

gastroenteritis, P. epidemic diarrhoea (PED) virus and the PRRS virus); parasitic (coccidia and worms); and dietary or nutritional (any sudden change in feed may cause scours).

- Piglets can develop diarrhoea due to feed and water contamination, feeding from the floor etc. Contaminated feed or water can introduce harmful bacteria, viruses or parasites into the piglets' digestive system, leading to digestive disturbances and diarrhoea.

Scours can be prevented through the following practices:

- Uptake of biosecurity practices that reduce the spread of scours such as disinfecting gumboots between visits to different pens, washing hands after handling a pig or piglet with diarrhoea and disinfecting equipment between pens.
- Employ an all-in, all-out system coupled with pressure wash and disinfection in the farrowing houses between batches.
- Floor hygiene: The cleanliness of the floor in the piglet's living area is crucial in preventing piglet scours. Regular removal of faecal material, cleaning and disinfecting the floor is necessary to reduce the presence of harmful micro-organisms. Keep farrowing pens dry before sows are transferred in to reduce bacterial multiplication. Proper pen hygiene should be observed with good drainage and frequent removal of dung.
- Separating age groups: Separating piglets of different age groups into specific areas or pens can help prevent the spread of diseases. Younger piglets are more vulnerable to infections and separating them from older piglets reduces the risk of exposure to pathogens shed by older pigs.
- Water quality: Ensuring a clean and uncontaminated water supply is crucial. Regularly cleaning and disinfecting water containers, using clean water sources and preventing water contamination are essential measures to prevent piglet scours.
- Consider vaccination: Vaccines for PCV2, P. parvovirus, erysipelas, leptospirosis, *Mycoplasma hyopneumoniae*, *E. coli*, *Salmonella* are available on the Ugandan market.
- Introduce creep feed gradually prior to weaning, i.e. from day 14 to 35.

Handling and rational use of drugs

Antimicrobials are key in treating infections in animals and humans and quite often have been used to prevent disease and on some occasions as growth promoters in food animals, especially pigs and poultry. It is important that the use of medically important antibiotics in animals is reduced to the possible minimum to preserve their effectiveness against pathogens that infect both animals and humans. To do so, these therapeutic agents should be handled and used in the most rational of ways.

6.8 Rational use of veterinary drugs and strategies to minimize antimicrobial use in pig farms

Often, many farms use veterinary drugs for therapeutic, prophylactic and inappropriately for growth promotion purposes especially if they are medically important. The use of veterinary drugs can be rational or irrational.

Rational veterinary drug use is where the sick animals receive medications appropriate to their therapeutic demands, in right doses as per their own individual requirements and time. On the other hand, irrational drug use refers to over prescription for other reasons other than therapeutic needs such as growth promotion, improper dosing and incorrect duration of drug administration.

Irrational drug use in animals comes with many health hazards such as drug resistance, presence of drug residues in food and the environment and limited efficacy of these therapeutic agents.

It is therefore imperative that the animal health professionals, paraprofessionals and all animal handlers promote rational drug use through good herd health management, use of nonmedically important antimicrobials growth promoters and adhering to withdrawal period of antimicrobials.

Adequate aeration to reduce the concentration of airborne pathogens, ammonia and other toxic gases produced by pig excreta.

Follow strict biosecurity protocols at the farm to keep off infections which would otherwise necessitate antibiotic use.

Developing and implementing a pig vaccines strategy considering the most common pathogens in the location.

Using nonmedically important antibiotics (such as ionophores), zinc and high value additives (amino acids, pre- and probiotics, enzymes) to promote herd health on the pig farm.

Strategic use of medically important antibiotics for extreme cases such as injectables.

6.9 Drug storage and transporting conditions

6.9.1 Warehousing and storage

Veterinary drugs just like other drugs should be stored as per the label instructions ensuring that adherence to temperature, humidity and light is observed.

The design of the storage facility should ensure good conditions such as clean and dry with enough air circulation or as per the drug labels.

All drugs that require refrigeration should be kept as required and the refrigerators should be of

- i. appropriate design, capacity and qualified,
- ii. maintained in good working state,
- iii. equipped with temperature incursion alarms,
- iv. do not support excessive frost accumulation,
- v. present good air circulation, and
- vi. backup power to maintain the temperature.

6.9.2 Transporting veterinary drugs

Transporting veterinary drugs in the field faces many challenges such as overheating. Storage and transportation temperatures outside the manufacturer's recommendations can adversely affect the quality of veterinary drugs. Exceeding the upper limit of the recommended temperature range may cause loss of drug quality due to degradation processes. For most veterinary drugs, a rise in the mean kinetic temperature of 5°C will decrease the drug's shelf life by a factor of two.

Considering the physical principles central to the thermal performance of drug transportation boxes, the following are recommended:

- Prior to transferring drugs into transportation containers, drugs should be put at the best temperature i.e. the lower limit for ambient temperature (2°C) especially in the warm climates.
- Use precooled icepacks in the transportation boxes. The icepacks should not be cooled below 0°C to avoid drug freezing on contact.
- The lips of the transportation containers should only be lifted when a drug is needed to avoid loss of cold conditions through draught.
- Keep the drug container in a cool place while in the field most appropriately under a shade.
- Monitor the inside temperature of the transportation cool boxes to detect any change in the storage conditions.

6.10 Drug withdrawal period

Excessive levels of drugs or drug metabolites are not permitted in pork just like any other animal product intended for human consumption. If drugs are to be used in animals, there should be no residues in their products through observing drug withdrawal periods before slaughter.

It is critical to control the amount of drug residues in foods of animal origin for two major reasons, (a) drug residues are toxic to humans and (b) any amount of drug residue can render targeted pathogens resistant, leading to antimicrobial resistance in animals and humans.

A drug withdrawal period is the time between the last drug administration and the time for safe slaughter for food.

To ensure that there are no drug residues in animals and animal products, the following practices are recommended:

- The animals that have been treated should be separated from the rest.
- All treatments should be recorded by date, animal ID (if tagged), dose given, the route of administration, the person who administered the treatment and the withdrawal period.
- The label instructions regarding the product use should be strictly followed during use.
- Avoid cheap and inferior drugs as they may cause performance loss or damage quality of the pig products.
- Use short withdrawal veterinary drugs whenever necessary.
- Avoid injecting more than 10 ml in an injection site.
- Reduce or completely avoid extra label drug use of antibiotics.
- Discourage farmers from self-treating pigs.
- Avoid using multiple antibiotics at the same time.
- Never mix different antibiotics in the same syringe.

Always consider the longest withdrawal period for all drugs given. Do not market pigs with antibiotic injection site lesions without examining the treatment history.

7 Pig housing and manure management

Pig farmers ought to be guided when they are constructing or modifying pig housing structures to make sure that they are compliant with the welfare and health of pigs i.e. reduce injuries, disease and stress for pigs.

Care must be taken to constructing a shelter that is easy to clean and there is a clear plan of waste management.

7.1 Pig floor space requirements

Just like other animals, pigs require enough individual space for lying, standing, feeding and eliminating digesta, therefore, space allowance should be followed when constructing a pig unit as shown in Table 9. It is imperative that the stocking density does not negatively affect the natural behaviour of pigs and the period spent lying. It is noteworthy that inadequate pig individual space stress it or cause injury which consequently affects growth rate, feed conversion, reproduction and general productive potential of pigs because freedom to move, rest, eat and drink are somewhat hindered.

Table 9: Space required for different pig age groups and categories

Pig category	Floor space per animal (m ²)	Extra recommendations
Pregnant sows/gilts	1.5–2	Pregnant pigs require a silent atmosphere. These can be housed in small groups of three
Lactating sows	4–6	Need a quiet environment. Individual pens can be used. There is need for a farrowing pen, creep space/brooder box, creep feed for piglets
Breeding boars	6–8	Walls must be strong to restrain boars from escaping to the gilts and sows that are on heat Unless planned breeding is desired, keep the boar physically separated from the females to prevent unwanted mating. This can be achieved through separate pens or by using sturdy partitions within the housing structure
Weaner piglets	0.3–0.5	
Fattening pigs	0.5–1	

7.2 Best bedding materials for pigs

Pigs require a comfortable, dry and well drained surface that minimizes stress, injuries and diseases to rest for the best welfare and healthy living.

Pig pen floors are required to be nonslippery to minimize falling which could result in injuries. If the floor must be slated, then the slats should be smaller than the claws to prevent foot injuries.

The floor can gently slope to ease drainage of both water and urine.

Clean, dry and comfortable bedding materials should be provided for pigs e.g. straw, wood shavings, coffee husks etc.

Pens with deep bedding materials can promote pigs to engage in natural behaviour, such as exploratory and rooting. Lack of enough biological relevant rooting materials is an important risk factor for developing behavioural issues.

There are also growth rate advantages compared to piglets reared in barren environments and an increasing body of evidence suggests that environmental enrichment for newborn piglets can enhance the robustness of a piglet's immune system.

In situations where providing large amounts of bedding material is not feasible, small amounts of good quality enrichment can have a significant benefit. For example, providing straw in raised racks can help to reduce tail biting without affecting waste management or becoming too costly.

To conclude, floors, bedding materials and any other resting surfaces should be cleaned as need arises, to guarantee good hygiene, comfort and abate the risk of diseases and injuries. Do not leave faecal matter to accumulate on pig resting surfaces.

7.3 Drainage

To achieve the best drainage, the floor must be made of concrete and sloping to allow liquid waste to easily drain off. A slope of 5% gradient is recommended and the water channels placed at the lower end of the sloped floor. Farmers are advised to have drainage channels from each pen directed to an outside collection channel. No liquid should be drained into another pen or flow to the outside via the pen door to avoid the spread of diseases.

The channels should be cleaned daily by flushing down water to avoid clogging. The channels can be of any length with 1–2% gradient along the length, 600 mm wide to facilitate slurry removal.

7.4 How to manage farm waste

It is key that every pig farm has a waste management plan to reduce the risk of pollution. A good manure management plan calls for a well thought out manure handling system, often accompanied enough land for disposal of solid and liquid wastes. This helps in the following: (1) best nutrient use; (2) land, labour or capital minimization; (3) manure smell control and (4) animal or human health and performance.

Manure from pig farms may be solid, slurry or liquid (urine and wastewater) and each of them may have a different formula of management. After all, it is key that the house floor is concrete for easy management through gutters.

7.4.1 Solid waste

Solid waste from pig pens (dung, feed wastes, litter) must be removed daily to avoid build up in the pig house which affects the health and wellbeing of the pigs. They can be removed manually using shovels or automated using mechanical scrapers and disposed of in a gazetted manure pit.

7.4.2 Liquid waste and slurry (semisolid waste)

Liquid waste can be drained through drainage gutters which can be 16 inches wide and at least 4 inches deep which directs the effluent to the waste pit.

Manure from pig units that have been diluted with wash water and urine may be too thin to be handled as solid and too thick to be handled as liquid. It is therefore important that slurry is further diluted and then drained into the gutters to the terminal waste pit.

When constructing drainage channels, care should be taken to avoid low points and the gradient should be well calculated to avoid sedimentation within the channels. Other than waste reception channels and trenches, it is preferred that enclosed pipes are used for effluent transfer lines whenever practicable.

The drainage conduits should be cleaned and flushed at least twice a week according to the need to reduce odours and clogging. Wastewater holding pits ought to be covered, to decrease the stench. Sediments in wastewater pits should be taken away preferably every 3 months.

8. Vaccinating and vaccine handling

In Uganda, many pig diseases and the associated morbidities and mortalities are preventable by vaccination as shown in Table 10. Vaccination is an important management tool that, when used according to instructions, can greatly reduce reliance on medications including medically important antimicrobials that are used to treat serious infections in humans. However, it is noteworthy that, vaccines can only be effective when administered before pigs are infected with pathogens of interest and are in good health condition. Vaccination should never be a substitute to good husbandry practices and biosecurity but instead should work together with the former.

8.1 Importance of vaccinating pigs

Pig vaccines can be useful in helping provide the pigs with immunity to reduce morbidity and mortality associated losses. Studies have highlighted the cost of disease (considering reduced production due to disease, treatment and/or death) overwhelmingly outweighs the cost of vaccination by at least 2.5:1 (Diaz et al. 2020; Thomann et al. 2020).

Some of the vaccinatable pig diseases are zoonotic in nature such as erysipelas, cysticercosis and influenza. Vaccinating against these diseases in pigs, in the long run, helps to prevent humans from picking the infection from the pigs they care for or consume.

Preventing disease by vaccination usually allows animals to be raised using fewer antimicrobials, including those that are medically important. Animals grow well and fast as the retrogressive effect of disease does not affect the pig population when proper vaccination has been carried out.

There will be limited need to treat the pigs because they are protected from severe disease by vaccine derived immunity. Reducing large-scale use of medically important antimicrobials, including many of those given in feed or water additives, helps prevent the emergence of antimicrobial resistant strains of pathogenic bacteria and fungi. This is critical for preserving the long-term efficacy of those agents for future use in both animal and human medicine.

Table 10: Pig vaccines marketed in Uganda and their target pathogens, target age groups, route of administration and storage conditions

Vaccine	Target disease(s)	Target age groups	Dose and route of administration	Storage conditions	Immunity period
FarrowSure	<i>P. parvovirus</i> , erysipelas and leptospirosis	Sows and gilts 2–4 weeks prior to breeding	5 mL, intramuscular	Store between 2°C and 7°C	26 weeks
LitterGuard	Enteric colibacillosis	Pregnant sows and gilts	2 mL, intramuscular or subcutaneous	Store at 2–7°C	16 weeks
Fostera	<i>P. circovirus</i> and <i>M. pneumonia</i>	3 weeks old piglets	2 mL, intramuscular	Store in the dark at 2°–7°C	23 weeks

8.2 Handling and using pig vaccines in general

Just like other injectable drugs, proper handling is important to achieve the best from pig vaccines and to avoid the risk of adverse effects. It is important that these products are used following the manufacturer's instructions and under the supervision of a veterinarian. The following points should be noted:

- It is good practice to keep an icepack in your tray at the pen side if you are raising a group of pigs. Never freeze vaccines.
- During the reconstitution of the vaccines, always use a sterile transfer needle and only prepare enough of the vaccine that will be used up quickly with less leftover.
- Use the entire contents of the vial when first opened. A reconstituted modified live vaccine is useless the next day!
- Use a sterile needle to remove the product from the vial. Each time a pig is injected micro-organisms are picked up from the skin. Using the same needle to withdraw contents from the vaccine bottle, contaminates the contents.
- Needles should be changed frequently preferably for every pen or litter worked on. Blunt needles cause injection site damage and may allow leakage of the vaccine from the site. Needles also become more contaminated after each use and may cause infection and subsequent development of an abscess at the injection site. Bent needles must not be straightened and reused. The risk of these needles breaking off inside the animal is too high and must be avoided. If a needle does break off in the animal, immediately take steps to identify it. If you are unable to retrieve the needle, that pig may still go to slaughter in due time, but it must be well identified and reported to the processor at the time of delivery.
- It is advisable that all injections in pigs be done in the neck area (because the area has less subcutaneous fat and more muscle) and when animals are well restrained to avoid inappropriate injections and broken needles. It is preferred that injections are done on dry, clean surfaces, avoiding the injection of wet or dirty pigs.

The most appropriate intramuscular injection site for pigs



Photo credit: American Association of Swine Veterinarians.

If the vaccine does not come with the needle, use the size of needles appropriate for the size of the pig being vaccinated or the route of injection. Given that pigs tend to have a thick layer of fat that is supposed to be penetrated before entering the muscle, a needle of 1.5 inches is necessary to give a mature sow an intramuscular injection, whereas a 1 inch needle would be appropriate for a grower. Vaccines are quite watery therefore an 18 gauge needle is sufficient as compared to most antibiotics (which are very thick and may require a larger sized needle i.e. a 16 gauge).

Read the label carefully before each use by paying attention to information about the proper injection site, dosage, type of animals to be used on and the withdrawal time to slaughter. The label insert should be stored along with all other drug labels for future reference.

Administer vaccines only to healthy animals.

Dispose of used needles and vials in properly identified hard plastic 'sharps' storage containers so that they can be safely transported to the nearest landfill site for disposal.

Record all the necessary information such as date, name of the product used, identifying individuals or pens, withdrawal time, etc. on the 'Treatment Record Chart' of your quality assurance manual. If sows are being vaccinated, the date and product used should be recorded on each individual sow card.

Using any vaccine or drug must be in accordance with the protocol set out in the 'Medication and Vaccine Usage Plan', which needs to be reviewed periodically with your veterinarian.

When an animal experiences allergic reaction to the product injected, treat it symptomatically against the reactions.



A vaccine carriage for temporary use at the farm and in the field Photo credit: Martin Kristiansen.

8.3 Vaccinating schedule for all pigs in the herd

No single vaccine strategy fits all farms given the population dynamics on the farm. The risk of diseases can vary based on geographical areas and pig flow patterns, including the entry of new stock or equipment sharing. Additionally, selecting vaccines and dosage regimen often depends on the pig's age and physiological status.

Prior to farm entry and again before breeding, gilts are typically vaccinated for two separate reasons: 1) they may be naïve to the current diseases present on the farm and 2) for them to pass on

maternal antibodies to the piglets. Vaccines can elicit a rapid immune response, including producing antibodies in the colostrum that is passed from the gilt to their first litter. However, because maternal antibodies fade in the first 2 to 3 weeks after birth, piglets will likely require another vaccine at weaning.

It is crucial for the farmer to consult with a veterinarian for advice on vaccines to use, their dosage and timing in accordance with the specific disease risks in the area. The veterinarian can customize and make recommendations based on the unique conditions of the farm.

A summarized vaccine schedule is provided in Table 11 for the Ugandan pig herds considering the prevailing diseases in the country. Combination products that offer protection against multiple diseases are available and can provide added benefits such as reducing labour, minimizing handling stress on the pigs and decreasing the number of injection site lesions. However, it is important to note that some diseases may occur less frequently in Ugandan pigs or existing vaccines may not consistently provide protection. The veterinarian may recommend the use of specific vaccines based on the prevailing circumstances in your area or those specific to your farm.

Table 11: Recommended pig vaccines schedule for smallholder farmers for the prevalent diseases in Uganda

Stage	Vaccine	Disease	Scheduling
Gilts and sows	(FarrowSure Gold or FarrowSure Gold B)	Leptospirosis	5 weeks pre-breeding—gilts and sows
		<i>P. parvovirus</i>	
		Erysipelas	
	(FarrowSure Gold or FarrowSure Gold B),	Leptospirosis	2 weeks pre-breeding—gilts and sows
		<i>P. parvovirus</i>	
		Erysipelas	
	Fostera PRRS	PRRS	
	LitterGuard LT-C	Enteric colibacillosis	5 weeks pre-farrowing—gilts 2 weeks pre-farrowing gilts and sows
	(FluSure XP)	Influenza	3 weeks pre-farrow—gilts and sows
Boars	(FarrowSure Gold or FarrowSure Gold B)	Leptospirosis	Every 6 months Every 6 months
		<i>P. parvovirus</i>	
		Erysipelas	
	Fostera PRRS	PRRS	
Piglets	Fostera PRRS	PRRS	7 days of age
	Fostera—PCV, MH	<i>Mycoplasma hyopneumoniae</i>	3 weeks or older
		<i>P. circovirus</i>	
	(FluSure XP)	Influenza	

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The CGIAR Research Initiative on Sustainable Animal Productivity for Livelihoods, Nutrition and Gender inclusion (SAPLING) is working in seven countries focusing on livestock value chains to package and scale out tried-and-tested, as well as new, innovations in livestock health, genetics, feed and market systems. SAPLING aims to demonstrate that improvements in livestock productivity can offer a triple win: generating improved livelihoods and nutritional outcomes; contributing to women's empowerment; and, reducing impacts on climate and the environment. Its seven focus countries are Ethiopia, Kenya, Mali, Nepal, Tanzania, Uganda and Vietnam.

It forms part of CGIAR's new Research Portfolio, delivering science and innovation to transform food, land, and water systems in a climate crisis.

