PACKAGE OF PRACTICES FOR ORGANIZED PIG FARMS

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PACKAGE OF PRACTICES FOR ORGANIZED PIG FARMS

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Chapter 1

Overview of Pig genetic resources of India

Introduction

India is endowed with a large genetic diversity in livestock population and pig species is not any exception. India has diverse population of pigs and 14 breeds of pigs have been characterized and registered as breed till July 2024. Apart from these 14 breeds, a substantial population of nondescript pigs are also present which still has to be characterized. Indian pig population constitutes 29.40 % of descript pig population comprising of 2.80 % of exotic, 18.10 % crossbred and 8.20 % indigenous pigs, while 70.60 % are non-descript pigs, which are yet to be categorized for their breed status.

The pig genetic resources of the country are three types-

1. **Exotic pig breeds:** These are breeds of foreign origin and were imported into the country for improving the production status of Indian pigs. The exotic breed mainly comprises Hampshire, Large White York Shire, Duroc, Landrace, and Tamworth.
    a. Large white Yorkshire (LWY) is the most commonly used exotic breed in India. They have white coat colour with occasional black pigmented spots, erect ears, snout of medium length and dished face. The mature body weight ranges from 300 to 500 kg.
    b. Landrace breed is typically white coloured with black skin spots. They have a long body, large drooping ears and long snout. Mature body weight ranges from 250 350 kg.
    c. Hampshire animals are black with white strip across forelegs to shoulder. Typical characteristics include small and erect ears, small and compact body. Sows have good mothering ability. This breed is also used widely in India.
2. **Indigenous pigs:** The major population of indigenous pigs is contributed by nondescript pigs which need to be characterized. Apart from the nondescript pigs, there are 14 distinct pig breeds which have been registered as breed in the national database. These indigenous pigs of India are identified as a distinct group due to gradual domestication of wild pigs.

These pigs differ in their characteristics from region to region depending on the climatic conditions and topography.

The indigenous pig breeds and their breeding tract are given in the table given below-

Sl. No	Name of the Breed	Home Tract
1	Ghoongroo	West Bengal
2	Niang Megha	Meghalaya
3	Agonda Goan	Goa
4	Tenyi Vo	Nagaland
5	Nicobari	Andaman & Nicobar
6	Doom	Assam
7	Zovawk	Mizoram
8	Ghurrah	Uttar Pradesh
9	Mali	Tripura
10	Purnea	Bihar and Jharkhand
11	Manipur Black	Manipur
12	Banda	Jharkhand
13	Wak Chambil	Meghalaya
14	Andamani	Andaman & Nicobar

Ghoongroo: It is found in Eastern Sub-Himalayan region of West Bengal and Assam. These pigs are black in colour with broad, flattened face and short, upwardly curved snout. Large, pendulous and heart shaped ears resembling those of elephant's ears are very distinct for identification. Ghoongroo are mostly black coloured with typical bull dog face appearance, with a litter size of 8-12 piglets with average of 9.

Ghoongroo (Image source: NBAGR)

Niang Megha: These pigs found mostly in the Khasi, Garo and Jayantia mountain of Meghalaya state. The colour of this pig is generally black but star shaped white at forehead and hock joint may present. The Snout is medium tapering partially

Niang Megha (Image source: NBAGR)

white at nostril, Bristle is long on midline and uniformly at other places.

Agonda Goan: It is found in Tiswadi, Bardez, and Pernem of the North Goa district; Mormugao, Canacona and Quepem talukas of South Goa district of Goa. The animals are small in size having short ears, short snout, pot belly and wild in nature with rough bristles. The predominant colour is black but few animals have white patches on legs and face. The average adult bodyweight is 41 kg for male and 43 kg for female. Average litter size at birth is 7.45.

Agonda Goan (Image source: NBAGR)

Tenyi Vo: It is found in Kohima, Phek, Dimapur districts of Nagaland. These animals have a long, strong and tapering snout, small erect ears and bright alert eyes. The colour is mostly black in both sexes. These are pot-bellied animals with sagging back and pendulous belly touching the ground in females, straight tail ending with white switch reaching the hock join. The average adult body weight is 40 kg and average litter size at birth is 5.

Tenyi Vo (Image source: NBAGR)

Nicobari: The breeding tract of Nicobari pig is Nicobar District of Andaman & Nicobar. The colour of Nicobari pig is mostly black and brown but few are creamy-white, reddish-brown and black and brown mixed. It has sturdy and short with long body, medium to short snout and short erect ears. Neck is short with very large jowl. No curling is the characteristic feature of the tail. Nicobari pigs are ferocious in nature with average adult body weight 63 kg.

Nicobari (Image source: NBAGR)

Doom: Doom pigs are found in Dhubri, Bongaigaon and Kokrajhar districts of Assam.

Doom (Image source: NBAGR)

These are black in colour and have a short, concave snout. The adult pigs weight between 36 kg and 50 kg. The colour of doom pig is black. These pigs have short concave snout. They are large; flat belly type with short erect ears. The average adult bodyweight is 41 kg for male and 45 kg for female. Average litter size at birth is 6.29.

Zovawk (Image source: NBAGR)

Zovawk: It is found in Aizawl, Lunglei, Lawngtlai, Champhai, Saiha and Kolasib District of Mizoram. The colour of this pig is black with white spot on the forehead (star) and sometimes white patches on belly and white boot. Zovawk pig has characteristics erect ears, concave snout, pot belly, concave top line and long bristles on mid-line. The average adult body weight is 54 kg.

Ghurrah (Image source: NBAGR)

Ghurrah: These pigs are native to Bareilly division and adjoining pats of Lucknow division of Uttar Pradesh. These are black coloured, few are greyish black or brownish, medium sized pigs with flat belly, angular body and long straight snout. Legs below hock joint are white. Head is elongated with triangular face and short leaf shaped vertically erected ears. Adult male weighs about 46 kg and female about 48 kg. Litter size is 6.85 at birth and 5.65 at weaning.

Mali (Image source: NBAGR)

Mali: Mali is native to Dhalai district of Tripura. The Mali pigs are generally black coloured with star shaped white patches on forehead, medium sized pig with pot belly. Medium to small bristles are ubiquitously distributed throughout the body. Adult body weight averages about 68 kg in males and 71 kg in females. Average litter size: 5.15 (range 3-7) at birth and 4.46 (range 3-6) at weaning.

Purnea: Purnea is black coloured, medium sized pig found in Purnea and Katihar districts of Bihar and Sahibganj district of Jharkhand. These pigs have compact body and pot belly. Adult body weight varies from 41 to 50 kg. Litter size at birth varies from 4 to 6.

Purnea (Image source: NBAGR)

Banda: The breeding track of Banda pig is Jharkhand. These pigs are black coloured, having short and erect ear. These pigs have a long and concave snout, medium to short bristle on neck. The average adult body weight is 28.0 kg in male and 27.0 kg in females and litter size ranges from 4 to 7.

Banda (Image source: NBAGR)

Manipur Black: The breeding track of Manipuri Black is Manipur state. The Adult body weight averages about 96.0 kg in males and 93.0 kg in females. Litter size ranges from 6 to 11 at birth.

Manipuri Black (Image source: NBAGR)

Wak Chambil: These pigs are found in Garo Hills of Meghalaya. It is a small sized pig with round and pendulous belly. The average adult body weight is 32.0 kg. Litter size at birth ranges from 4 to11.

Wak Chambil (Image source: NBAGR)

Andamani: This pig is distributed in different islands of Andaman group of islands. They are sturdy and medium in size and black or brownish in colour short to medium snout, short and erected upwards ears. The slight downward arch/ curvature of the back is the most commonly observed feature. The average body weight is 60-75 kg for male and 55-65 kg for female. Litter size at farrowing ranges from 6-13.

Andamani (Image source: NBAGR)

3. **Crossbred pigs:** Crossbred pigs have been developed by crossing different indigenous pigs with exotic pigs and continuous selection over the generations. There are 9 crossbred varieties developed by ICAR-NRC on Pig and different AICRP centres present in different regions of the country. These crossbreds have better production and reproduction performance than the indigenous pigs. The crossbreds pigs are preferred by commercial pig farming system.

Rani: Rani crossbred pigs were developed at ICAR-NRC on Pig by crossing Hampshire boar with Ghoongroo sows with 50 % exotic inheritance. These pigs were developed for north eastern region of India as breeder pigs.
The average litter size at birth of Rani is 9-10 while weight at slaughter age is 75-80 Kg.

Rani (Image source: ICAR-NRCP)

Asha: Asha crossbred pigs were developed at ICAR-NRC on Pig by crossing Rani Sow with Duroc terminal sire with 75 % total exotic inheritance. These pigs were developed for north eastern region of India as finisher pigs. The average weight at slaughter age is 78-88 Kg.

Asha (Image source: ICAR-NRCP)

Mannuthy White: These crossbred pigs were developed by AICRP unit at Kerala by crossing LWY boar with female local pig of Kerala with 75 % exotic inheritance. The average litter size at birth is 8-9 while weight at slaughter age is 75-80 Kg.

Mannuthy White (Image source: ICAR-NRCP)

TANUVAS KPM Gold: These crossbred pigs were developed by AICRP unit at Tamilnadu by crossing LWY boar with female local pig of Tamilnadu with 75 % exotic inheritance. The average litter size at birth is 8-9 while weight at slaughter age is 75-80 Kg.

TANUVAS KPM Gold
(Image source: ICAR-NRCP)

Lumsniang: These crossbred pigs were developed by AICRP unit at Meghalaya by crossing Hampshire boar with Niang Megha sows with 75 % exotic inheritance. The average litter size at birth is 8-9 while weight at slaughter age is 65-70 Kg.

Lumsniang (Image source: ICAR-NRCP)

HDK-75: These crossbred pigs were developed by AICRP unit at AAU, Khanapara by crossing Hampshire boar with Doom sows with 75 % exotic inheritance. The average litter size at birth is 8-9 while weight at slaughter age is 75-80 Kg.

HDK-75 (Image source: ICAR-NRCP)

Landly: These crossbred pigs were developed by AICRP unit at IVRI, Bareilly by crossing Landrace boar with Ghurrah sows with 75 % exotic inheritance. The average litter size at birth is 8-9 while weight at slaughter age is 80-85 Kg.

Landly (Image source: ICAR-NRCP)

SVVUT 17: These crossbred pigs were developed by AICRP unit at Andhra Pradesh by crossing LWY boar with female local pig of Andhra Pradesh with 75 % exotic inheritance. The average litter size at birth is 7-10 while weight at slaughter age is 70-75 Kg.

SVVUT 17 (Image source: ICAR-NRCP)

Jharsuk: These crossbred pigs were developed by AICRP unit at Jharkhand by crossing Tamworth boar with female local pig of Jharkhand with 75 % exotic inheritance. The average litter size at birth is 7-8 while weight at slaughter age is 70-80 Kg.

Jharshuk (Image source: ICAR-NRCP)

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Chapter 2

Breeding strategy to followed in organized breeding farms

Introduction

Pig farming represents a lucrative opportunity for entrepreneurs and farmers alike. The success of a pig farm depends on the productivity of the pigs raised within it, which, in turn, is influenced by factors such as breed selection and the quality of boars and sows chosen for breeding purposes. Indigenous pig breeds often exhibit smaller body sizes, poor reproductive performance, and slower growth rates, yet possess valuable traits such as adaptability to Indian conditions, disease resistance and quality pork production. Conversely, exotic, and crossbred pigs typically display higher growth rates and better reproductive performance but require significant investment in feed, housing, and health management. These costs can be circumvented by opting for local pigs, which can thrive in low-input or even no-input systems, such as backyard farming on kitchen scraps. Once you have chosen the breed of pig you intend to raise, your initial priority should be selecting the animals to acquire for your farm, as this decision significantly impacts the future generations of your pig farming venture.

The performance of pigs can be enhanced by-

1. Selection of Parents for the next generation
2. Mating System

Selection of pigs for breeding purposes?

Effective animal selection serves as a cornerstone of successful swine production, significantly impacting producers' profits over the long term. The process of choosing pigs for the next generation of parents can be done on the basis of-

a) ***Individual own performance:*** The selection of sow and boar will be done based on their own performance. Choosing animals with a track record of good performance can yield offspring with similar attributes.

b) ***Family performance:*** It is also known as family selection in which animals are selected based on performance of their family members. Assessing animals based on the performance of their relatives can guide breeding decisions.

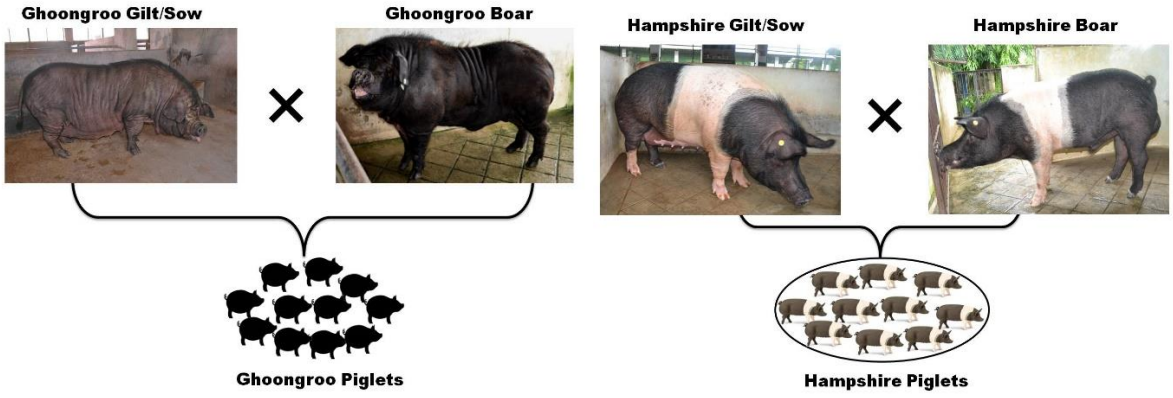
c) ***Pedigree Performance:*** As like begets like, the sows and boars with good performance will produce piglets with good performance. Hence, the selection of animals is done based on their parents' performance. Considering the performance of an animal's parents can help predict the potential of their offspring.

Pig Mating Systems

The mating systems are the pairing of sow and dam for breeding to incorporate desired traits. Out of different types of out breeding system, selective breeding, grading up and crossbreeding is generally adopted in swine breeding practice. There are following types of mating in pig breeding-

a) Random mating within a breed: mating individuals within a breed without considering their pedigree. Any male pig can breed to any other female pigs. The performance can not be enhanced in this system.

b) Pure breeding: Mating between individuals of same breed is known as pure breeding. The piglets produced by pure breeding has the same genetic makeup i.e., of same breed. For e.g. A Ghoongroo boar is mated to a Ghoongroo sow to produce piglets. A Hampshire boar is mated to a Hampshire sow to produce piglets.



(a) **(b)**

Fig.1 : Pure breeding system in (a) Ghoongroo Pig (b) Hampshire Pig

On the basis of the relationship between mating pairs, two types of breeding system can be described as-

1. **Outbreeding:** When mating occurs between unrelated parents then it is known as outbreeding. One form of outbreeding is crossbreeding in which boar and sow from two different breeds are used for piglet production. Fig. 2 depicts the outbreeding system for same breed and for crossbreeding.

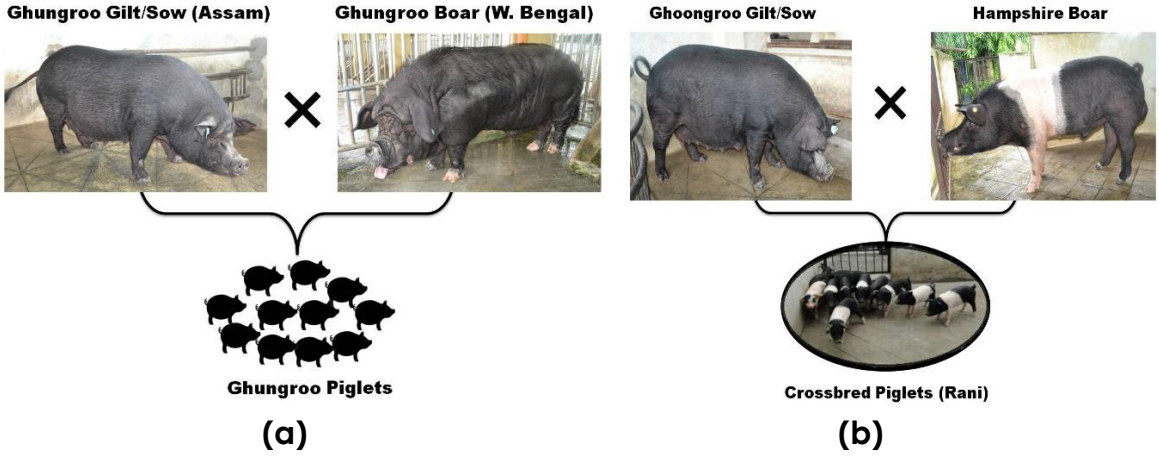


Fig. 2: Outbreeding system of mating (a) within same breed (b) Cross-breeding

2. **Inbreeding:** mating between more closely related sow and dam within the breed. Inbreeding is avoided in pigs due to adverse effect of this type of breeding system in the performance of the animals.

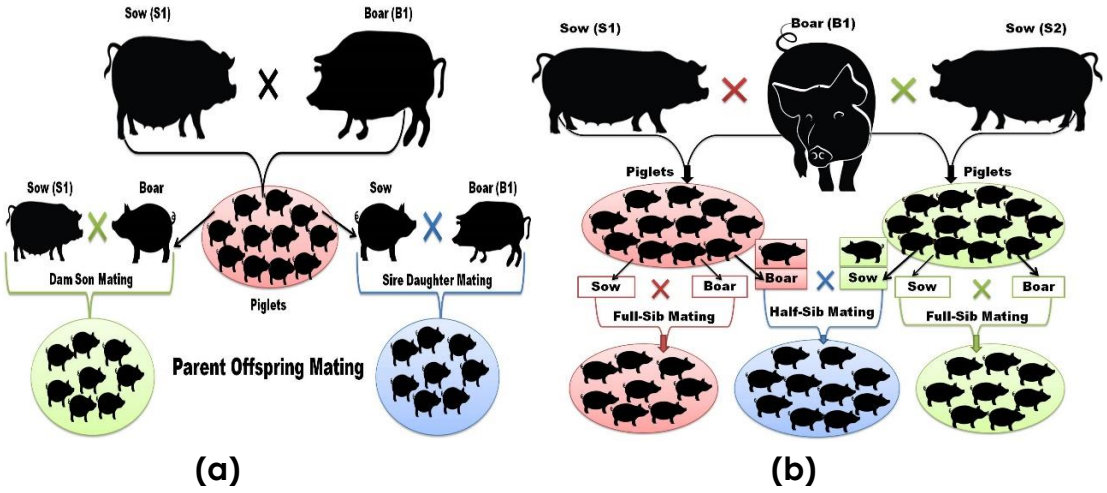


Fig. 3: Inbreeding system of mating (a) Parent offspring mating (b) Sib mating

c) **Selective Breeding:** This is a method of breeding where superior male and female animals within a breed are selected and mated. This method is useful for increasing the performance of a well-developed breed.
d) **Grading-up:** In this method, non-descript sows are mated with superior bores with high production potential of a well-developed breed from generation after generation. After the 7^{th} generation of crossing the indigenous non-descript animal will have more than 99% inheritance with superior performance.

Criteria for Selecting Breeding Pigs:

There are important economic traits which are considered while selecting male and females for breeding. These traits include litter size at birth and weaning, litter weight at birth and weaning, growth rate, feed conversion efficiency, no. of litters per year, carcass traits, pre and post weaning mortality and genetic disorders

Boar Selection:

Boars play a crucial role in herd genetics, exerting a significant influence on herd improvement. Thus, careful attention must be paid to their selection, management, and replacement. Boars have a greater impact than females, hence selection should be made with utmost care.

Selection Criteria for Boars:

- Acquire boars from breeders or farms with comprehensive performance records. The boar should be selected from a dam which has consistently farrowed and weaned high litters.
- A desirable breeding boar should ideally reach a weight of 90 kg within 5-6 months, with allowances made for Indian breeds based on their body confirmation.
- Emphasis should be placed on pigs achieving maximum weight by 6 months of age, along with efficient feed conversion to reach 90 kg.

- Traits such as growth rate and carcass quality can be inherited by offspring, underscoring the importance of selecting superior boars.
- Boars must possess genetic potential to enhance progeny performance and physical soundness for continued breeding activity.
- Final selection of young boars should be based on performance testing conducted between 20 and 30 weeks of age.
- Boars should be sourced from reputable, disease-free herds, with attention given to their leg and foot health.
- Boars should exhibit normal testicular characteristics and functionality, with good libido being a desirable trait.
- Selection should prioritize economically important performance traits, with preference given to boars from sources that extensively test or record performance.
- The dam of the selected boar should have consistently produced large litters of 8 piglets or more.
- Negative blood tests for brucellosis and leptospirosis, along with vaccination against swine fever, are essential.
- Boars should be culled when they reach 2 years of age, based on criteria such as poor conformation, lameness, libido, semen quality, disease presence, or aggressive behaviour.

Selection Criteria for Gilts:

- Gilts, typically purchased at market weight around 90 kg, are selected for breeding after reaching 7 or 8 months of age. It is advisable to procure breeding stock from reputable breeders with documented records of gilt lineage and performance.
- Gilts should be selected from dams with a history of consistently producing large, healthy litters at weaning.
- Desired traits in gilts include long bodies, correct structural conformation, and feminine characteristics.
- Gilts should have fully developed vulvas and functional underlines, with a minimum of six teats per side.
- Traits such as sound feet and legs, good growth rate, and appropriate back fat deposition are important considerations.
- When selecting gilts, attention should be paid to avoiding those that are overly muscled, short, or excessively fat.

- It is crucial to avoid selecting gilts with immature vulvas or inadequate teat structure.
- Isolating newly added gilts for 3-4 weeks helps prevent disease transmission and ensures herd health.

Breeds recommended for rearing in different states of India:

- Agriculture and animal husbandry subjects are covered by state list in the constitution. The pig breeds used for breeding and rearing by farmers or entrepreneurs will be decided based on the state specific breeding policy.
- The breeding strategies for indigenous breeds and nondescript pigs found in the breeding tracts of respective states should be selective breeding and grading up with descript breeds, respectively.
- No crossbreeding is recommended in the breeding tract of pure breeds to avoid indiscriminate breeding.
- The crossbreds developed in different regions of the country will be inter-se mated (mating between unrelated animals of same generation) to produce next generation of crossbreds.
- However, keeping view of different agroclimatic zones of country, following crossbreds were recommended for propagation in different regions of country.

Sl. No.	Region	Crossbred Recommended
1	Northern India	Large White Yorkshire Large White Yorkshire Cross Landrace Cross
2	North-Eastern India	Hampshire cross Large White Yorkshire Cross for Mizoram and Tripura Tripple Cross with Duroc as terminal Sire Large Black Cross
3.	Eastern India	Hampshire Cross Tamworth Cross (Jharkhand)
4.	Central India	Landrace cross Large White Yorkshire cross
5	Southern India	Large White Yorkshire Cross Tripple Cross with Duroc as terminal sire

6	Western India	Large White Yorkshire cross

(Source: National Guidelines for formulation of State Pig Breeding Policy. 2019 https://www.dof.gov.in/sites/default/files/2019-12/National%20Guidelines% 20for% 20 formulation % 20of% 20State% 20Pig%20Breeding% 20Policy%20.pdf Accessed on 18/05/2024)

Any Pigs having any genetic disease like cryptorchidism, Hernia, Atresia ani, polydactyly, Inverted Nipples, hermaphrodite, splay leg etc. should be immediately cull along with their parents and relatives. Thus, the breeding of right pig by correct method will enhance the profitability of the pig farm.

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Chapter 3

Care and Management of Pig

Introduction

The scientific care and management of swine during various stages of their life cycle are fundamental to ensuring their health, welfare, and productivity. Starting from the transition period of farrowing, and the critical early days of piglets, each stage of dam and boar demands specific and meticulous attention. This chapter comprehends the best practices and scientific principles guiding the care of pigs throughout these stages while highlighting the unique needs and management strategies required. By understanding and applying these principles, farmers can ensure the well-being of their pigs, improve reproductive success, and maximize overall farm efficiency.

Care and Management of breeding boar

- The breeding boar should be maintained in a separate pen.
- The boar should be scrubbed and washed daily.
- The boar pen must be kept clean and dry.
- Slippery surfaces or dampness should be avoided.
- Trimming of boar's feet periodically will prevent lameness in boars.
- The bolt cutters can be used to remove the tusks of boars to avoid injuries to sows and attendants during breeding.
- Newly purchased boars should be quarantined for a minimum period of 3 weeks to avoid the risk of introducing any disease into the farm.
- Nutritional supply should be optimum. They should neither be overfed nor underfed since both will affect their breeding capacity. An additional 0.5 kg of the concentrate may be given 2 weeks before breeding season.
- Boar should have free access to water.
- Boars should not be used for breeding earlier than 8 months of age.
- A boar can be allowed to serve before being fed.
- Older sows may be used for breeding with younger boars.

- Two services, 12-18 hours apart, usually give better results than either a double service 24 hours apart, or a single service. A third mating, 12 hours after the second, maybe planned if litter size is considerably low.

Care and Management of breeding gilts and sows

- Gilts may be housed in groups.
- Moving gilts to new pens, increased exercise, and daily exposure to boars beginning from 160 - 180 days of age will help to stimulate the onset of estrus.
- Breeding should be delayed until the second or third estrus to increase the probability of large litters and prevent dystocia. The gilts that do not conceive after mating at two successive estrous periods may be medically examined or marketed. Likewise, gilts that have not expressed heat by 9-10 months of age should not be kept in breeding stock.
- The week before insemination in case of gilts, and the 4-5 days period between weaning of piglets from previous farrowing and insemination in case of sows, are critical. Bio-stimulation and flushing are two concepts of relevance for a farm manager, during this period.
    - ***Bio stimulation***: Repeated studies have shown that daily physical contact with a mature boar (the 'boar effect') is an effective method of stimulating reproductive efficiency and onset of estrous in females. To utilize this bio-stimulation there should be intensive boar contact using a teaser boar, twice daily.
    - ***Flushing***: Flushing is a practice of giving extra feed to sows and gilts from 1-2 weeks prior to mating and returns to normal feeding after mating. Providing an extra 1Kg feed per day has been shown to increase litter size.
- Routine heat detection, preferably two times a day, should be carried out. A teaser boar may be brought to the pen where females are kept for heat detection. Apart from the estrus behaviour activities and signs of heat, riding test/back pressure test may be performed where a female remains immobile on applying a pressure on the rump area (even when an attendant sits on its back). Riding test is confirmatory for a female in heat.

- Pen mating, hand mating and artificial insemination are the different mating systems usually practiced in organized pig farms. Hand mating, where the female in heat is brought to the pen of desired boar, is practiced in majority of organized farms in India. The breeding arena on kuccha floors may be used for heavy animals to avoid hoof injury during mating.
- Breeding in batches is the most effective breeding strategy in an organized farm, where all the breedable female stock is inseminated during the selected months, probably leaving 2–3-month intervals in between. Breeding in the selected season and batch farrowing optimizes labour management, improve piglet crop, facilitates better health care, and addresses many biosecurity concerns. The management of weaners, growers, and finishers in batches facilitates better resource utilization.

Care and management of pregnant sow

- Record the date of mating and note the farrowing date. This will help to monitor the feed intake during pregnancy and facilitate animal movement to the farrowing sheds in time.
- Mixing pregnant gills/sow with others is not recommended. Stress, kicking, abusing, pushing etc., should be avoided and train staff to treat them kindly. Don't make the animal to walk a long distance which may cause fatigue.
- Floor should be kept clean, dry and non-slippery. Provision of bedding of 8-10 cm chopped straw under covered area is preferred especially as farrowing approaches.
- Keep the animal liberally fed. Another feeding strategy during pregnancy is steaming up. **Steaming up** which is also called "**bump-feeding**", aims at providing 1-1.5 kg of extra feed for 2-3 weeks before farrowing to increase birth weight. This is beneficial for thin sows and gilts from Day 100 of gestation to farrowing, but feed allowance for fatty sows should not be

increased.

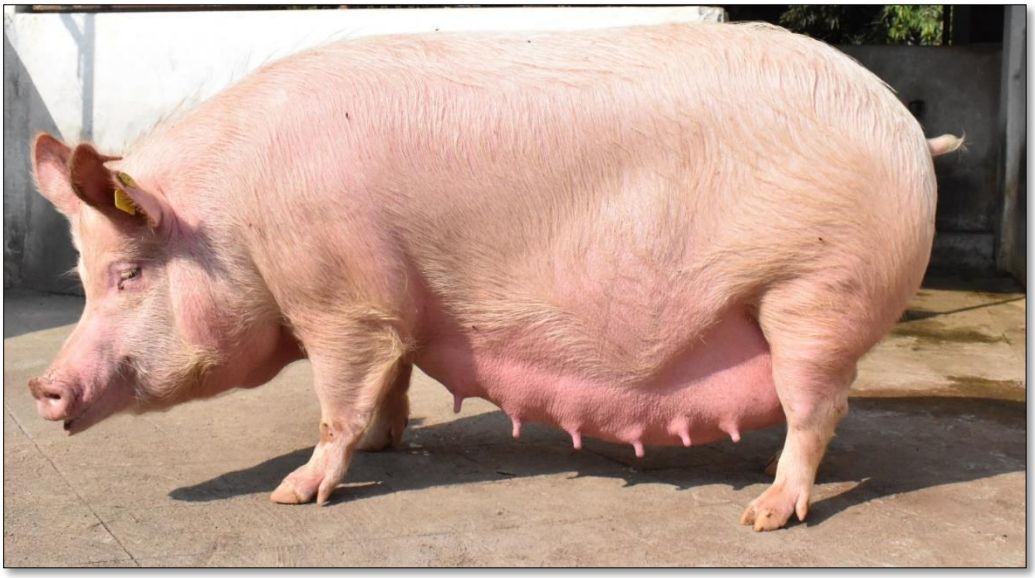


Fig: A sow in her advanced pregnancy

Care and management of farrowing sow

- The sow may be transferred to farrowing pen at least 8-10 days before the expected date of farrowing to accustom her in the new environment.
- The sow should be cleaned and washed properly just before transferring to farrowing pen.
- The farrowing pen should have non-slippery floor and provided with guard rails to protect the piglets.
- Thorough cleaning and disinfection of farrowing shed should be done one day before the transfer to ensure dry surface when the animal is brought in.
- Batch farrowing is always recommended where all-in-all-out strategy is adopted. Batch farrowing facilitates better newborn care round the clock and hence ensure better piglet crop.
- If the farrowing prolong beyond 10 hours or if the interval between piglets are prolonged, dystocia may be suspected and veterinary assistance is advised.
- Understanding the signs of approaching parturition will be useful for closely observing the sows.

Physical signs & behaviour during peri-partum period

Item	Time
Vulvar swelling	4 days before parturition
Milky secretion in udder	12-24 h before parturition
Duration of farrowing	4 h (25 min to 8 h)
Interval between each piglet	15 min (1 to 230min)

The following points should be noted around the farrowing.

- The sow should be provided bulky ration and it should be reduced to 1/3 on the days before farrowing and withdraw 12 hours before farrowing.
- Every farrowing, irrespective of the time of farrowing, should be attended by trained attendants.
- Some gilts and sows may attempt savaging the piglets when they approach the dam for suckling. This is attributed to pain experience during the farrowing. Attendants should be trained to massage the udder to facilitate milk letdown and reduce the pain.
- Don't wash the animal on the Day1. If necessary clean hind portion of sow with Luke warm water. Cleaning with normal water should be avoided at any cost as washing the farrowing pen may also make the animal and piglets wet. The piglets have limited mechanisms to maintain homeothermy, hence splashing of water can lead to mortality.
- Sow should be provided free access to clean and fresh water for drinking.
- Provide adequate balance nutritional ration to the lactating sow for sufficient milk production for piglets
- Load noise and dog barks which irritate the sow may hinder the farrowing process. Calm and silent area is preferred for farrowing.

Care and management of piglets

- **Assistance for breathing**: Attendants should check the patency of breathing passage of piglets. Remove the mucus from nostrils using a piece of cloth. In case of difficulty in breathing, swing the piglets at arm's length to initiate breathing. Each piglet should be rubbed carefully, dry with a cloth.

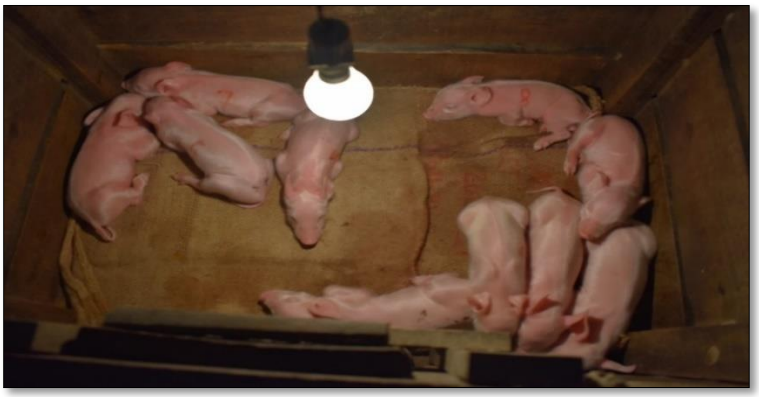
- **Umbilical cord care:** Usually newborn piglets do not require tying the umbilical cords. In cases of excess bleeding or shorter breakage of naval cord, it may be tied and clamped. Navel cord may be cut with sterilized scissors leaving 3 cm from the body. Afterwards, the navel should be soaked in a cup of iodine solution to prevent inflammation and for maintaining asceptic conditions.

- **Colostrum feeding** within the initial 30 minutes after farrowing is very important. Suckling will encourage the sow to let down her milk. Attendants may assist if the piglet fails to suckle. Check the udder for agalactia (lack of milk), mastitis (inflammation of udder) and number of functional teats to assess the nourishing capacity of sow.

- **Nursing Management**: The nursing behavior should be closely monitored. Smaller piglets have lesser opportunity to get sow's milk, hence it should either be cross fostered or provided with artificial milk. The same principle should be followed for the orphan piglets. Cross fostering can be done with another sow, which farrowed up to three days before, with more milk production and lesser number of piglets than its teat number. If there is no sow to take over feeding the piglets, then commercially available

neonatal feed formulations, goat/cow milk or mashed bean porridge are alternative options.

- **Transferring piglets to creep area**: Creep area in a farrowing pen should be made to provide a micro-environment of light and heat to keep neonates comfortable. Arrangement to provide temperature of 25°C to 34°C, is required in creep area (~0.09 sq.m/piglet) to protect piglets from chilly weather. The newborn pig has a "lower critical temperature" of about 30°C-34°C. When the environmental temperature falls below 34°C, the neonates experience cold stress. The area will also protect the piglets from crushing and can be utilized to provide creep food. In case of nervous/irritable dam, piglets should be transferred to creep area to protect them from savaging dam. Easy access into and out of the creep area should be provided for the piglets and accordingly the opening of the farrowing pen into the creep area should be sufficiently sized.



- **Iron Injections**: Sow's milk is deficient in Iron, which can provide only 1-2 mg/day through milk while they need 7mg during the first week. The quantity of iron decreases in blood rapidly causing anaemia, if not supplemented and their growth slows down. This is an important problem, especially for young piglets kept indoors. For preventing piglet anaemia, 100 – 200 mg iron dextran injections are given in the neck on 4th and 14th day of age, by a qualified veterinarian.


Clipping needle teeth: Needle teeth, also called the wolf teeth, can injure the dam during nursing. The resultant pain disturbs the dam to stop nursing the piglets. So, to solve this welfare issue, the needle tooth are trimmed using clippers on the first day to prevent them from biting the udder. Only the points of the needle teeth should be removed and the procedure shall only be carried out under the supervision of a Veterinarian. However, care may be taken not to remove/uproot the entire needle teeth. Research works have found that clipping needle teeth decreases injuries to the sow underline and reduces the incidence of pigs with facial injuries (Estienne et al., 2001)

- **Castration of pigs**: Castration is done in male animals designated for pork production as the biomolecules produced by adult testis causes unfavorable boar taint. It should be done at an age of 3-4 weeks. Open method of castration is used for removing the testes of the piglets, by a qualified veterinarian under anaesthetic conditions with proper post procedural therapeutic care. The scrotum and surrounding must be applied with disinfectant after castration. Application of fly repellent is advised.
- **Creep feeding**: Young piglets from 7 days onwards should have high protein feed available to them. Creep feeding, as the name indicate, is provided at the creep area where the mother cannot eat the feed. Creep feeding is essential for substituting the decreasing milk production of sow and is beneficial for early weaning. Feeding in small amount frequently will help to keep the ration fresh.
- **Animal identification:** Ear tagging, ear notching and tattooing are the various methods of pig identification. Ear tagging is presently most preferred as it suits animal welfare concerns and enables better animal tracing. An ear tag must be—

✓ easy to read during the pig's lifetime;
✓ made of either metal or plastic or a combination of metal and plastic;
✓ tamper-resistant;
✓ incapable of re-use;
✓ sufficiently heat-resistant that neither the ear tag nor the information printed or stamped on it can be damaged by the processing of the carcass following slaughter; and
✓ designed to remain attached to the pig without harming.

Ear tags with unique identification numbers or with an RFID identification system need to be implanted before weaning. Keep the numbered part of the tag in the inner ear so that the number can be visualized by an approaching handler.

- **Weaning Management**: Weaning is the process of separating piglet from its mother. The sow's milk production starts falling dramatically by 5 weeks after farrowing and is inadequate to maintain piglet growth rates beyond weaning age. But weaning is a stressful experience for young piglets, affecting them both socially and physiologically. So, the weaning practice depend on the management practice adopted at each farm. Pre-weaning complications can be reduced by offering creep ration.

  Weaning can be performed when piglets are 42 days old and 5-10 kg live weight (depending up on the breed). By this age and weight, piglets become accustomed to dry feed and can better adjust to premature changes and stress. However, if the growth performance of the piglets is optimum and the farming practices are scientific, weaning can also be performed at 28 days of age to avoid negative energy balance of sows and to allow weaning of greater number of piglets per sow per year.

Points to be noted during weaning

- Prior to weaning at 3 or 4 weeks of age, piglets are commonly achieving 300-350 g of daily gain. Following weaning, this plummets to about only 100 g/ day. A quick, sustained recovery depends on the quality of their feed, the environment and the skill of their attendant.
- Changes in the stomach occur within 6 hours of weaning. The pH of the gut contents rises, making it more favourable for rapid growth of some organisms, especially the E. coli bacteria. Overeating, especially the first few days destabilize the intestinal flora. So a good feeding practice is to continue to feed the same high quality creep diet for 10-14 days after weaning. Feed little and often. Feed at least twice daily and match the feed consumed with a gradual increase in feed offered. A target should be 150 g/day in the first week, rising to around 250-300 g/day in the second week. The use of flavourings or sweeteners could be considered if the consumption of high quality diets is still low.
- Never underestimate the importance of clean water supply for young pigs. Upgrading the water quality in the farrowing and

weaner areas has resulted in dramatic improvements in young pig performance.

- Weaners are highly susceptible to any disease challenge. Therefore, highest level of hygiene should be maintained. The 'all-in, all-out' system is ideal.

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Chapter 4

Swine Shelters

Introduction

Swine shelters play a crucial role in modern pig farming, significantly impacting animal welfare, productivity, and environmental sustainability. The design and management of these shelters are vital not only for the health and comfort of the swine but also for the economic viability of farming operations. As the swine industry evolves, integrating advanced technologies and sustainable practices into shelter design becomes increasingly important. This chapter provides a comprehensive overview of best practices in swine shelter design and management. By adopting these practices, farmers can ensure the welfare of their animals, provide comfort, and boost productivity.

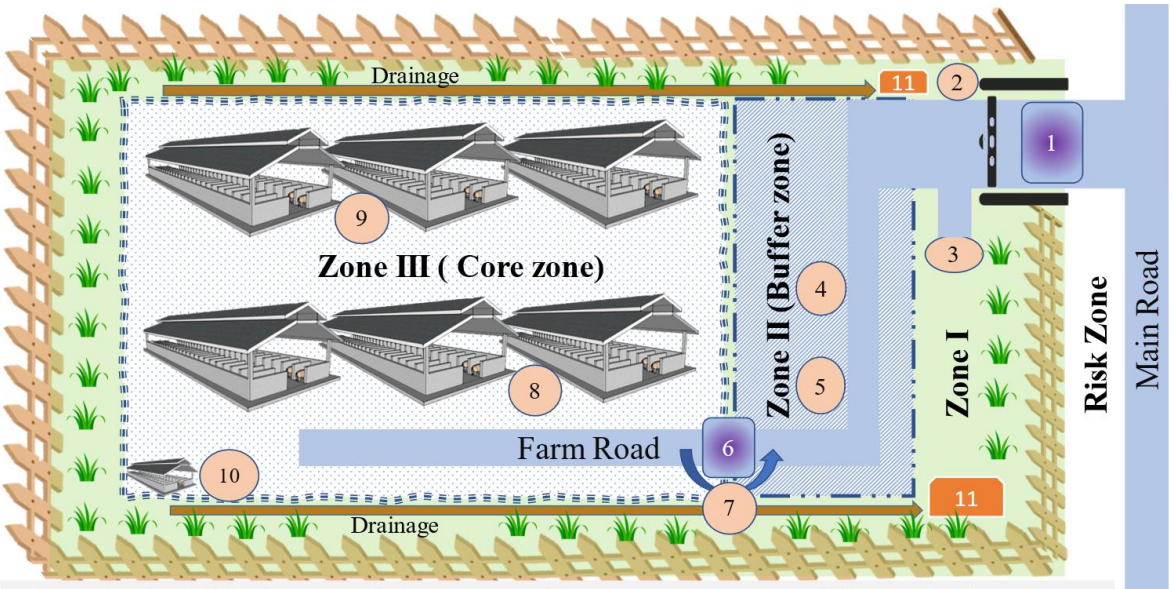
Choice of location

- Elevated place
- Protected from sun and have ample fresh air
- Away from residences.
- Connected to roads
- Suitable for manure disposal
- Connected to reliable water and electricity sources

Layout and construction

- The basic principle of swine housing is that the floor and the wall
- Constructions made of impervious and sturdy materials
- The floor of the house must be raised about 60 cm above the ground
- Buildings 15 to 20 m apart
- The roof must be rainproof
- Good slope (1:40)
- Adequate ventilation
- A pigsty can be constructed using locally available materials.
- It needs to be constructed according to climatic conditions and according to the swine production system.

- The pigsty should provide comfort to the animal. It should have good ventilation and ample shade. absence of foul odours and dampness are recommended
- The building should be constructed with its long axis in an East-West direction (protected from sun and rain)
- The shelter needs to be divided into different pens for each phase of the production cycle. Specialized pens in separate houses for the various stages
- The number and the size of the pens depend on the expected number of swine to be housed in each production phase.
- Avoid overcrowding. Optimize livestock density
- All-in-all-out system
- Secure fencing
- Erect signages
- Consider biosecurity while construction of sheds



1. Tyre Dips & Disinfection area at the entrance, 2.Security check/Documentation, 3. Farmhouse/office, 4. Feed storage and processing, 5. Change rooms, 6. Tyre Dips/Disinfection area, 7. Loading ramp, 8. Sheds for growers/finishers, 9. Sheds for breeder stock, 10. Isolation shed, 11. Manure disposal/processing.

- The layout of the sheds should be such that boar pens or mating area should be farthest from the entry gate, followed by sow sheds, farrowing sheds, weaner sheds, and grower-finisher sheds in decreasing order of distance from the farm gate. This will reduce the exposure of more precious stock from extrinsic risk factors.

- Holding pens for market-age pigs should be the nearest to the loading ramp or fence.
- Loading ramp should facilitate animal movement across the core zone to the buffer zone without entry of vehicles or buyers from outside.

Minimum distance from nearby structures

- At least 15 m away from dwelling and factories,
- At least 30 m away from dairies, animal and poultry houses and food grains storage structures
- At least 45 m away from fire sources
- At least 1 km away from garbage dumping grounds, slaughter houses, hide curing centres and tanneries.
- The boundaries of the site shall be at least 50 m away from the nearest transit roads

Required shelters for a breeder farm

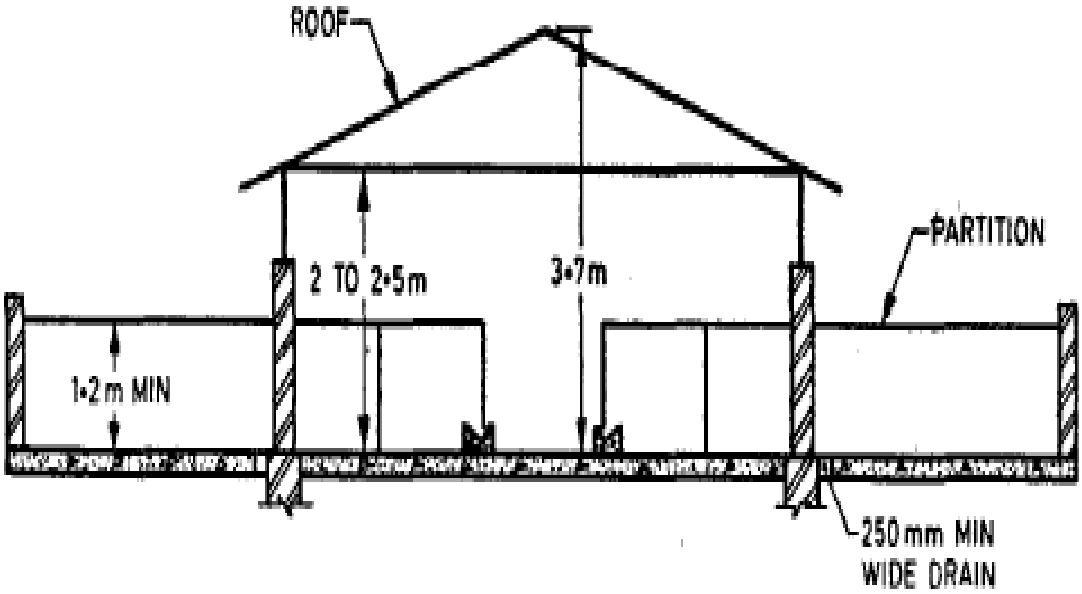
- Farrowing-Suckling Pens
- Dry Sow/Gilt Pens
- Replacement Pens
- Boar pens
- Isolation sty /Sick animal stys
- Quarantine sty

Required shelters for a breeder farm

- Grower pens
- Finisher pens
- Isolation sty /Sick animal stys
- Quarantine sty

Space requirements

Type of animal	Weight of animal (kg)	Covered floor area per animal (m^2)	Open yard area per animal (m^2)
Boar	Up to 120	6.25	8.8
	121-199	7.00	10.5
	200 and above	7.50	12
Farrowing sow	Up to 120	7.50	8.8
	121-199	8.25	10.5
	200 and above	9.00	12
Weaner	Up to 20	0.96	0.96
Grower	21- 70	1.50	1.50
Finisher	71 and above	1.80	1.80
Dry sow or gilt	Up to 80	1.80	1.80
	81-150	2.25	2.25
	151 and above	2.70	2.70



Stocking density

- ***Boar sty***: Each boar sty shall normally have not more than 24 pens under one roof & each pen shall accommodate not more than one animal
- ***Gilt Sty*** : Each sty have not more than 40 pens under one roof in two rows.
- ***Farrowing or Nursing Sow Sty***: Maximum 40 pens under one roof and each pen shall accommodate not more than one animal with the litter.
- ***Grower sty***: Maximum 15 pens under one roof and each pen may have 20 to 35 animals kept for fattening, purposes.
- ***Pregnant animal sty***: Maximum 20 pens under one roof and each pen shall accommodate not more than one animal.
- ***Fattening Sty*** : Maximum 20 pens under one roof and each pen may have 15 to 30 animals kept for fattening, purpose.
- ***Sty for Weaner Piglets***: Maximum 30 pens under one roof. Each pen may accommodate 10 to 20 animals
- ***Sty for Sick Animals***: Minimum accommodation for 5 percent of the farm stock

Constructional details of swine sty

- ***Floor*** : The floor shall be hard, non-slippery, non-abrasive, impervious to water and easy to clean. The surface of the floor shall be suitably patterned to give a rough surface. The details of construction shall vary from place to place depending on the climatic conditions and shall be constructed on the recommendation of the local housing experts.
- ***Walls***: The height of walls shall be 2 to 2.5 m from the floor level. There should be enough open spaces for free ventilation and framed wire meshes may be used to separate open areas from closed areas.
- ***Roof***: The roof may be of RCC flat type or gabled. In the case of the gabled roof, roofing materials may be asbestos/ cement sheets, corrugated galvanized steel sheets or clay tiles. In the regions of extreme

climatic conditions, the roof may be insulated either by providing a layer of thatching or ceiling to reduce the severity of heat inside the sty.

- ***Doors***: The doors shall be strong and so fitted that it is close to the floor level. The width of the door of an individual pen may range between 0.75 to 1 m while the doors of a sty may range between 1.2 to 1.5 m and the height 1.2 to 2 m
- ***Drainage***: Each sty shall be provided with at least one drain on one side of the sty for proper drainage. The drain shall have a minimum width of 250 mm and a slope of 25 mm for every 10 meters. Farm drainages should be designed in such a way that the effluents should flow from more biosecure areas to less biosecure areas. Effluents from the isolation shed should never be allowed to pass through the healthy animal shed areas.
- ***Water supply***: Ensure potable drinking water supply, and avoid chances of mixing with contaminated water. Regular cleaning of pipelines, drinkers or pans should be performed

Supporting / Subsidiary structures

Store Building: The store building may have a store-keeper's office, a mixing room to mix the feed of the animals, a room for keeping miscellaneous items, such as farm equipment and tools and a feed store meant for bulk storage of feed in bags.

Feed store: The size of the feed room shall vary according to the number of animals kept. The space required for the feed room in a farm may be calculated as given below but at the same time some provision shall be made for future expansion.

Floor space required = $\frac{\mathrm{X} \times \mathrm{Y} \times \mathrm{Z}}{\mathrm{B}} \times \frac{1}{N}$, where

X = Area requirement of one bag,
Y = Average feed consumption per day in kg,
Z = Number of days the feed has to be stored,
B = Capacity of each bag in kg, and
N = Number of bags to be stacked one over the other.

Isolation sty / Sick animal sty

- Buildings used for the on-farm isolation must be dedicated to the on-farm isolation and be physically separate from any buildings used for other livestock.
- A minimum distance of three metres is required between the perimeter of the isolation fields and any other livestock.
- Stock-proof double fencing is advised for this three-metre separation.
- The facility must be designed such that any discharges, effluent and manure are retained there or disposed of in such a manner that they do not come into contact with healthy livestock.
- This facility must be fully cleansed and disinfected after use.

Quarantine facility

- Animals are quarantined when new animals are brought to the farm from outside sources.
- A quarantine shed should be preferably located in a distant plot. A minimum distance of 500 meters from the main farm area is necessary under any circumstances.
- A quarantine shed should have provisions for the supply of potable water, a storage facility for feed and medicines, proper waste disposal pits etc.
- An all-in-all-out protocol is recommended for the quarantine shed.
- Cleaning and disinfection of sheds after every animal movement is necessary.
- Choose a location that is isolated from the main farm and other pig populations, preferably with a separate entrance.
- Ensure proper drainage and avoid areas prone to flooding.
- Construct the shed with sturdy and easy-to-clean materials, such as concrete, to prevent the entry of pests and facilitate disinfection.
- Install separate water and feed systems for the quarantine shed to avoid cross-contamination.
- The quarantine facility should have dedicated equipment, storage, staff uniforms, etc.

- Efforts should be made, where feasible, to engineer drainage and waste disposal systems in a manner that effectively contains effluents, thereby mitigating the potential spread of pathogens to adjacent areas.

Loading and Unloading Ramp

- The maximum recommended angle for adjustable ramps is 25°. For pigs in case of non-adjustable ramps, 15° is recommended.
- Recommended dimensions are a 30 cm minimum tread width and a 5 cm rise for slaughter-weight pigs.
- Both loading and unloading ramps should have solid fences.
- Ramps used for unloading only should be 2.5 to 3-m wide to provide animals with a clear exit from the vehicle.

Tyre dips and foot dips

- The tyre washing facility and tyre dip should be located at the farm gate.
- Tyre dip should have sufficient length to facilitate at least two tyre rotations while passing through it.
- The width should be more than the width of the road to avoid the chances of bypassing.
- Depth should be sufficient to facilitate disinfection of all treaded areas of the tyre.
- A facility for draining off the disinfectant solution should be provided in the dip.
- Central walking alley should have provision for foot dip.
- Foot dip should be provided before the farm gate, buffer zone, core zone and individual sheds.

Fencing / Farm Boundary

- Pig farms require strong fences that are built close to the ground to prevent animal movement and to provide protection against pests and invaders.
- Barbed wire along the ground helps prevent rooting.
- Fences of height 1-1.2 meters will be sufficient for a pig farm.
- In the case of woven wire fences, several horizontal lines of smooth wires will be held apart by vertical wires called stays. The distance or spacing between horizontal line wires may vary from as close as 4 cm at the

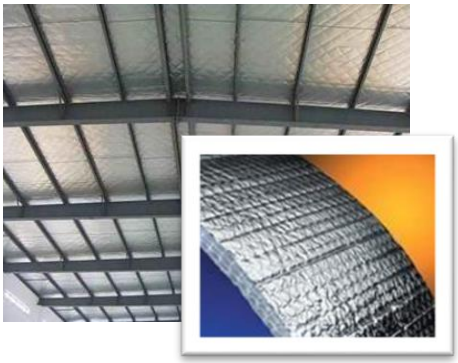
bottom. Stay wires should be spaced 15 cm apart. Thickness of 12-to-14-gauge size may be used.

- Barbed wire fences are made of two or more strands of smooth, galvanized-coated, steel wire twisted together with two or four barbs spaced every 10-12 centimetres. Standard barbed wire fences usually have three to five strands of barbed wire stretched between posts that are spaced between 5 - 7 meters apart.
- Farms located near forest areas can also install electric fences and they can be used for the control of feral and wild animals. It must be well designed and there should be provisions to ensure adequate power for the length of fencing.

Shelter enhancements for summer management

Ventilation: The airflow is regulated to ensure there is always enough fresh air in all the sections of your house. Ceiling fans can be used in open shelters. Drafts can be placed evenly at regular intervals to facilitate longitudinal airflow throughout the entire length of the sty.

Roof insulators: Shelters require roof insulators to provide a comfortable microenvironment for pig and to save electricity. Insulation can be done using commercially available insulators as shown in the picture below, or using locally available resources.



Sprinklers & Foggers: Wetting the pig's skin and allowing it to dry causes evaporation, which pulls heat from the pig's body and creates a cooling effect. However, if the pigs remain continuously wet, the humidity increases, reducing the cooling effect from evaporation. Therefore, configure the system to wet no more than half of the pen and allow to dry following it.

- Mount the foggers 54 inches high along the outside pen walls, with the nozzles angled downward at 45 degrees, to ensure proper wetting of the pen.
- Select a nozzle that emits droplets, which fall quickly to cover specific areas, to achieve accurate coverage.
- Effective evaporation requires substantial air movement across the pigs. Tunnel-ventilated buildings provide adequate airflow at 300 to 400 feet per minute. In naturally ventilated buildings, it is necessary to add stir fans to maintain air movement when there is no outdoor breeze.

Note: Section 11(1) e of The Prevention of Cruelty to Animals Act 1960 mentions that if any person keeps or confines any animal in any cage or other receptacle which does not measure sufficiently in height, length and breadth to permit the animal a reasonable opportunity for movement amounts to cruelty to the animal. Thus, one must take utmost care while designing the shelters for pigs.

Chapter 5

Feeding Standards and Nutrient Requirements of Pigs in Indian Conditions

Introduction

Feed costs are the major recurring expenditure in pig farming, accounting for nearly 70% of the total cost. Scientific interventions in animal feeding are critical to curtail costs while also increasing farm profitability. Pigs are monogastric and omnivorous animals, just like human beings and they have limited capacity to digest fibre. Pig farming began with an extensive rearing system in which the animals roamed free for the entire day, scavenging for feed. The semi-intensive system received some household kitchen or hotel waste as input. Recent developments in pig rearing encourage intensive systems to maximise production and profitability. The importance of feeding evolved as pig populations in the intensive farming system increased. Animals in the intensive system will be given balanced diet in the form of concentrate to full fill the nutrient requirements. Pigs should receive a balanced feed that includes nutrients such as carbohydrates, proteins, fats, minerals, and vitamins. A diet balanced with all the nutrients improves the feed utilization efficiency, growth rate, and body weight of the animals. The amount of feed required in pigs depends on the breed, age, body weight, and physiological status (pregnant, lactating, breeding, etc.) of the animals, as well as environmental conditions. The animals' nutrient requirements vary as they age, leading to the modification of feed formulation to meet these requirements at different stages.

Feeding standards

Various national and international councils provide nutrient requirements for pigs. The National Research Council (NRC, 2012) from the USA and the Agriculture Research Council (ARC, 1981) from the UK have outlined nutrient requirements for elite pure breeds of pigs, which typically exhibit greater growth rates and body weights. For Indian conditions, the Indian Council of Agricultural Research (ICAR, 2013) and the Bureau of Indian Standards (BIS, 1987) have

established nutrient requirements specifically for crossbred and desi breeds of pigs. According to ICAR, (2013) recommendations, nutrient requirements are divided based on the age of the animals into three stages after weaning: 8 to 16 weeks, 17 to 24 weeks, and 25 to 35 weeks. Further, these recommendations are categorized separately for lower-medium, medium-higher, and higher growth rates in pigs. For exotic breeds under Indian climatic conditions, separate nutrient requirements are provided. Similarly, for indigenous pigs, the nutrient requirements are defined for three stages: 8 to 20 weeks, 21 to 28 weeks, and 29 to 32 weeks of age. Two phases specify the nutrient requirements for pregnant gilts: a) 0 to 75 days and b) 75 to 114 days. Similarly, two phases specify the nutrient requirements for lactating sows: a) 0 to 21 days; b) 21 to 56 days. BIS (1987) has recommended nutrient requirements in three stages, namely a) starter/creep feed, b) grower feed, and c) finisher feed, based on the age and body weight of animals. The BIS (1987) guidelines for feeding pigs are commonly followed in India; the several categories based on age and body weight are listed below.

Table 1. Different feeding stages in pigs (BIS, 1987)

Stage I	Starter/creep feed	up to 2months, Body weight : 5 – 12 kg
Stage II	Grower feed	2 to 5 months, Body weight : 12 – 50 kg
Stage III	Finisher feed	After 5 months, Body weight : 50 – 100 kg

Starter, grower, and finisher pigs have slightly different nutrient requirements, which necessitates different stages of nutrient supply. The advantages of different-stage feeding include (a) improved nutrient utilization by the animals; (b) decreased feed cost; and (c) reduced environmental pollution (due to the excretion of excess nitrogen or phosphorus).

Nutritional care of newborn piglets

After piglets are born, they are allowed to suckle the first milk (colostrum) of sow. Colostrum provides essential nutrients and antibodies that boost their immune system and protect them from diseases. Colostrum also provides vital energy to prevent hypoglycemia and helps regulate body temperature. This milk feeding continues until the piglets are weaned. In cases where piglets lose

their mother after birth, they require a suitable alternative to sow milk, such as milk replacer. An effective milk replacer should contain at least 24 -28% protein and 8 -10% fat to support optimal growth and development. Milk replacer can be prepared by using 60% skim milk powder, 30% oat flour, and 10% whey protein powder, combined with 100 ml water and 5 ml soybean oil to create a nutritious substitute. This mixture is warmed to body temperature to mimic the sow's milk. Sow milk, although beneficial, lacks sufficient iron content to meet the piglets' daily requirements. This deficiency makes piglets highly susceptible to anemia. Preventing piglet anaemia involves providing additional iron in the form of iron salts through either oral administration or injection. Total of 200 mg of iron within seven days of birth is sufficient to prevent anaemia and promote pre-weaning and post-weaning growth. Alternatively, a recommended regimen involves administering 100 mg of iron on the 3 rd or 4 th day, followed by a booster dose on the 14 th day of age. This strategic iron supplementation is essential for ensuring the optimal health and development of piglets.

Creep feed: Piglets, once they reach 2 weeks of age, are transitioned to creep feed, which is provided in a separate area to prevent access by their mother. This feed serves as their first solid food and must be highly palatable, easy to consume, and digestible. At this stage, piglets' digestive systems are still developing and lack the necessary enzymes for digest solid food. Introducing creep feed early on helps train their digestive systems to handle the solid feed more effectively after weaning. This practice typically allows for earlier weaning, reducing the time from 8 weeks to around 5-6 weeks. To address potential iron deficiency, creep feed can be fortified with ferrous sulphate salt, usually in a ratio of 9:1. An example of a creep feed ration is provided in Table 2. Since piglets experience rapid growth during this stage, it's essential for farmers to meet their increased protein requirements accordingly. Proteins derived from animal sources, such as skim milk, fishmeal, or meat meal, are preferred due to their higher relative biological value compared to plant-based proteins. Including these animal proteins in the creep feed formulation promotes optimal growth and development in the early stages of piglet rearing.

Starter feed: Piglets at the age of five weeks are given with the starter ration. By this stage, piglets are capable of digesting starch, sugars, and proteins. Lactose based skim milk powders are replaced by grains like maize, sorghum or rice. The

low digestibility of fiber restricts its inclusion percentage to less than 5%. A good quality creep feed and starter diet containing 20 – 22% protein result in body weight gain of up to 12 - 20 kg by the time of weaning.

Table 2. Example of creep ration

Ingredients	Parts (%)		
	I	II	III
Maize powder	47	35	30
Rice powder	0	15	20
Skim milk powder	10	10	10
Soyabean meal	6	6	6
Sesame oil cake	12	12	12
G.N cake	15	15	15
Molasses	5	5	5
Mineral mixture	1.5	1.5	1.5
Lysine	1.5	1.5	1.5
Methionine	0.01	0.01	0.01

Grower feed

After reaching a body weight of 12-15 kg, piglets undergo the weaning process, transitioning into the grower stage. Grower animals have a well-developed digestive system and higher feed utilization efficiency. Consequently, the fiber content in their diet can be increased to 8%. Microbial digestion in the large intestine also contributes essential nutrients to the animals. Therefore, to enhance feed utilization efficiency, the protein content can be reduced to 18%, and the total digestible nutrient (TDN) to 80%. Supplementing the diet with limiting amino acid lysine at a rate of 0.8% supports lean growth in the growing pigs.

Finisher feed

Once grower pigs reach a body weight of 35 - 50 kg, they transition into the finisher stage. During this phase, the growth of the animals slows down, resulting in decreased energy and protein requirements compared to the grower phase. The surplus energy provided during this stage is primarily utilized for fat deposition in the body. Excess protein intake can lead to the loss of nitrogen through urine and feces, contributing to environmental pollution. Therefore, it is crucial to restrict the protein and total digestible nutrient (TDN) requirements to 16% and 75%, respectively, in the finisher diet. By managing protein and energy levels appropriately, we can ensure optimal growth and minimize environmental impact during the finisher stage of pig production.

Table. 3. Nutrient requirements of pigs in different stages (BIS, 1987)

Parameters	Starter feed	Grower feed	Finisher feed
Moisture, percent by mass, Max	11	11	11
Crude protein, (N × 6.25) percent by mass Min	20	18	18
Crude fat, Percent by mass, Min	2.0	2.0	2.0
Crude fibre, percent by mass, Max	6	8	12
Total ash, percent by mass, Max	8.0	8.0	8.0
Acid insoluble ash, percent by mass, Max	4.0	4.0	4.0
Metabolizable energy (k cal/kg), min	3360	3170	3170
Aflatoxin B1 (ppb), Max	20	20	20

Table 4. Minerals requirements of pigs in different stages (BIS, 1987)

Sl.No	Minerals (Moisture free basis)	Starter	Grower	Finisher
1	Calcium (Ca), percent by mass, min	0.6	0.6	0.6
2	Available phosphorus, percent by mass, Min	0.6	0.4	0.5
3	Iron (Fe), mg/kg, Min	100	90	80
4	Copper (Cu), mg/kg, min	8	6	6
5	Manganese, mg/kg, Min	30	30	20
6	Zinc, mg/kg, min	50	50	50
7	Common salt (NaCl), percent by mass, Max	0.5	0.5	0.5

Table 5.Vitamin requirements of pigs in different stages (BIS, 1987)

Sl.No	Characteristic	Starter	Grower	Finisher
1	Niacin, mg/kg, Min	17	14	10
2	Pantothenic acid, mg/kg, min	11	10	10
3	Riboflavin, mg/kg, Min	3	2.4	2.2
4	Vitamin B12 activity, µ/kg, min	15	11	11
5	Vitamin A, IU/kg, Min	1700	1300	1300
6	Vitamin D, IU/kg, Min	190	180	130

Feeding of pregnant and lactating sows

Flushing: It is a specific feeding regimen practiced 1-2 weeks before breeding of gilts or sows, aims to enhance the number of ovulations. This method involves feeding a diet containing 16% protein, 3,000 kcal DE/kg, and 0.7% lysine. By providing 2 – 2.5 kg of feed per day during flushing, reproductive hormones such as follicle-stimulating hormone (FSH) and luteinizing hormone (LH) are stimulated, resulting in increased quality and quantity of oocytes,

ultimately leading to a higher number of piglets born. The gestation period of pigs lasts for approximately 114 days. During pregnancy, the diet provided to pregnant animals must be well-balanced to support the developing fetus. To prevent excessive fattening, which can impair growth and lead to embryonic mortality in developing fetuses, the energy content of pregnant animals is intentionally restricted. However, it's crucial to ensure that other essential nutrients, such as protein, minerals, and vitamins, are well-balanced to support the healthy growth of both the mother and the fetuses. Pregnant sows are typically fed 6000 kcal ME per head per day, with feed quantity limited to 2 kg per head per day. The nutritional composition of the diet should include 14% crude protein, along with 9 g lysine, 16 g calcium, and 14.5 g phosphorus daily. ICAR, (2013) has recommended ME of 3300 to 3280 kcal/kg diet and CP of 18.84 to 18.92 % in two phases from 0 to 75 days and 75 114 days respectively. Around the time of farrowing, sows are fed bulky feed such as wheat bran, oats, or ground legumes to facilitate parturition. Following farrowing, the feed provided to lactating sows is gradually increased to meet their appetite by the 5th day. It is crucial to provide high-quality feed to lactating sows to aid in the recovery of body weight loss, which typically ranges from 20 – 25 kg around farrowing, as well as to support milk production. Lactating sows are typically fed 3 - 4 kg of feed per day, along with an additional 0.2 kg of feed per piglet to meet their requirements. ICAR, (2013) has recommended ME 3264 to 2592 kcal/kg diet and CP 21.80 to 17.30 % for average daily dry matter intake of 3.8 to 4.8 kg in lactating sows. This feed is usually provided twice a day at 8-hour intervals. To prevent constipation, laxatives such as wheat bran, oats, or succulent green fodder may be offered along with concentrate feed. Towards the end of the piglet weaning period, feed is gradually reduced to facilitate the drying of sows.

Feeding of boars

Breeding boars require special attention to prevent overweight or obesity. They can be fed a finisher diet containing 16% crude protein, 3,000 kcal DE/kg diet, and 0.7% lysine. However, their daily intake should be limited to 2.5 kg per head to prevent excessive weight gain. In addition to the finisher diet, feeding 4–5 kg of green fodder, such as berseem or lucerne, can be beneficial for their overall health and well-being. Furthermore, boars have increased calcium, phosphorus, and vitamin D requirements to support proper bone development. Ensuring that

these essential nutrients are provided in adequate amounts is essential for maintaining the health and vitality of breeding boars.

Table 6. Daily feed requirement of different classes of pigs

Stages of pigs	Days	Body weight (kg)	Feed requirement (kg/pig/day)
Weaner	56 - 120	12 – 15	0.25 – 0.75
Grower	121 - 180	15 – 35	0.75 – 1.50
Finisher	181 – 300	35 – 80	1.50 – 2.50
Pregnant gilt	2 – 2.5 kg feed per day		
Lactating sows	3.0 – 4.0 kg feed + 200 g feed/piglet		
Boar	2.5 kg feed + 4 – 5 kg succulent green fodder		

Table 7. Example of feed formulation for different stages of pigs

Ingredients	Starter (%)	Grower (%)	Finisher (%)
Maize	60	64	60
Wheat bran	6.5	6.5	14.5
Soyabean meal	13	12	10
Ground nut cake	12	10	10
Fish meal	6	5	3
Mineral mixture	2	2	2
Salt	0.5	0.5	0.5
Lysine	1.25	0.8	0.7

Commonly used feed ingredients for feed formulation

Energy sources: Energy ingredients are valuable sources of carbohydrates with a protein content of less than 18%. Cereal grains are the most commonly used energy sources in pig feeds due to their high starch content. These grains typically contain 8-12% crude protein and 1-6% fat, depending on the variety. However, they are deficient in essential amino acids such as lysine and methionine. Common cereal grains used in animal feeds include maize, sorghum, wheat, pearl millet (bajra), barley, rice, oats, and other millets. In addition to whole grains, byproducts from the cereal milling process, such as wheat bran, rice bran, deoiled rice polish, and sugarcane molasses, serve as cost-effective and nutrient-rich energy alternatives. While cereal grains are a good source of phosphorus, the availability of this nutrient is limited due to its presence in the bound form of phytic acid. Moreover, cereal grains are deficient in calcium and vitamin D, necessitating supplementation to meet the nutritional requirements of animals.

Protein sources: Protein sources in pig feeds should contain more than 18% crude protein. These protein sources can be classified into plant proteins and animal proteins. Oil cakes, which are byproducts of oil extraction from oilseeds, are essential protein sources for pig rations. Depending on the extraction method, the fat content in these oil cakes can range from less than 1% to 10%. Common examples include soybean cake, groundnut cake, linseed cake, rapeseed cake, sesame cake, sunflower cake, and safflower cake. Additionally, byproducts from the milling process of pulses, known as dal chunnies, which consist of hulls, embryos, and broken cotyledons, are also rich in proteins and minerals. However, their use in pig feeds is limited due to their high fiber content, which can negatively impact digestibility and nutrient absorption.

Animal protein sources: These are highly valued for their rich content of essential amino acids vital for pigs' growth and health. Compared to plant protein sources, animal proteins generally offer superior bioavailability. Among the most prevalent animal protein sources in pig diets are fishmeal, meat meal, blood meal, and skim milk powder. These ingredients provide a complete amino acid profile and are readily absorbed and utilized by the animals. In recent years, there has been growing interest in alternative protein sources, particularly insect meals such as silkworm pupa meal and black soldier fly larvae. While

these insect-based proteins offer a sustainable and nutritious option, their usage in pig diets is still somewhat limited but gaining traction. As research continues, these alternative protein sources could play a more significant role in pig nutrition, contributing to both sustainability and performance in pork production systems. However, biomass of animal origin/animal protein shall be utilized only after adhering to recommended preprocessing techniques, as applicable.

Miscellaneous feeds: Various agricultural practices yield byproducts with significant feeding value for pigs. However, using these miscellaneous feeds as the sole diet is often restricted due to the presence of anti-nutritional factors, which can impair digestibility. Roots and tubers, abundant in certain regions, serve as valuable carbohydrate sources for pig feeding. Root crops are rich in sugars and tubers are rich in starch. Common root crops like carrots, turnips, and beetroots, along with tubers such as potatoes, sweet potatoes, and tapioca, are utilized, albeit with caution due to anti-nutritional factors. Pretreatment methods are typically employed to mitigate these factors before inclusion in pig diets. For instance, boiling tapioca tubers and potatoes helps eliminate cyanogenic glucosides, chaconine, and solanidine, which are anti-nutritional compounds. Additionally, other unconventional feeds include minor oilseed cakes (such as neem seed cake, rubber seed cake, and nahar seed cake), fruit wastes (like pineapple, banana, jackfruit, and apple pomace), aquatic plants (including azolla, spirulina, and water hyacinth), agro-industrial byproducts (such as brewer's grains), animal byproducts from slaughterhouses, and vegetable wastes (like cabbage, tomato pomace, and radish). These diverse feed sources provide supplementary nutrition and contribute to overall diet diversification for pigs, enhancing both sustainability and resource efficiency in swine production systems.

Table. 8 Commonly used unconventional feeds and their inclusion levels

Ingredients	**Anti-nutritional factor**	**Inclusion level and remarks**
Molasses	High ash content	Used as an energy source at 10% in weaner diet, 20% in grower diet and 30 % in finisher diet
Topioca starch waste	Cyanogenic glycosides	Replacement of maize up to 20 -30 % in grower-finisher ration. Boiling is needed

		before feeding
Potato	glycoalkaloids, a-solanine and a-chaconine	Boiling is required before feeding, Replace cereal grains up to 10% in starter, 25% in grower and 30% in sow diet
Sweet potato	Tannins, Phenolic compounds	Boiled before feeding, can replace 10 -20 % cereal grains
Cabbage	Oxalate, saponin and phytate	10 – 20% in grower-finisher diet
Radish	Glucosinolates, nitrate	10 % in grower-finisher diet
Sugar beet pulp	High fiber content	10 % in grower-finisher diet
Turnip	High fiber	8-10% in grower-finisher diet
Bakery waste	High Salt	25% cereals can be replaced in grower-finisher diet
Blood meal	Imbalanced amino acids and less palatability	2 – 2.5% in weaner diet, 3 -4% in grower-finisher diet
Water hyacinth	Oxalate, tannins, high fibre	6-7% in grower-finisher diet
Fruit waste	High fibre	10 -20 % in grower-finisher diet

General guidelines for pig feeding

Pig feed can be provided in various forms such as meal, pellets, cubes, or crumbs, either in dry form or wet form (mixed with water at the time of feeding to make a slurry).

- **Quality Standards**: Feed should be free from rancid odor, high moisture (≯11%), dust, visible foreign materials, adulterants, fungus, or insects.
- **Additives and Supplements**: Feed should be free from urea or other non-protein nitrogenous substances. However, pure amino acids may be added to balance the dietary protein. Feed additives such

as probiotics, prebiotics, enzymes etc. can be added to improve feed utilization efficiency of animals.

- **Antibiotics**: No antibiotics are recommended for use as growth promoters in feed to prevent the accumulation of antibiotic residues in pork and the development of antibiotic resistance in pathogenic bacteria.
- **Regulatory Compliance**: Feed manufacturers should follow the guidelines of the Bureau of Indian Standards (BIS) for the composition of feed tailored to the nutrient requirements of different age groups of animals. (FSSAI)
- **Nutritional Balance**: Prepared feed should be balanced with essential minerals and vitamins.
- **Storage**: Feed with no more than 11% moisture should be stored in clean and dry places. Packaging materials may include polyethylene-lined jute bags, laminated paper bags, or HDPE bags with sealed mouths.
- **Water Quality**: Water used for livestock should contain no more than 5,000 coliforms per 100 mL, with a maximum total dissolved solids (TDS) level of 3,000 ppm.

Balanced feeding in pigs

Although economic feeding can effectively increase swine production, maintaining a balanced diet is essential to guaranteeing profitability, environmental sustainability, and production efficiency. Balanced feed is a "complete feed that supplies the appropriate amounts of nutrients tailored to a specific animal species and class to achieve a particular purpose". Diet formulation should balance energy, proteins (amino acids), minerals, and vitamins to support growth and production performance. While excess nutrients do not compromise animal production, they lead to environmental pollution and increased costs due to nutrient loss through feces and urine. Cereal-based diets fed to growing pigs can result in a 33% loss of nitrogen and phosphorus. However, balanced feeding can minimize nutrient losses by improving nutrient utilization efficiency. For instance, supplementing phytase in cereal-based diets

enhances phosphorus utilization, and adding limiting amino acids to low-quality protein diets improves nitrogen utilization efficiency.

Key Considerations for formulating balanced diets

- Nutrient requirements: Understand the nutrient needs of different pig classes based on age, body weight, and physiological status.
- Nutrient composition: Estimate the nutrient content of available feed ingredients.
- Anti-nutritional factors: Assess any anti-nutritional factors in feed ingredients.
- Feed formulation: Formulate feeds with available ingredients to limit excess nutrients.
- Dietary adjustments: Adjust the diet composition by externally supplying limiting nutrients to match the estimated requirements.

Balanced feeding reduces the carbon footprint by using low-protein, locally available feeds, or agro-industrial byproducts supplemented with synthetic amino acids. It also minimizes phosphorus excretion by using low-phytate varieties or microbial phytase fortification. Unconventional feeds may require enzyme supplementation to increase feed utilization efficiency. While high dietary zinc can promote growth and decreases incidence of diarrhea in piglets, its environmental excretion is a pollution concern. Therefore, balanced diet formulation requires comprehensive nutritional information about ingredients and their utilization efficiency, as well as the specific requirements of the animals. Benefits of balanced feeding involves 1) Production efficiency: supports optimal growth and production performance. 2) Cost-effective: reduces wastage and lowers production costs, and 3) Environmental sustainability: minimizes nutrient loss and environmental pollution.

Conclusion

In conclusion, the three-stage system of feeding (starter, grower, and finisher) recommended by the BIS (1987) is widely practiced in India offers a cost-effective and environmentally friendly approach to swine nutrition. Feeding pigs according to their age and physiological stage optimizes growth and performance while minimizing waste and resource usage. The use of unconventional feed resources holds promise for supplementing conventional

diets, but it necessitates careful consideration of anti-nutritional factors and inclusion levels to ensure animal health and productivity.

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Chapter 6

Reproductive Management in Pigs

Introduction

In Pig farming, typically, prized reproductive traits include litter size, particularly total number of pigs born, and pigs weaned, weight of the litter of piglets at birth and weaning, wean-to-estrus interval, and pigs per sow per year. For economic and profitable pig farming, the reproductive managmental practices should be followed.

Legal Responsibilities

Under all circumstances, producers should adhere to the locally applicable Act and Laws that regulate management, welfare, feeding, health and housing practices. Always it should be tried to solve reproductive issues by adjusting management strategies first. If approved by law, under the supervision of Veterinarian, pharmaceutical intervention can be used to support the production flow on critical problem(s) and get sows back to production. For example, estrus in gilts and post weaning anestrous sows or farrowing can be initiated with exogenous hormones, if found required. However, these hormones circumvent natural selection for reproductive efficiency, and this should be kept in mind while they are used in breeding management programs. Exogenous hormones should not be used as a long-term solution to address reproductive inefficiency in a herd.

Reproductive cycle

Sows and gilts are non seasonal and polyestrous, with the estrous cycle lasting 18–24 (average 21) days. Puberty is characterized by estrus exhibition which lasts ~36–48 hr in gilts and ≥48–72 hr in sows. Naturally or artificially served females may establish 114 days of pregnancy which results in birth of piglets after farrowing. Most sows exhibit estrus 3–7 days after weaning. Post weaning heat is fertile and progress to next reproductive cycle.

Puberty and sexual maturity

Puberty and sexual maturity is characterized by estrus exhibition. Estrus detection is the most critical factor linked to reproductive success. Twice in a day heat detection should be followed.

Heat detection

- Estrous detection should be done first thing in the morning, before feeding or at least an hour after feeding. If this is not possible, the afternoon or early evening can work if the ambient temperature is not too high.
- A vasectomized or teasure boar should be allowed to mount on the female, the female in the heat will stand and be rigid.
- Handler apply pressure on the the back/lion of female pig and female in heat stands rigid and firm.
- Visual and physicals signs of heat should be observed twice a day at 10-12 hours apart in the presence of a boar.

Service

The three methods of service are pen mating (boar run natural mating with females), hand mating (supervised natural mating), and artificial insemination (AI).

- Service practices must not cause injury or suffering to any of the animals.
- Maintain slip resistant floors in mating areas and remove any objects or projections, such as feeders or nipple drinkers, that may cause injury during mating.
- First heat after puberty should be skipped to service in gilts while skip-a-heat should also be practiced for sows in a poor body condition.
- Flushing should be adopted as per recommended dietary guidelines.
- The boar and the gilt/sow should preferably be about the same size.
- Service should be done preferably either in morning or late evening.
- Boars should be used 3-4 times a week for natural mating or twice a week for semen collection in AI
- In Natural Service: the female should be double served at 10-12 hours interval and boar should be taken out from the female room. Mating can last upto 5-10 minutes.

- In AI, semen should be used from a reputable source and AI should be done 12 hours (gilts)/ 24 hours (sows) after the handler gets the first 'standing' reaction and again 10 to 12 hours later.
- AI performance: the technique should imitate natural mating as closely as possible.
- Before inserting the catheter, the sow's vulva and the area around it should be cleaned with a povidone soaked cotton or fresh, damp cloth or paper towel.
- Small amount jelly on the anterior portion of the catheter should be applied and direct the lubricated catheter in the vulva at an inclined angle till it stops further, at this point the catheter should be rotated in anticlockwise direction so that it get fixed or aligned in the cervix.
- Then attach the semen dose packet at the posterior end of the catheter, and allow the semen flow in the tract.
- Simultaneously, apply pressure by massaging her vulva and udder for sexual stimulation.
- When the dose become empty, take out the catheter by rotating clockwise.
- Record keeping- dates and times of inseminations, the boar used, the 21-day check-back date and the due date should be noted

	
Estrus detection in pig	Artificial Insemination in Pig

Pregnancy diagnosis

Pregnancy diagnosis can be done indirectly by detecting the return to estrus while exposed to a boar or directly by ultrasound.

- Daily observation of the behaviour of the female when a boar is present, particularly at 18-22 days post-service to note any of the estrus signs, if so then animal is non pregnant.
- Test the sow at 30-35 post-service using ultrasonography and again between 50-60 days.

Gestation

- Restricted and challenged feeding during the gestation should be practiced as per recommended dietary guidelines.
- Gestation area should be organized so that fighting can be controlled. Protect small, young, and timid sows from undue competition.
- Exercise during gestation can improve the farrowing performance of sows
- Gilts and sows that have lost body condition should be managed as separate groups or individually
- Deworming of the pregnant sows should be done between 100-105 days of pregnancy to avoid trans-placental/trans-colostral transmission of worms.

Farrowing

The stock person has a significant influence on the performance and welfare of the pigs. Stockpersons should seek guidance from the herd veterinarian on how to recognize and prevent difficult furrowing. Supervised farrowing alone can help to reduce piglet mortality, because it minimizes stillbirths, facilitates access of pigletsmto needed warmth, allows for observation of nursing activity, and prevents crushing and cannibalism. If required, farrowing can be induced using prostaglandings after confirm 112 days of gestation under the supervision of Veterinarian. Sows are more likely to farrow in the evening or night. Birth of the litter usually takes 1 to 4 hours, with an interval of 10 to 20 minutes between piglets. Pigs can be born either head or tail first.

- The sow/gilt should be transferred to the cleaned, disinfected farrowing pen 2 weeks before the expected date of farrowing.
- Clean and dry bedding materials (wheat/paddy straw) should be provided on the floor.
- Calm surroundings during the farrowing process should be maintained
- Sows must be observed frequently around their expected farrowing times. Some sows and gilts need assistance during farrowing.

- Upon discovering sows in farrowing difficulty, prompt assistance must be provided.
- Oversized and malpositioned piglets obstruct the birth canal; a gentle pulling may save the lives of the piglets under supervision of a Veterinarian.
- In case of dystocia/difficult farrowing, as per requirement and with concise of Veterinarian, oxytocin 10 I.U. by IM route can be given.
- Consult a veterinarian regarding the appropriate administration of antibiotics and/or analgesics following difficult births, If required.
- The farrowing process is usually completed within 1-6 hrs. The placenta will be expelled generally within a short. The placenta should not be eaten by the sow and immediately disposed off.
- Care should be taken to avoid crushing of newborn piglets during and after farrowing.
- When farrowing is complete, the sow should appear comfortable and should not continue to strain. Sows should stand and drink in a few hours.
- Remove piglets from a nervous sow and allowed to suckle under supervision.
- If respiration delays in newborn piglets immediately mucous from their nose and mouth should be removed and air should be blown into nose and mouth.
- All piglets must have access to colostrum as soon as possible after birth, and within 12 hours.
- Placenta, dead piglets, soiled bedding etc. may be removed and buried in time with least delay. The pen should be washed with a mild disinfectant solution.
- The farrowing pen should be as calm as possible so that the natural vocalizations of the piglets are audible to the sow.
- Sow health problems are most common during the first few days after farrowing, and sows need to be checked regularly (4 or 5 times per day) during post farrowing period.

	
Pregnant Sow	Sow with piglets

Post Weaning Estrus and Service

- Post weaning 4-7 days, estrus is exhibited and sows should be bred naturally or artificially as mentioned in previous sections.

Estrus synchronization

- Estrous synchronization may be achieved by synchronized weaning of lactating sows; estrus occurs 4–10 days later.
- A combination of equine chorionic gonadotropin (eCG) and human chorionic gonadotropin (hCG) could induce estrus in gilts with delayed puberty and sows with post weaning anestrus.

Use of Oxytocin hormone for farrowing management

Oxytocin hormone should be used in case of difficult furrowing under the supervision of Veterinarian. Oxytocin dose is 10 I.U., applied 2x maximum, with shots 2 hours apart by IM route. However, there are strict guidelines on manufacturing, prescription and use of the hormone. As per the section 26A of the Drugs and Cosmetics Act, 1940 (23 of 1940), the Central Government hereby directs that the drug oxytocin shall be manufactured for sale or for distribution or sold in the manner specified below, in addition to the provisions contained in the said Act and Rules (The Gazette of India, extraordinary, part ii—Section 3—Sub-section (i) 17th Jan 2014, New Delhi) made there under, namely :—

1. The manufacturers of bulk oxytocin drug shall supply the active pharmaceutical drug only to the manufacturers licensed under the Drugs and Cosmetics Rules, 1945 for manufacture of formulations of the said drug.

2. The formulations meant for veterinary use shall be sold to the veterinary hospitals only.

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Ready Reckoner for Artificial Insemination/ Service and Farrowing in Pig

शूकरों में कृत्रिम/प्राकृतिक प्रजनन एवं प्रसव के लिए रेडी रेकनर:গাহৰি কৃত্রিম /প্রাকৃতিক প্রজনন আৰু প্রসৱ তালিকা

AI/Service Date एआई/सर्विस तिथि কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	January जनवरी জানুৱাৰী	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	January जनवरी জানুৱাৰী
Farrowing Date प्रसव तिथि প্রসৱ তিথি	April अप्रैल এপ্রিল	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	May मई মে
AI/Service Date एआई/सर्विस तिथि কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	February फ़रवरी ফেব্রুৱাৰী	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	--	--	--	February फ़रवरी ফেব্রুৱাৰী
Farrowing Date प्रसव तिथि প্রসৱ তিথি	May मई মে	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	-	-	-	June जून জুন
AI/Service Date एआई/सर्विस तिथि কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	March मार्च মাৰ্চ	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	March मार्च মাৰ্চ
Farrowing Date प्रसव तिथि প্রসৱ তিথি	June जून জুন	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	July जुलाई জুলাই
AI/Service Date एआई/सर्विस तिथि কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	April अप्रैल এপ্রিল	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	--	April अप्रैल এপ্রিল
Farrowing Date प्रसव तिथि প্রসৱ তিথি	July जुलाई জুলাই	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	--	August अगस्त আগষ্ট
AI/Service Date एआई/सर्विस तिथि কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	May मई মে	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	May मई মে
Farrowing Date प्रसव तिथि প্রসৱ তিথি	August अगस्त আগষ্ট	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	September सितंबर চেপ্টেম্বৰ
AI/Service Date	June	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	--	June

এআই/সর্বিস তিথি কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	জুন জুন																																		জুন জুন
Farrowing Date প্রসব তিথি প্রসৱ তিথি	September सितंबर চেপ্টেম্বৰ	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	--	October অক্টুবর অক্টোবৰ
AI/Service Date এআই/সর্বিস তিথি কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	July जुलाई জুলাই	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	July जुलाई জুলাই
Farrowing Date প্রসব তিথি প্রসৱ তিথি	October अक्टूबर অক্টোবৰ	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	November नवंबर নৱেম্বৰ
AI/Service Date এআই/সর্বিস তিথি কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	August अगस्त আগষ্ট	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	August अगस्त আগষ্ট
Farrowing Date প্রসব তিথি প্রসৱ তিথি	November नवंबर নৱেম্বৰ	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	December दिसम्बर ডিচেম্বৰ
AI/Service Date এআই/সর্বিস তিথি কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	September सितंबर চেপ্টেম্বৰ	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	--	September सितंबर চেপ্টেম্বৰ
Farrowing Date প্রসব তিথি প্রসৱ তিথি	December दिसम्बर ডিচেম্বৰ	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	--	January जनवरी জানুৱাৰী
AI/Service Date এআই/সর্বিস তিথি কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	October अक्टूबर অক্টোবৰ	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	October अक्टूबर অক্টোবৰ
Farrowing Date প্রসব তিথি প্রসৱ তিথি	January जनवरी জানুৱাৰী	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	February फ़रवरी ফেব্রুৱাৰী
AI/Service Date	November	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	--	November

एआई/सर्विस तिथि কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	নবंबर নৱেম্বৰ																																নবंबर নৱেম্বৰ
Farrowing Date प्रसव तिथि প্রসৱ তিথি	February फ़रवरी ফেব্রুৱাৰী	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	--	March मार्च মাৰ্চ
AI/Service Date एआई/सर्विस तिथि কৃত্রিম /প্রাকৃতিক প্রজনন তিথি	December दिसम्बर ডিচেম্বৰ	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	December दिसम्बर ডিচেম্বৰ
Farrowing Date प्रसव तिथि প্রসৱ তিথি	March मार्च মাৰ্চ	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	April अप्रैल এপ্ৰিল

Chapter 7

Transportation of Pigs

Introduction

The need to transport food animals occurs essentially in commercial agriculture and to a lesser extent in the rural or subsistence sector. These animals need to be moved for a number of reasons including marketing, slaughter, re-stocking, from drought areas to better grazing and change of ownership. Typically, methods used to move animals are on hoof, by road motor vehicle, by rail, on ship and by air. The move by air, train, sea and road will be sanctioned by a competent authority as per the prevailing situation. However, Pigs are difficult animals to transport, and the only satisfactory method is by road, although rail can be used under careful circumstances. Hence, the following points should be considered for transport of the pigs by Rail and road as per BIS guidelines (IS 5236: 2022).

Transport of Pigs by Rail and Road

There are a number of simple procedures that can be implemented prior to the loading of pigs, which will considerably reduce the risk of injury and stress. Fighting amongst pigs that are strangers is common, resulting in skin damage, wounds and stress. Most animals can be fed and watered before transporting. This has a settling effect. However, pigs should not be fed before transport as the feed ferments and the gas causes pressure on the heart in the thoracic cavity, leading to heart failure and death. Pigs should not travel with other species unless separated by a partition. Animals that are diseased, injured, emaciated or heavily pregnant should not be transported, and unfit, heavy, pen fed animals should not travel far as they cannot stand up to the rigorous of transport.

Administrative considerations

Only healthy animals in good condition shall be transported unless otherwise required as per the provisions of '*The Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009*'. These animals should be certified by a qualified veterinarian for freedom from infectious diseases and ecto-parasitic diseases and their fitness to undertake the

journey. The certificate shall be in a form specified in Annex A of this standard which is as per Schedule K of Transport of Animals (Amendment) Rules, 2001.

General considerations

To avoid exhaustion, the animals shall be given humane treatment and care during transportation. An attendant along with first aid equipment shall accompany the animals in transit. When pigs are to be transported from endemic areas of a disease to non-endemic areas, the pigs should be given protective vaccination and kept in quarantine for 30 days, before transportation. Sows in advance stages of pregnancy (above 60 days of pregnancy) shall not be transported. When transporting boars special arrangements by providing suitable partitions should be made to protect the animals from infighting. Similar arrangements should also be made to protect the young ones from crushing when sows with litter are transported.

PRELOADING

Vehicle preparation

- All vehicles should be inspected for safety, suitability and cleanliness before loading the animals. The floor and walls should be undamaged and there should be no nails or sharp projections which may injure the animals.
- The vehicles should be thoroughly cleaned, sprayed with suitable disinfectant before loading the animals.
- A layer of clean sand to cover the floor of transport vehicles to a thickness of not less than 6 cm shall be provided. This layer of sand shall be moistened with water during the summer month. During these months arrangements shall be made to sprinkle water on the animals at frequent intervals. In winter, a 2 cm layer of clean sand with another 6cm layer of whole-straw shall be provided.
- Partitions shall be made in the vehicle keeping in the view of space requirements. Please refer Table 1 and Table 2 for space requirements for pigs in railway wagon and road vehicle respectively. The pigs shall not be bound or chained during transit and space provided for them shall be large enough to stand or lie.
- Vehicles should be fitted with a portable ramp to facilitate emergency offloading in case of prolonged breakdowns.

- Lighting must be provided on the livestock container which is sufficient to load and unload safely and allows for inspection and care of the animals during transportation.
- Pigs shall not be transported along with cattle in rail wagon. In case it is necessary to do so, cattle should be tied securely and, shall be separated from pigs by partition..
- Tyre pressure shall be checked before transporting animals.
- If pigs are to be transported in extreme cold or hot climate, it is preferable to transport them in covered Lorries on road so that they may not die or exhaust or suffer from acute respiratory disease and journey under such adverse climate shall be minimized. Each consignment should bear a label showing the following particulars:
  a) Number and kind of the animals loaded;
  b) Name, address and telephone number, if any, of the consignor;
  c) Name, address and telephone number, if any, of the recipient;
  d) Quantity of feed provided;
  e) Instruction regarding feeding and watering;
  f) Time of the commencement of transport; and
  g) Expected duration of transport.

Animal Preparation

Several aspects of the preparation stage are related to the animals that are intended to be transported and aimed to avoid: 1) Excessively long loading time which can be particularly stressful in hot climate conditions in a stationary truck, in which ventilation is critical, 2) Poor fitness of pigs to travel which can worsen during transport and become dramatic and causing animal suffering. It is essential that all animals are checked before loading to determine fitness for transportation.

- Pigs should be selected and identified by a marker or identification number before the transport vehicle arrives to avoid unnecessary delays.
- Before loading, the animals should not be fed heavily. Only light feed may be allowed. For journeys less than 12 h no feed may be carried but for longer journeys sufficient feed shall be carried to last during the journey. Watering facilities shall be provided at regular intervals. During transport, it must be ensured that the pigs have constant access to water.

- Light and heavy animals shall be separated by providing partitions. Animals from different pens/sheds shall preferably not be mixed during transportation. Male stock shall not be transported with female stock (adults) as males try to mount on females in heat.
- Pigs when driven for loading-or unloading shall never be struck with stick. Driving could best be done by soft rubber pipe. During loading and unloading, pigs must never be handled in ways or using tools that cause pain or suffering. In particular, it is prohibited to:
  a) hit or kick animals;
  b) put pressure on particularly sensitive body parts causing unnecessary pain or suffering
  c) lift animals up with mechanical means tied to their bodies
  d) drag or pull animals up on their head, ears, legs, or tail
  e) use herding tools, including electrical ones, or other tools with sharp ends
- In transport of pigs by rail or road, the animals shall not be fettered (shackled/restrained) unless there is a risk of their jumping out and their legs shall not be tied down.

LOADING

- While loading, the extremes of temperatures shall be avoided.
- Suitable ramp shall be provided for loading and unloading the animals. The ramp should be at least1.5 metre in width with raised sides at least 75 cm high. The floor of the ramp shall have cleats at intervals of about 15 cm, so that animals do not slip as they climb: or descend. The angle of the ramp with the floor shall not be more than 30°. The ramp shall be covered with straw to avoid slipping.
- There should be no gap between the loading system of the truck and the concrete platform of the farm loading quay, as this increases the risk of injury and fractures.
- Van at any time of loading and unloading shall be kept clean to avoid slipping of pigs.
- In case of railway wagons when loading is done on the platform, the door of the wagon may be used as ramp. In such cases, bails or bags of hay, *Bhusa,* etc, may be placed on the either side of the dropped door to prevent the animals from getting their legs between the sides of the wagons and platform.

TRAVELLING

The longer the journey, the greater the risk that welfare is negatively affected. There are four main aspects of animal transport, which have increasing impact on welfare as duration increases. These relate to the physiological state of the animal, feeding and watering, rest and thermal environment. If pigs are fit, properly prepared to travel and the journey has been planned well, pigs are likely to arrive at destination in a good welfare state and able to recover quickly after unloading and a relatively short time of rest. Drivers play one of the most important roles in transport. Smooth, consistent driving habits allow the animals to relax more during a journey than hard, erratic driving. Avoid harsh breaking and try to use a constant throttle.

- Overcrowding shall be avoided.
- In transport of pigs by rail no railway wagon shall accommodate more than the number of weaner, young and adult pigs as specified in the Table 1.
- Adequate ventilation shall be provided in every wagon and the upper door of one side of wagon shall be kept open and properly fixed and the upper door of the wagon shall have wire gauge, closely welded mesh arrangements to prevent burning cinders from the engines entering the wagon and leading to fire breakout.
- In transport of pigs by road, no road vehicle shall accommodate more than the number of weaner, young and adult pigs as specified in the Table 2.

Table 1 Maximum Number of Pigs in a Railway Wagon

Category of Animal	**Broad Gauge**	**Metre Gauge**			**Narrow Gauge**
	Wagon having Floor Area 63.5 Square Meter	Area of Wagon More than 21.1 Square Meters	Area of Wagon Less than 12.5 Square Meters	Area of Wagon More than 12.5 Square Meters	Not Allowed
Weaner	211	70	41	42	-
Young	151	50	29	30	-
Adult	104	34	20	21	-

Table 2 Maximum Number of Pigs in Road Vehicle

Sl No.	Type of Animal	Maximum Number of Pigs Permitted for Road Vehicle			
		Vehicle having size 5.6 m × 2.35 m	Vehicle having size 5.1 m × 2.18 m	Vehicle having size 3.03 m × 2.18 m	Vehicle having size 2.9 m × 2.0 m
1.	Weaner	43	37	22	19
2.	Young	31	26	15	13
3.	Adult	21	18	10	9

UNLOADING

Unloading starts with the arrival of the vehicle to the unloading area of the final destination and ends when all the animals are present on the platform. It is an important phase of the transport process, and is a stressful situation for the animals due to the rapid changes of their close environment. Pigs often arrive stressed and tired at a control post or at their final destination. The design of the unloading area as well as the handling skills of the staff should help to reduce stress as much as possible.

- Unloading areas should be secure and provide a wide, clear and straight path from the vehicle to the holding pens and sufficient staff should be present to unload the pigs as soon as the truck arrives.
- As with loading, options that lower the angle of ramps will reduce stress and the risk of injury to pigs.
- During unloading pigs should be observed carefully, to check their general condition and signs of suffering and/or impaired health.
- The animals should be checked to see that they are fit and have not been injured during the journey.
- The animals should have access to food and water

ARRIVAL

- Trucks should be cleaned directly after unloading, and before they enter the overnight parking space.
- Before cleaning and disinfecting, dirty bedding should be removed.
- The driver should ensure that all the relevant documents are left with the animals at the place of arrival.

TRANSPORT OF PIG BY AIR

Guidelines given in Terrestrial Animal Health Code, Chapter 7.4. 2018 by World organization for Animal Health (WOAH) should be followed for transportation of pigs by air. Some points are mentioned below.

- Crate design and shipment planning should recognize that swine are extremely susceptible to high heat and humidity and that they normally carry their head near the floor.
- In the use of multi-tiered crates, special attention should be paid to ensure air can move through the crate, in accordance with the aircraft's ventilation pattern and capacity to remove heat.
- Crate construction should take into consideration the tendency for mature swine to chew.
- Litter should be dust-free, shavings or other non-toxic materials may be used but not sawdust.
- Containers for immature swine should only be constructed when flight is imminent, since rapid growth can result in undersized containers if the flight is delayed.
- In order to reduce fighting, swine shipped in group pens should be housed together as a group prior to shipment and not be mixed with other swine before loading on the aircraft.
- Mature boars and incompatible females should be shipped in individual crates.
- Individual crates should be 20 cm (8 in.) longer than the body, 15 cm (6 in.) higher than the loin of the pig and of sufficient width, to allow the pigs to lie on their side.
- Heavily pregnant animals should not be carried except under exceptional circumstances. Pregnant animals should not be accepted when the last service or exposure to a male prior to departure has exceeded the 90 days of gestation:

Stocking density

- The current stocking densities agreed by IATA should continue to be accepted (Table 3). However, the graphs giving the space requirements should be extended to take into account animals larger and smaller than those dealt with currently.

Table 3. Pig stocking density for transport by air

Species	Weight	Density	Space/ animal	No. of animals per 10 m²	Animals per single tier pallet		
	kg	kg/m²	m²		214x264 cm²	214x308 cm²	234x308 cm²
Pigs	25 100	172 196	0.15 0.51	67 20	37 10	44 12	48 14

TRANSPORT OF PIG BY SEA

Guidelines given in Terrestrial Animal Health Code, CHAPTER 7.24. 2018 by World organization for Animal Health (WOAH) should be followed for transportation of pigs by sea. There are some points which needs to be taken care further. Pigs have poor eyesight, and may move reluctantly in unfamiliar surroundings. They benefit from well-lit loading bays. Since they negotiate ramps with difficulty, these should be as level as possible and provided with secure footholds. Ideally, a hydraulic lift should be used for greater heights. Pigs also negotiate steps with difficulty. A good 'rule-of-thumb' is that no step should be higher than the pig's front knee. Serious aggression may result if unfamiliar animals are mixed. Pigs are highly susceptible to heat stress.

IMPORT OF LIVE PIGS IN INDIA

For the import of the live pig to the country, 'Protocol for Import of Live Breeding Pigs' has been published in the website of Department of Animal Husbandry & Dairying, Govt. of India. The said guidelines shall be followed.

ANNEXURE A

Proforma for Certificate of Fitness to Travel Pigs
(*Schedule K of Transport of Animals* (*Amendment*) *Rules, 2001*)

(This certificate should be completed and signed by a Veterinary doctor)

Date and time of examination ……

Species of animals……..……

Number of animals……..……

Sex……..……
……...

Age……..……
……...

I hereby certify that I have read Rules 86 to 95 in Chapter VII of the Transport of Animals Rules, 1978.

1. That, at the request of (consignor)……. I examined the above mentioned animals not more than 12 h before their departure.
2. That each appeared to be in a fit condition to travel by rail/road/sea and is not showing any signs of any infectious or contagious or parasitic disease(s) and that it has been vaccinated against any infectious of contagious diseases(s).
3. That the animals were adequately fed and watered for the purpose of the journey.
4. That the animals have been vaccinated.
(a) Type of vaccine(s):
(b) Date of vaccination:

Signed……..……

Address……..……...

Qualifications……..……

Date……

References

Indian Standard, Transport of Pigs by Rail and Road -Code of Practice, (Second Revision), Bureau of Indian Standards (IS 5236: 2022), Govt. of India

Guidelines for humane handling, transport and slaughter of livestock, Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific. RAP Publication 2001/4; Compiled by:Philip G. Chambers and Temple Grandin; Edited by: Gunter Heinz and Thinnarat Srisuvan.

Transport of animals by air, Terrestrial Animal Health Code, Chapter 7.4. 2018 by World organization for Animal Health (WOAH)

Transport of animals by sea, Terrestrial Animal Health Code, Chapter 7.2. 2018 by World organization for Animal Health (WOAH).

Protocol for import of Live Breeding Pig into India, Department of Animal Husbandry & Dairying, Govt. of India

Chapter 8

Training and Responsibilities of Farm Personnel

Introduction

Pig farm workers play a pivotal role in maintaining the health and productivity of the pigs. Their responsibilities range from feeding and nutrition to monitoring health, assisting with breeding, and caring for piglets. They also maintain clean and safe housing environments, manage ventilation and temperature, and upkeep equipment. Effective collaboration and required training are crucial for performing these duties efficiently and making pig farms a great place to work.

Responsibilities and duties of farm workers

1. Keep the piglets comfortable: Make sure their house (barn) stays at the right temperature with good airflow.
2. Able to mix the feed ingredient when required to prepare feed for pig and serve them on a regular basis in a fixed time.
3. Able to clean the pig pen on a regular basis.
4. Should dispose the waste material as per the farm plan.
5. Can perform sanitization, disinfection and spraying activities in farm as and when required as per management plan.
6. Able to identify the sick or diseased animal and report to the farm manager.
7. Can perform weaning activities according to the schedule.
8. Can separate the animals as per the instruction of the farm manager.
9. Able to restrain the animal as and when required for treatment or castration.
10. Maintain the cleanliness of the farm and farm premises including fences and barns.
11. Maintain proper cleaning and sanitization of equipment and utensils used in regular farm activities.
12. Able to perform the nursery activities and be trained for newborn care and management like cleaning of newborn piglets after birth, umbilical cord handling, teeth clipping, assistance in colostrum and milk feeding, providing extra heat source etc.
13. Can do ear tagging or other identification processes followed in the farm.

14. Able to identify the heat/estrous pig.
15. Should know to transport or shift pigs when required to shift pen or sick or slaughterhouse or processing plant.
16. Be responsible for accurate and timely record keeping through supply of accurate and timely transmission of information to the farm manager.
17. Perform the duties enthusiastically, responsibly and accurately according to farm policy and in a timely manner.

    Along with that the farm should keep records for :

18. Must keep health record of all the workers.
19. Must perform regular self-health checkups for all workers at six-month/yearly intervals.
20. Worker must follow a deworming schedule.

Recommended Hygiene Practices for pig farm personnel

1. **Personal Hygiene of the workers:**
    - Should take a shower or bath every day to remove germs from your skin and hair.
    - Keep nails short and clean to avoid spreading dirt and bacteria.

Hand Washing: Hand-washing practices are essential for easy maintenance of health and hygiene of farm workers. Farm workers must wash their hands with soap and clean water. Handwashing stations should be easy to find near toilets, eating areas, and where workers handle animals or food. Dirty water from handwashing shouldn't soak into the ground. It should be directed away from the field and not dumped near drinking water sources.

When to Wash Hands

Workers should wash hands before the start of the shift, before and after breaks for food, drinks, or smoking, and after using the restroom. Hands should also be washed thoroughly after handling animals, sanitizers, or disinfectants. Ensure hand washing before transitioning from field work to pen work, refrain from touching hair and clothes, but if contact does occur, wash your hands promptly. After coughing or sneezing, touching the face, tools, raw materials, or trash, before donning gloves, and upon returning from breaks, it's essential to wash hands. Additionally, after touching dirty surfaces, equipment, or utensils, handling dirty raw materials, trash, garbage, or waste,

managing contaminated or potentially contaminated materials, and performing equipment maintenance, hand washing is necessary.

How to wash hands properly:

- The hand should be washed using clean, running water, which can be either warm or cold.
- Make sure the worker should apply enough soap to thoroughly cover your hands
- Hands and arms should be washed for at least 20 seconds, ensuring attention is given to tricky spots like between fingers and under nails.
- All the soap should be washed away with clean running water.
- Should dry hands and arms completely, using a clean paper towel or hand dryer.

Eating and smoking areas

- Eating and smoking areas should be kept far from where pigs or their food are handled.

Work Attire

- To prevent the spread of germs, it is important to wear clean clothes every day. The worker attire should be washed regularly and kept clean.
- Clothes should be changed and washed after working with animals every day.
- Avoid wearing jewelry or wristwatches while working, as they can fall off and spread contamination.
- Should wear clean clothes according to the biosecurity norms of the farm, ensuring they are suitable for the job

Gloves

- Prior to putting on gloves, it is essential to wash hands.
- For small cuts or bandages use of gloves can help keep things clean, as long as they're not ripped.
  Reusable gloves should be washed and sanitized regularly and should not have any holes.

Recommended protocol for management of health emergencies during farm operations

Injury during Pig handling

The majority of the injuries occur due to poor handling techniques. Sometimes accidents occur during pig handling. Proper pig handling is crucial for various reasons, including worker safety, animal welfare, and farm efficiency. When pigs are handled gently and with care, it helps reduce stress levels in the animals, which in turn can lead to improved productivity and overall well-being. Stress-free handling also minimizes the risk of injury to both the pigs and the workers, creating a safer and more efficient working environment on the farm. Training programs that focus on gentle and effective pig handling techniques can significantly benefit both the animals and the farm operation as a whole.

Precaution to reduce risk during animal handling

1. Workers should receive training on how to handle animals safely and efficiently.
2. It is advisable to always watch the pig and avoid facing away from it.
3. Consider using a pig board or a guard/shield-type object to guide and handle pigs effectively.
4. When lifting young pigs, it's best to grip their hind leg while supporting their chest with the other hand.
5. Make sure stock handlers are aware that boars can be very aggressive
6. Always ensure there is a clear escape route and plan before entering a boar pen or sows with litters.
7. Boar tusks should be trimmed to an appropriate length when necessary, and piglet needle teeth should be clipped to prevent injuries to other animals or for safety reasons.
8. Sows should be appropriately restrained or separated when handling their piglets.
9. Only pigs weighing less than 10-15 kg should be lifted. Heavier pigs should be guided or herded when relocation is necessary.

Training for farm staff

Proper training for farm workers is crucial. It helps make the farm more efficient by reducing pig stress, avoiding disease outbreaks, and improving nutrition.

Trained workers are also more engaged, motivated, and adaptable to changes in pig farming, which means they can respond quickly to health issues. It's important to teach workers how to keep both the pigs and themselves clean to prevent illness.

- Make sure the training is easy to understand, in their language, and covers the specific risks on your farm.
- Review the training regularly to keep everyone up-to-speed.
- Biosecurity training to farm workers that includes following strict biosecurity protocol and identification of disease animals.
- Training is essential for easy handling of pigs.
- Suggested training topics include: basic hygiene, recommended handwashing technique, and reporting injury or illness.

Chapter 9

Record Keeping

Introduction

Record keeping is essential for a successful pig farm as it requires serious planning where animal numbers, reproductive status, age structure, daily production and input needs keep on changing. For effective planning, the manager or farmer has to know the number of pigs of different stages, their reproductive status, health status and feeding. Along with that he should know daily production metrics such as piglet births, mortality rates and weight gain, input requirements for feed, water and medications to ensure resource optimization. Record keeping helps the farmer to identify where he is, where is he going and what his financial position. By analyzing these records, farmers can make informed decisions and improve overall farm management.

By keeping records, farmers can:

- Identify which pigs perform well and which don't.
- Track expenses and earnings accurately.
- Choose the best animals for breeding.
- Benchmark their farm's performance against others.
- Spot health or fertility issues early.
- Recognize and address management weaknesses.

In pig farming, various records are vital for monitoring and improving farm performance, covering areas such as animal performance, economic transactions, and daily activities. These records help farmers track progress toward production goals and ensure efficient management practices.

How to keep records:

1. Keep identification of pigs: Ear tagging is a most common method.
2. Maintaining different register or cards.
3. Record book where a page is assigned to each pig or piglet where each event of that pig's life used to recorded date-wise.

Grower Record Card

Grower/finisher record cards track pig details; like, name or identification number, birthdate, breed, sex and performance like; weights, gain, feed intake, conversion etc. This helps farmers evaluate their management process, find areas for improvement, and maximize pig growth and profit.

Animal No	DOB	Sex	Breed	Sire No	Dam No	Date of Slaughter
Birth weight	**Weekly body weight**			**Body weight at weaning**	**Average Daily Gain**	**Feed Conversion Ratio**
	Week 1	**Week 2**	**Week 3**	**Week 4**		

Monthly body weight								
Month 1	**Month 2**	**Month 3**	**Month 4**	**Month 5**	**Month 6**	**Month 7**	**Month 8**	**Month 9**

Sow record card

By keeping detailed sow record cards with mating dates, health, and farrowing results, pig farmers can track individual sow performance and make informed breeding decisions to optimize their herd. These cards act as a vital tool for managing sow health, productivity, and ultimately, farm profitability.

Animal No	**DOB**	**Sex**	**Breed**	**Sire No**	**Dam No**	**No of teats**	**Date of culling/ disposal**

Date of estrus	**Date of Service**	**Date of Successful Service**	**Boar No used**	**Breed of boar**	**Date of Farrowing**

Parity	No. of piglets born alive	No. of piglets born dead	Litter weight at birth	Litter size at weaning	Litter weight at weaning

Boar record card

Just like sow record cards, boar record cards track individual health and performance. They include boar details (ID, birthdate, breed) and breeding history (sows served, dates, piglets born & weaned) to monitor effectiveness and take corrective actions when needed.

Animal No	DOB	Sex	Breed	Sire No	Dam No	No of rudimentary teats	Date of culling / disposal	Congenital defects if any	Results of any disease testing

Date of puberty	Date of first semen collection	Date of service	Sow No served	Type of mating (AI, hand or pen mating)	Litter size at birth	Litter size at weaning	Litter weight at birth	Litter weight at weaning

Breeding record

A well-maintained breeding record is the backbone of a pig farm's success. It tracks breeding performance, ensures animal health, and ultimately boosts farm productivity and profitability.

Animal no	Date of Service	Date of Successful Service	Boar No used	Breed of boar	Expected date of Farrowing	Date of Farrowing

Farrowing records

Pig farmers who keep meticulous farrowing records can track sow performance, identify trends in litter health, and use this data for smarter breeding and farm management.

Animal no	Date of Farrowing	Litter size at birth(born alive)	No. of Still births, mummified or macerated fetuses	Date of weaning	Litter size at weaning

Animal stock register

This register tracks essential information about the pigs in the herd.

Month	Year	No of piglets	No of growers	No of sows	No of boars	No of culls and mortalities	Total no of animals

Feed Register

A feed register is essential for ensuring pigs receive proper nutrition, managing feed inventory efficiently, and become aware of major expenditures or costs, ultimately enhancing the farm's productivity and profitability.

Date	No of animals	Type of feed	Feed in the stock brought forward (Kg)	Feed purchased (Kg)	Feed issued (Kg)	Balance feed carried forward (Kg)

Note: It is advised to maintain a record of source of feed for ensuring traceability.

Treatment register

A treatment register for a pig farm is important for keeping track of all medical treatments given to the pigs. It helps monitor their health, follow veterinary guidelines, and manage the farm better.

Date	Animal no	Pen no	Age	Sex	Symptoms	Diagnosis	Treatment

Medicine and Vaccine register

Sl. No	Date of receipt	Farm name & Address	Qty	Order no. Date	Bill No.	Date of Issue	Issued Amount	Balance	Initials

Mortality register

A mortality register in a pig farm helps track and analyze pig deaths, identifying patterns or causes to improve management practices, animal welfare, and

farm productivity. It includes details like date of death, pig ID, cause of death, and any relevant notes for each case.:

Date of death	Animal no	Pen no	Age	Sex	Cause of death	Postmortem findings

Sale register

Date	Anim. No.	Sex	Weight	Unit Price	Challan No.	Money receipt no.	Amount	Remarks

Cash book

A cash book for a pig farm is a financial record that logs all cash transactions concerning the farm's activities. It acts as a key tool for financial management, tracking income, expenses, and cash flow. A comprehensive cash book for a pig farm should include details such as date, transaction description, amount, and category (income or expense), organized in chronological order for clarity and easy reference

Money received			Money spent			Balance
Date	Item	Amount	Date	Item	Amount	

Chapter 10

Common Diseases of Pigs and Health Management

Introduction

Pigs have a greater potential than other livestock species to help farmers to achieve a faster return on their investment due to a number of inherited characteristics, including high fecundity, improved feed conversion efficiency, early maturity, and short generation intervals. Pig rearing plays an important role in rural livelihood and nutritional security more particularly in the tribal dominant states of India. Despite its importance, the growth of piggery is showing a declining trend and one of the most important impediments affecting the growth of piggery in the country is the occurrence of various diseases. Diseases of pigs can be broadly classified in to two categories viz A. Infectious diseases and B. Non-infectious diseases. Infectious diseases include mainly (i) Bacterial, (ii) Viral and (iii) Parasitic diseases and Non-Infectious diseases can be categorized in to (i). Deficiency diseases and(ü). Miscellaneous diseases. In this chapter common diseases of pigs with their main clinical signs, prevention and control measures and routine health calendar for pigs is presented .

Note: All treatments must be either carried out by a qualified Veterinarian or under the supervision of a qualified Veterinarian.

A. INFECTIOUS DISEASES			
BACTERIAL DISEASES			
Disease	**Etiology**	**Clinical Signs**	**Prevention and control**
Colibacillosis	***Escherichia coli* (E. coli)** is a gram-negative bacillus organism.	• Most common during the first two weeks of life • Diarrhoea occurs even within the first 2-3 hours • Affects individual piglets or whole litters • Faeces may be clear white/brown • Dehydration in severe cases	• Should be treated with an oral antibiotic preparation • Dehydration can be treated with ORS. • Probiotics can also be used to check diarrhoea in piglets. • Managing suckling and fostering in order to ensure that all piglets • Consume colostrum. • Reduction in feed intake of sows and weaned piglets through • Supplementation of high protein and fibre diets. • Keeping sufficient levels of clean and dry straw in farrowing pen. • Proper disinfection of farrowing pen • Bedding should be either removed or burned properly

Salmonellosis	***Salmonella cholaraesuis*** a gram negative facultative anaerobic bacteria.	• Generally, occurs between weaning and 3 or 4 months of age. • Affected pigs often bury themselves in straw and show cyanosis of the ears, limbs and center of the back. • High rise of temperature and pigs may die within 24-48 hours. • In acute enteric form in younger pigs, animals pass thin watery • Yellowish diarrhoea. • Pneumonia, weakness and nervous signs such as paralysis and • Tremor may occur. • In severely affected cases, skin discoloration is present.	• Affected animals should be treated with antibiotics • Adoption of strict hygienic measures in the farm, provision of clean water, • Rodent and fly control and netting against birds will help in preventing the introduction of salmonellosis to a farm • Control on infected farms will require medication when disease is expected and should be accompanied by disinfection. • Recommended to take advice from a nearby registered veterinary practitioner for treatment and follow-up.
Pasteurellosis	***Pasteurella multocida*** is a gram-negative organism causing progressive atrophic rhinitis	• The main clinical signs of the disease are coughing, dyspnoea, fever and extreme weakness. • Chronic cases have less fever, a	• Sick animals can be treated with antibiotics • Elimination of the organism is the primary means of control

	and pneumonic pasteurellosis in pig	persistent cough and a more marked dyspnoca. • When pneumonia develops there is abdominal breathing.	• Newly purchased animals should be quarantined for at least 3-4 weeks before introduction to the existing herd. • Mixing and sorting of pigs should be minimized • Avoiding stresses to the animals along with control of other endemic respiratory tract pathogens. • Segregated early weaning, "all-in/all-out" management, reduced stocking rates when possible, and improved ventilation are recommended for prevention. • Recommended to take advice from a nearby registered veterinary practitioner for treatment and follow-up.
Clostridial infection	**Clostridium perfringens types A and C** cause diarrhea,	• Affected piglets are normal at birth, sick on the first or second day of life and usually die within 12-	• Affected piglets usually die. Sick animals can be treated with antibiotics

	dysentery and death in pigs.	24 hours of the onset of clinical signs. • Profuse diarrhoea rapidly becomes claret-coloured. • The hindquarters may be soiled with bloody faeces, • Affected piglets become weak, collapse and die. Some may be found dead • In more chronic cases, shreds of necrotic (dead) material may appear in the reddish-brown watery faeces.	• Adoption of strict hygienic measures in the farm, provision of clean water,
Swine mycoplasmoses	***Mycoplasma hyopneumoniae***. This disease causes huge economic losses in pig production because of poor growth and poor feed conversion efficiency.	• Mortality is low but several animals may be affected. • Non-productive coughing I is the most obvious clinical sign. • Coughing is observed over a few weeks or months, but is not constant • Affected animals find difficulty in breathing and there is fever	• Although antimicrobials are capable of controlling the infection, complete elimination of the organism from the respiratory tract cannot be achieved by medication. • Effective control depends on an optimal environment(air quality,ventilation, temperature)

			• Methods including the periodic examination of lungs from slaughter, clinical inspections and serological diagnosis, etc. are necessary
Swine erysipelas	***Erisepelothrix rhusiopathiae***is a gram-positive non motile bacterial organism	**Clinical signs** • Sudden death or collapse with high temperature and a scarlet flush on the skin. • Diamond skin lesions occur within 48 hours of the onset of clinical signs and can be felt as raised patches along the back or neck but rapidly become purplish-red. • In chronic cases, there is arthritis and animals show lameness.	• Acute outbreaks of swine erysipelas usually can be controlled by administering penicillin to affected pigs along with antimicrobials added to the drinking water until no sick pigs have been observed for at least three days. • A combination of good sanitation, the elimination of carriers with skin and joint lesions, and appropriate quarantine measures for purchased stock will help in the control of swine erysipelas.
Leptospirosis	***Leptospirospp. serovars***is a spiral shaped	• Loss of appetite • Fever • Depression	• Antibiotics such as tetracycline or

	gram negative spirochetes **.** **Clinical sings**	• Abortions during late pregnancy • Stillbirths • Increase in number of mummified piglets • Increase of weak, nonviable piglets • Increase in number of premature piglets	oxytetracycline can be used. • Provide well drained concrete surfaces particularly in defecating areas and boar pens. • Keep rodents under control • Remove slurry regularly • Where there is a history of periodic infertility, in-feed medication can be targeted just prior to the expected time of disease.
Greasy pig disease	***Staphylococcus hyicus***is a gram-positive facultative anaerobic bacterial organism.	• This is particularly a disease of young piglets • Characterized by excessive sebaceous secretion and the formation of a brownish coat of exudates over the body. • Up to 90% animals can be affected in an infected herd. • There is absence of itching in this disease unlike mange.	• The disease can be effectively treated with antimicrobials. • Prevention is possible only through adoption of strict hygienic measures such as regular disinfection and cleaning of pig shed.

Streptococcus suis infection	***Streptococcus suis*** is a gram-positive organism	• There may be presence of wide range of clinical signs such as meningitis, arthritis, septicaemia including signs of pneumonia. • In young piglets and disease has been observed most commonly during the first week of their life • The first sign noticed in young piglet is the swelling of the joints (both hock and knee joints are involved) and later on septicaemia and meningitis (when CNS is involved) develops. If treatment is not initiated in the early stage of the disease, treatment in later stage (when meningitis develops) is not successful. • When nervous system is involved, signs like ataxia, incoordination and circling movement are observed.	• The disease can be effectively treated with antimicrobials. • The most effective antibiotic against this infection was found to be penicillin • Adoption of strict hygienic measures in the farrowing pen.

		• There is accumulation of excessive fluid in thoracic cavity (visible on post mortem)	
Brucellosis	***Brucella suis***, a gram-negative coccobacillus or short rod bacterial organism.	• Generally no signs of infection prior to evidence of infertility in the herd. • In a herd several sows or gilts return to heat 30-45 days after breeding. • Abortions or birth of dead and weak piglets. • The incidence of abortion may vary from 0-80%. Abortions may also occur early in gestation. • Usually, sows or gilts that abort early in gestation return to estrus soon and are rebred. • Other signs include temporary or permanent sterility, orchitis, Lameness, posterior paralysis, spondylitis and occasionally metritis and abscess	• Treatment with antibiotics is not very effective and generally should not be attempted. Affected pigs should be destroyed. • In some cases, the only measure that achieves complete elimination of the bacteria on the herd is the stamping out followed by a thorough cleaning and disinfection and replacement with Brucella -free pigs. This is also the safest procedure from the pig attendants' and public's stand-point • Other approaches include repeated herd blood tests with removal of positive reactors,

		formation. • Sterility in sows, gilts and boars is common and may be the only manifestation.	This may be effective if only a few pigs are infected but is likely to be unsuccessful if many pigs are positive.
Bacterial conjunctivitis in pigs		• Common clinical signs observed are redness and swelling of the eyes, photophobia, discharges from the eyes and sometimes discharge of mucopurulent materials from one or both the eyes. • In most cases affected eyes remain closed because of excessive secretion of mucopurulent materials.	• Bacterial conjunctivitis can be treated effectively with a combination of steroid and antibiotics given as eye drop. • Prior to application of eye drops the affected eyes should be cleaned properly through a swab ringed in normal saline/sterilized water • The effectiveness of the antimicrobials depends on the type of bacteria involved. It has been observed that gentamicin is the most effective antibiotic for the treatment of conjunctivitis in pigs. • Adoption of strict

			hygienic measures in the farm. • Quick separation of in-contact animals and prompt treatment of affected litters with suitable antimicrobials. • Practice of keeping of different breeds of pigs in the same pen should be avoided.
VIRAL DISEASES			
Classical Swine Fever (CSF)	Classical swine fever is caused by **Pestivirus (family Flaviviridae),** related to the virus of bovine virus diarrhea (BVD) and sheep's border disease (BD).	• Dullness, lethargy and high fever (105-107°F) in acute cases. • Conjunctivitis, constipation, diarrhoea with occasional vomiting. • Huddling together • Reddening and blotching of the skin and difficulty in breathing. • Convulsions occur early in the disease and are followed by circling and incoordination. • Death normally occurs within 4-8	• Applying strict and rigorous sanitary prophylaxis, and hygiene measures • Protecting domestic pigs from contact with wild boar are the most effective measures to prevent the disease. • There is no treatment. Control is possible only through successful vaccination.

		days of infection in hyperacute • Cases, 9-19 days in acute cases and between 30 and 95 days in chronic disease.	
African Swine Fever (ASF)	African Swine Fever (ASF) is a highly contagious viral disease caused by **asfivirus, a member of the Asfarviridae family** of viruses. The virus affects domesticated pigs and wild boars.	• There are four forms of the disease: peracute, acute, subacute and Chronic. • Mortality may reach up to 100% depending on the virulence of the virus. • Acute and peracute forms of the disease are characterized by a severe haemorrhagic disease with close to 100% mortality. • Affected pigs develop high fever (up to 42°C) followed rapidly by lack of appetite, incoordination and become extremely weak and may die at this stage without showing other clinical signs. • Surviving pigs will then exhibit	• There is no vaccine against this disease. So prevention (with strict implementation of biosecurity measures) is the only option to control this disease. Following biosecurity measures can be adopted to keep the farm free of ASE. • Any suspected cases of ASF should immediately be reported to Veterinary doctors and to the District Veterinary Officer. • The people from disease free zone should not travel to the Infected Zone (1Z). • Immediate segregation of the

		reddening or cyanosis of the ears and snout followed by more generalized reddening of the body and bleeding from the nose and anus. • Affected pigs may also show difficulty in breathing, vomiting and abortion (if pregnant). • Pigs that survive acute infection may appear healthy or chronically diseased. • Pigs may also exhibit non-specific clinical signs and lesion often characterized by loss of body condition, swollen joints and respiratory problems if they are infected with low virulent form of the virus.	animals from the potentially infected Animals. Double fencing of the periphery of the farm complex in recommended. • The visitors and vehicles should not be allowed to enter into the farm premises. If there is necessity then the vehicle's tyres& wheels and visitors (any outside person) shoes/boots should be disinfected with 2 % sodium hypochlorite or 3:1000 Potassium Permanganate solutions. • There should be provision of foot dip at the main gate of the farm and also at the entrance and exits of individual pig shed/pen. These Foot dips with proper disinfectant solutions should be made mandatory at the entry point of each pig shed.

			There are several chemicals which can be used in foot dip like Potassium Permanganate (3:1000), 2% Sodium hydroxide, 1% formaldehvde, 1% bleaching powder or 1% Calcium hydroxide (lime) etc. • The pig shed and premises should be disinfected by disinfectants like 8:1000 NaOH (30 min), 1-2% sodium hypochlorite (30 min).3:1000 formalin (30 min), 3% ortho-phenylphenol (30 min), Iodine compounds, quaternary ammonium compounds and some multi-constituent compounds (Virkon, Lysofromin, Verocid. Neogen® Viroxide Super) etc. • The farm workers should properly wash their hands before entry into

			the farm and also after completion of work. The hands should be washed with any detergent based soap. • The farm workers after completion of their work should wash their gumboots properly and disinfects theirs special dresses worn during Work and keep their gumboots and dresses in a separate dry place (preferably under sun light as sunlight is a natural disinfectant). • Introduction of pigs to the farm should be made always from the authorized/ known sources. • The newly purchased pigs should not be mixed immediately with other pigs. The newly purchased pig should be kept in quarantine • For 30-45 days and should monitor their

			health daily for any observable sign of illness. • After quarantine period, pigs should be screened for the presence of disease and if found negative then only they should be introduced into the farm. • No diseased pigs should be sold to traders/ butchers. • Swill feeding (kitchen waste, hotel waste, airport/seaport waste or meat meal) should be prohibited • Movement of breeding boar from one farm to another farm or village should be strictly prohibited. • Proper disposal of dead carcass with deep burial of 6 feet deep Using lime/bleaching powder.
Rotavirus infection	**Rotavirus A (RVA) and C**	• Almost all pigs are affected.	• There is no specific treatment.

	(RVC) are the most common among all RV species reported in swine	• Diarrhoea in post-weaned pigs. • Diarrhoea is profuse and in milk-fed pigs, this is yellow with • Floccules floating in a whey-like fluid, while in others it may be yellow or dark grey. • Vomiting may be seen. • Clinical signs regress 4-6 days after infection but loose yellow facces may persist for 7-14 days.	• Adoption of strict hygienic measures like regular cleaning and disinfection. • Disinfection can be carried out using hypochlorite on clean surfaces and proprietary disinfectants such as a mixture of surfactant, organic acid and oxidising agents.
Foot-and-mouth disease (FMD)	**An Aphthovirus of the family Picornaviridae causes FMD**	• Sudden onset of severe lameness in a group of pigs which rapidly spreads to others in the same herd. • Arched back condition and reluctance to move. • Produces a noisy sound called squealing. • Vesicles are seen on the top of the tongue, on the snout and on the • Udder of the suckling sow and may rupture readily to leave small ulcers.	• Use strict biosecurity measures for animals, animal products, vehicles, people and equipment. • Restrict all animal movement to prevent entry or spread of the disease. • Prevent contact with free roaming animals (wildlife, cats, dogs). • Observe, detect and report any disease or unusual signs to local veterinarian as

			quickly as possible.
Swine pox	**Swine pox virus, a member of the Poxviridae family,** is the etiologic agent. It is mainly transmitted through lice.	• Only pigs less than 4 months old are affected. • Fever and appearance of lesions over the body which may persist for 1-3 weeks. • In young piglets the bursting of the vesicle (blister) on the face may lead to wetting, scab formation and conjunctivitis.	• Use of insecticide to eliminate lice and flies which transmit the disease on a farm • Thorough cleaning and disinfection of pens in which outbreaks of the disease have occurred will help in reducing the incidence
Porcine circovirus type 2 (PCV2) infection .	**Circoviruses are small (17–22 nm in diameter),** nonenveloped single strand of circular DNA.	• Gradual wasting in weanling pigs • Rough hair coat • Difficulty in breathing • Enlarged peripheral lymphnodes • Díarrhoea • Evidence of pneumonia • Jaundice and paleness • Abortion, mummification and stillbirth	• Can be controlled only by vaccination
Porcine Reproductive and Respiratory	It is caused by a virus classified as a member of the	**In gilts, sows and boars** • Loss of appetite, fever and lethargy • Respiratory distress or	• Adoption of strict biosecurity measures to prevent the entry

Syndrome (PRRS)	genus **Arterivirus**.	vomiting • Cyanosis of the cars (common), vulva and abdomen • Delayed or abnormal estrus cycle • Increased premature farrowings, late term abortions, stillborn or Weak piglets and mummified foetuses. **In young, growing and finishing pigs** • Primary clinical signs among young pigs are fever, depression, lethargy and pneumonia • Sneezing, fever and lethargy are followed by difficulty in breathing and impaired growth • Older piglets will have similar respiratory signs. •	of the disease to a clean farm • Regular disinfection of pig sheds with multi-constituent compound like • Maintaining close herds • Don't allow entry of pigs in your farm without testing for PRRS • Don't import pigs from unknown sources. • Use semen from PRRS free boar for artificial insemination. • Restrict movement of visitors • Regular sero-surveillance and culling of sero-positive pigs. • Dispose of dead pigs with appropriate scientific method.
Porcine parvovirus infection (PPV)	**Porcine parvovirus (PPV)**, belongs to Parvoviridae fa mily, is a single-stranded DNA	Signs depend on the time of infection- • < 30 days- embryo resorbed • 30-70 days- mummy • >70 days- dead or weak, survive	• Adoption of strict biosecurity measures to prevent the entry of the disease to a clean farm • Regular disinfection

	virus	normally • No other signs of illness • SMEDI- stillbirth, mummy, embryonic death, infertility • Increase in mummified fetuses after a normal gestation period is • The most important sign of PPV is failures to farrow • Prolonged gestation length	of pig sheds with multi-constituent compound.
PARASITIC DISEASES			
Ascariasis	**Ascariasis is the infestation of swine by the roundworm, *Ascaris suum*, which can cause pneumonia, hepatitis, and ill thrift.**	• In young, growing pigs showed unthriftiness, failure to gain weight, rough hair coat, pendulous abdomen, chronic paroxysmal coughing and occasionally, abdominal expiratory dyspnea ("thumping"). • Sometimes, respiratory disease may result in 7-14 days after naïve pigs (feeder pigs or breeding stock previously unexposed) are	• Good ascariasis control in confinement systems may include deworming sows approximately 1 week before farrowing; • washing sows to remove any adherent ascarid eggs before moving to sanitized farrowing sheds; • using all-in/all-out production systems with thorough cleaning between groups. • Anthelmintics

		placed in facilities heavily contaminated with ascarid eggs. • Other effects in heavily exposed gilts include delayed estrus, poor conception rate, pneumonia or death	• Supportive treatment as needed
Mange infestation	A parasitic disease of the skin caused by the sarcoptic mange mite and often characterized by marked pruritis and papules.	• Frequent rubbing and scratching are the usual signs. These signs often are more marked when the skin is first warmed by the sun, presumably the result of increased activity of mites. • Decreased rate of growth, inefficient use of feed and low sow productivity follow. Although morbidity is high, mortality from mange alone is unusual. • Young pigs that have developed hypersensitivity to mange have reddened macules or papules, especially over the rump, flanks and	• Control programs should focus first on the breeding herd which, to avoid transmitting mites to the piglets. treatment of dams with external acaracide sprays or with an injectable Ivermectin a few days prior to entering the farrowing facility. • Eradication of mange is achievable in most production settings by immediately following the two consecutive doses of an injectable Ivermectin, 14 days apart, are administered to every pig on the farm (adults,

		abdomen.	neonates, and growing pigs). • Removal of bedding material, if present, as well as application of an effective pesticide to environmental surfaces is often recommended at the same time injections are given. • Standard biosecurity procedures to keep the mite from returning to the farm.
B. **NON INFECTIOUS DISEASES**			
Rickets	A deficiency of vitamin D or of this vitamin and calcium is the chief cause of rickets in swine	. • Basically a disease of young animals • Poor appetite and weakness lameness • May lie on one side, unwilling or unable to get up • Bowing of front and hind legs • Enlargement of joints • Arched back condition • Tetanic convulsions in advanced cases	• Exposure to direct sunlight. • Rickets can be readily prevented or cured in the early stages by correcting the diet. • Ensuring an adequate calcium and phosphorus intake is as important as supplying vitamin D, Many feeds, including buttermilk, skim mílk, fish meal, and

			meat scraps, are rich in both calcium and phosphorus.
Calcium & Phosphorus deficiency in breeding sows		• A reduction in growth • Rough scaly skins, dirty in appearance. • The pigs were periodically "off their feet" with their legs bending inwards • Joints become enlarged, lameness • Udder could be very flabby especially in comparison with the normal sows • The sows often refuse their feed towards parturition • Great difficulty in farrowing and could not stand on their feet for two or three days afterwards. • No signs of milk could be seen before or after farrowing	• Supplementation of mineral mixture in the ration. • Good pasture and legume forage should be included in the ration of the breeding sow whenever possible. • Inclusion of feeds that are good sources of phosphorus such as wheat bran, and especially the protein-rich concentrates such as fish meal, soybean and peanut meals in the ration.
Piglet anaemia	It occurs due to deficiency of iron and sow's milk is not a good source of iron.	• Anaemia within 2-3 days of birth • Difficulty in breathing • Oedema • Pale skin • Lethargy	• By administering iron supplement (iron dextran: 100-150mg) on the 4h and 14 Day of birth

Iodine deficiency		• Enlarged thyroid glands • Weak hairless pig at birth • Reproductive failure • Young pigs may be stillborn or they may born alive and die shortly afterward	• Supplementation of mineral mixtures (containing iodine) in the ration.
Vitamin A deficiency	Vitamin A deficiency occurs most commonly in pigs fed in dry lots on ration of grain other than yellow corn, without access to green feed,well-cured forage or other sources of carotene or vitamin A.	• Night blindness • Partial posterior paralysis • Convulsion, rolling of eyes, strugling a little or lying with legs • Watery discharge from the eyes • Loss of appetite, diarrhoca, weakness and in the later stages • Complete incoordination of the hind limbs	• Feeding of green pasture or soybeans alone or in combination with cereal grains etc. for sows and young growing swine. • Well-cured, green, leafy legume hay, particularly alfalfa, is an excellent source of carotene and prevents acute vitamin A deficiency in pigs. • Supplying vitamin A through cod-liver oil or some other fish oils. • Swine suffering from vitamin A deficiency will usually respond very quickly when the vitamin is supplied in adequate amounts.

Acute hypoglycaemia in newborn pigs (Baby Pig Disease)	Hypoglycaemia is the term for low blood sugar level. During the first few days of life the newborn piglet is unable to mobilize the low glycogen reserves in the liver to provide adequate levels of glucose in the blood. It is therefore dependent for energy on a regular intake of lactose from the sows milk. If a piglet cannot obtain sufficient lactose to maintain its energy output, it runs out of energy, its body temperature drops and ultimately it goes into a coma and dies.	• Hypoglycaemia usually occurs within the first 12-24 hours of birth. • Shivering, dullness and loss of appetite • Burrowing under the bedding • Paddling, fits and convulsions, frothing at the mouth, sunken eyes and head bent backwards due to dehydration. • Hair coat becomes rough, the skin cold and clammy, • Death of several or all pigs in the litter often occurs within 24 to 36 hours after the first symptoms are manifested. •	• Affected animals can be given intraperitoneal injectíons of 15 ml 5% glucose solution every 4-6 hours interval or oral glucose by stomach tube and kept a minimum temperature of 85-95°F, • If the sow is unable to feed them, an artificial sow milk replacer should be given by stomach tube initially or they should be fostered onto another sow. • The provision of dry bedding and additional heating will also improve their chances of survival. • Piglets with temporary conditions such as splay leg should be enabled to suck and supported until they can do so.

White muscle disease	It generally occurs in nursery or grower pigs and is due to deficiency of selenium/vita min E.	• Acute death • Muscle weakness	• Vitamin E injection • Supplementation of selenium in feeds
MISCELLANEOUS DISEASES			
Agalactia	Agalactia is the failure of the sow to produce milk. Most common cause of Agalctia due to excessive colostrum/ milk production around farrowing leading to pressure build-up in the udder and resulting tissue damage that limits milk production. Agalactia may occur due to the blockage of teats for congenital	• The lesions seem to be very painful, and the resulting clinical signs include anorexia, depression, salivation, agalactia, and lameness. Weight loss, mastitis, and secondary bacterial infections are common sequelae.	• Where mastitis or milk let down is a problem, injection of oxytocin to release retained milk is the first step. • If this treatment does not provide adequate milk for the piglets, or if let down is not the primary problem, freshly prepared milk substitute should be provided to the piglets. • Young piglets should receive colostrum as their first feed and may need to be fed by stomach tube. • Where agalactia is due to mastitis or metritis, an antimicrobial may

	reasons. Infectious agent may cause also ause agalactia and occur in one or more mammary glands		be given by injection along with the oxytocin. • Water Must be made freely available. Adequate nutritional feeding will correct under production of affected sows. • Where correction of agalactia is not possible, piglets should be fostered or reared artificially. • Agalactia may be prevented by careful examination of the udder of sows prior to service, • Clean housing with adequate drainage to reduce infection, reducing udder damage using soft floorings or by clipping piglets' teeth, proper feeding during pregnancy and lactation,
Heat stroke	Pigs do not sweat and have relatively small lungs.	. • This disease affects all pigs • The key clinical signs	• Provision of adequate shade and ventilation. • Sprinkling of water

	Due to these physiological limitations and their relatively thick subcutaneous fat, pigs are prone to heat stress. Inadequate shade or ventilation may make pigs vulnerable to this condition. It is most common in heavier pigs. Large White and Landrace breeds are particularly susceptible to this condition	include a high respiratory rate • Distress • Rectal temperature of 43°C	• To avoid shock, make sure the water is not too cold. • Sprinkling is a useful preventive measure when heat is excessive

Reporting scheduled diseases obligatory: Every owner, or any other person, non-governmental organization, public bodies or the village panchayat, in charge of any animal which he or it has reason to believe to be infective of a scheduled disease (African swine fever; Classical swine fever; Nipah virus encephalitis; Porcine cysticercosis; Porcine reproductive and respiratory syndrome; Swine vesicular disease and Transmissible gastroenteritis) shall report the fact to the Village Officer or village panchayat in-charge, who may report the same in writing to the nearest available Veterinarian, as prescribed in The Prevention And Control Of Infectious And Contagious Diseases In Animals Act, 2009.

HEALTH CALENDAR FOR PIG

1. VACCINATION PROGRAM:

Vaccine	Dose &Route of administration	Age of Primary vaccination	1st Booster	Revaccination
Classical Swine Fever Vaccine	1ml, I/M	Post weaning (Weaning is usually done at 45 days)	After 30 days of 1st vaccination	6-month interval
FMD Vaccine (Oil adjuvanted trivalent)	2ml, I/M	2 Months	-	6-month interval
Porcine Circo virus vaccine	1 ml, I/M	3weeks of age (Single dose vaccine)	-	-

2. DEWORMING SCHEDULE:

Deworming of the animals should be don for both end and ecto parasites as per the recommendation

For Control of Endo parasite				
Name of dewormer	**Dose rate**	**First dose**	**Second dose**	**Repeat**
Piperazine liquid (45 % w/v)	@100-300mg/kg body weight	at 3weeks of age	at 21 days of first deworming	at 2 months interval
Albendazole	@5- 7.5 mg/Kg. body weight orally			
Fenbendazole	@5-7.5 mg/Kg. body weight orally orally			
For Control of Ecto-parasite				
Ivermectin	@ 0.3-0.6mg/kg. body weight subcutaneously			

3. General health management for pigs:

Separating the umbilical cord	The naval or umbilical cord should be cut(keeping 2.5 cm distance from umbilicus)as early as possible after birth	Disinfected by using an iodine solution to prevent any secondary infection
Teeth clipping	Done on the day of birth	It is advisable to clip teeth using a suitable tusk clipper
Iron injection	Iron supplements	I/M, on 4thand 14thday of birth

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Chapter 11

Disease Reporting Mechanism of Livestock with Special Reference to Pig Husbandry in India

Introduction

India, with its diverse and extensive livestock population, ranks among the world's largest producers of milk, poultry, and other livestock products. The health of this livestock is crucial not only for the economy but also for food security and rural livelihoods. Pigs play a crucial role in India's livestock sector, providing meat, income, and employment, particularly in rural and tribal areas. The health of pigs is paramount not only for the economic stability of these regions but also for ensuring the safety of pork products. Effective livestock disease reporting mechanisms are essential to manage and mitigate the spread of diseases, ensuring the health of animals and the safety of animal products.

Significance of reporting systems

- **Disease Control Measures:** Data from disease reports guide the implementation of control measures such as quarantine, isolation, vaccination campaigns, and travel advisories.
- **Prevention programs:** Accurate data from disease reporting source helps in identification of risk factors and risk population which helps in targeted prevention programs.
- **Public Health:** Many livestock diseases are zoonotic, which spread from animals to humans. Effective reporting helps to ensure the safety of public health.
- **Global Health Security :**Disease reporting contributes to global health security by enabling countries to share information about outbreaks and coordinate responses.Reporting systems help countries comply with international health regulations, such as the International Health Regulations (IHR) mandated by the World Health Organization (WHO).
- **Trend Analysis:** Continuous monitoring of disease incidence helps to identify trends and patterns, which are critical for understanding the epidemiology of diseases.

- **Economic Stability:** Livestock diseases can devastate economies, especially in rural areas where livestock farming is a primary source of income.Early detection and intervention reduce the need for expensive control measures, such as widespread culling, extensive vaccination campaigns, and prolonged quarantine measures.
- **Food Safety:** Ensuring that animal products are safe for consumption relies heavily on monitoring and controlling livestock diseases thus it helps in reducing foodborne illness in consumers.
- **Resource Allocation :** Data from disease reporting helps public health authorities to allocate resources and fund efficiently, directing efforts where they are the need of the hour.
- **Policy Making and Planning :** Policy makers rely on data from disease reporting source to make decisions about strategies to prevent further spread and helps in making public health policies. It will be helpful for planning activities like stockpiling vaccines, developing response plans, conducting training programmes, etc.,
- **Data for Research:** Accurate data from disease reporting source provides valuable information for epidemiological and clinical research which helps to drive research in innovative pathway for diagnostics, treatments and vaccines.

Structure of Livestock Disease Reporting in India :

India has established a multi-tiered system for livestock disease reporting that integrates local, state, and national levels. Key components of this system include:

1. National Level

Department of Animal Husbandry and Dairying (DAHD): The DAHD, under the Ministry of Fisheries, Animal Husbandry and Dairying, is the apex body responsible for livestock health. It formulates policies, implements programs, and oversees disease control measures.

National Animal Disease Reporting System (NADRS): Launched in 2012, NADRS is an online system that connects various stakeholders involved in animal health. It enables real-time reporting and monitoring of livestock diseases across the country.The project's goal is to streamline the reporting of animal diseases by establishing a computerized network between the Central Disease Reporting and Monitoring Unit at the DADF in New Delhi and each Taluka / Block, District,

and State Headquarters. 7500 block-level veterinary facilities in India are electronically networked under this system to enable real-time disease reporting. To determine the status of livestock disease in India, analysis is done on the disease data that are uploaded in this system.

The National Animal Disease Referral Expert System (NADRES) : It is a remote sensing-enabled expert system that forecasts livestock disease and gathers data on the occurrence of 13 economically significant livestock diseases across the nation. Districts are categorized into six distinct risk groups for each of the thirteen diseases after complex statistical models are executed in the R programming language environment. This process occurs after the integration of data. Tables and GIS maps are typically used to illustrate the forewarning outputs. Two months in advance, the DADF, GOI, and the state animal husbandry department receive the so-generated warning information. Each month, the NADRES publishes a notice at the district level alerting the department of animal husbandry about potential livestock diseases so that it helps in implementing control measures in well-timed manner.

2. State Level

State Animal Husbandry Departments: Each state has its own department responsible for implementing national policies at the state level. They work closely with district-level authorities to manage and report disease outbreaks.

State Disease Diagnostic Laboratories: These laboratories play a crucial role in diagnosing and confirming diseases reported from the field.

Assistance to States for Control of Animal Diseases (ASCAD) Funding Pattern: The ASCAD component focuses on vaccination against economically important diseases of livestock and backyard poultry, as well as zoonotic diseases like anthrax and rabies. It also includes control of emerging and exotic diseases, surveillance, ring vaccination, and compensation for culling, elimination, and destruction of poultry feed/eggs. A new activity, 'Research & Innovation, Publicity & Awareness, Training, and allied activities,' is proposed, involving funds for collaborations in research, innovation, capacity building, and crisis management. Funding is 60:40 between the state and the state, with 100% central assistance to UTs.

3. District and Local Levels

District Veterinary Officers: These officers are on the frontline of disease detection and management. They collect data from local veterinarians and farmers, which is then uploaded to NADRS.

Local Veterinarians and Paravets: They are the first point of contact for farmers. They conduct initial diagnoses, provide treatment, and report any suspected cases to higher authorities.

Stepwise disease reporting mechanism:

A. At farm level

1. Early Detection:

Farmers should be trained to recognize common symptoms of animal diseases in their livestock, such as fever, unusual behavior, decreased feed intake, and abnormal discharges.

Establish a clear and efficient reporting system where farmers can quickly notify local veterinary authorities upon suspecting the presence of an animal disease on their farm.

***2.Farm level disease containment*:**

Quarantine animals showing symptoms or suspected of being infected to prevent the spread of the disease to healthy livestock. Implement strict biosecurity measures, including controlling access to farms, disinfecting vehicles and equipment, and limiting movement of personnel and animals.

3. *Informing local veterinary Authorities:*

Local veterinary authorities should promptly respond to reports of suspected animal diseases and conduct thorough investigations. They should collect appropriate samples from affected animals for laboratory testing to confirm the presence of the disease.

B. At state level

***Detection*:** Farmers or local veterinarians detect signs of illness in livestock.

***Field Investigation*:** The veterinary officer investigates the case, collects samples, and provides a preliminary diagnosis.

***Laboratory Confirmation*:** Samples are sent to state or regional laboratories for confirmation.

C. At National Level

***Reporting to National Animal Disease Reporting System (NADRS)*:**

Local veterinary authorities must report confirmed cases of animal diseases to the National Animal Disease Reporting System (NADRS) for further action and coordination.

Reporting notifiable diseases to WAHO:

Atrophic rhinitis of swine
Enterovirus encephalomyelitis
Porcine brucellosis
Porcine cysticercosis
Porcine reproductive and respiratory syndrome
Transmissible gastroenteritis

***Initiating National Action Plan*:**

The National Animal Disease Reporting System (NADRS) The Department of Animal Husbandry and Dairying, Ministry of Fisheries, Government of India, is in charge of overseeing the reporting of animal diseases throughout the nation. An online information technology platform called the National Animal Disease Reporting System (NADRS) is used by States and Union Territories (UTs) to report animal diseases at the field level. The NADRS's main goal is to document and track the nation's livestock disease situation in order to quickly begin preventive and curative measures in the case of an emergency, implement control measures such as quarantine, culling infected animals, disinfection of affected premises, and establishing restricted zones to prevent the spread of the disease. Conduct contact tracing to identify and monitor animals that may have been exposed to the disease.

***Public Awareness and Education*:**

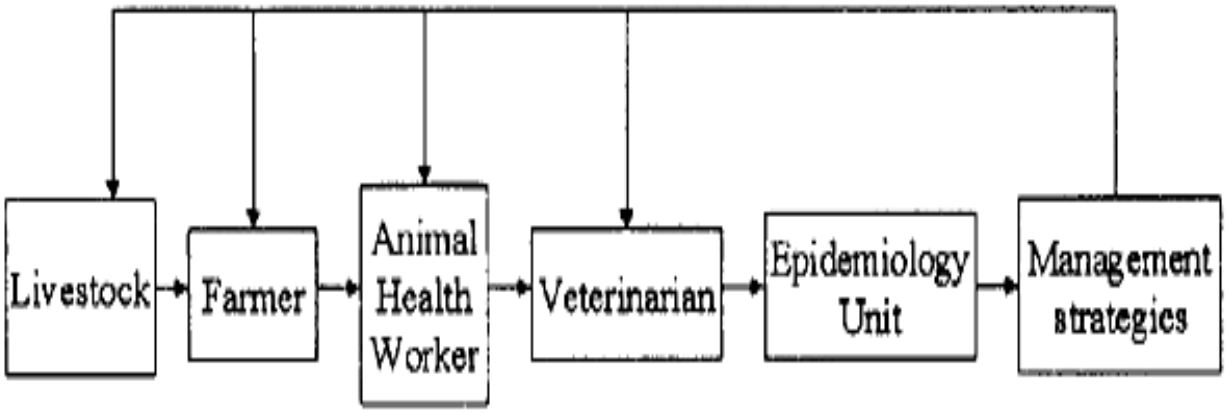
Conduct public awareness campaigns to educate farmers and the general public about the signs, transmission, and prevention of common animal diseases. Provide guidance on biosecurity measures and protocols to minimize the risk of disease transmission on farms.

7. Support for Affected Farmers:

Provide financial assistance and compensation to affected farmers for the loss of animals due to culling or disease control measures. Offer veterinary support and counseling to help farmers manage the impact of the disease outbreak on their livelihoods.

9. Continuous Monitoring and Surveillance:

Implement continuous monitoring and surveillance programs to detect any re-emergence of animal diseases and to prevent future outbreaks. Regularly update farmers and stakeholders on the status of animal diseases and any new control measures being implemented.



Livestock Disease Reporting Mechanism in India: Ensuring Animal Health and Food Security

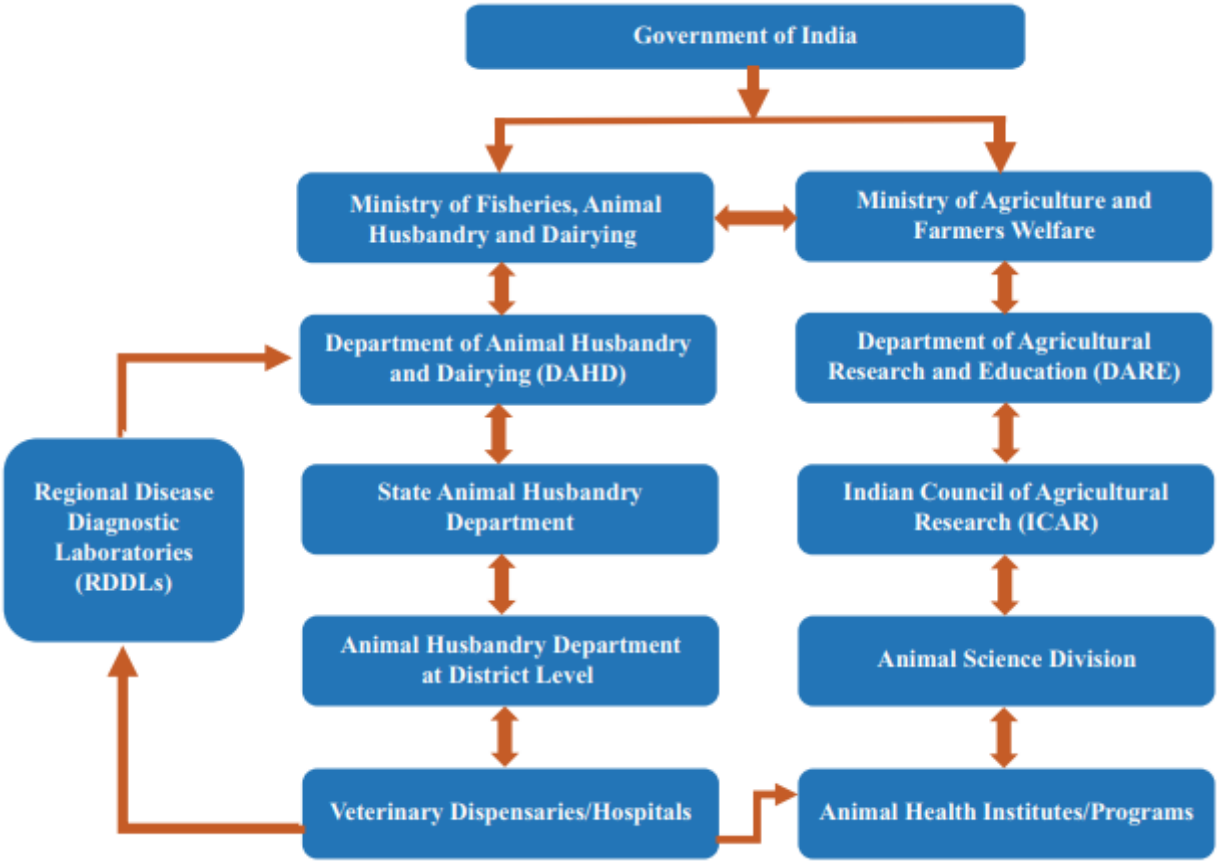


Fig. Organizational setup of Animal Health Research Institute under Indian Council of Agricultural Research and Department of Animal Husbandry and Dairying for Animal Disease Surveillance.

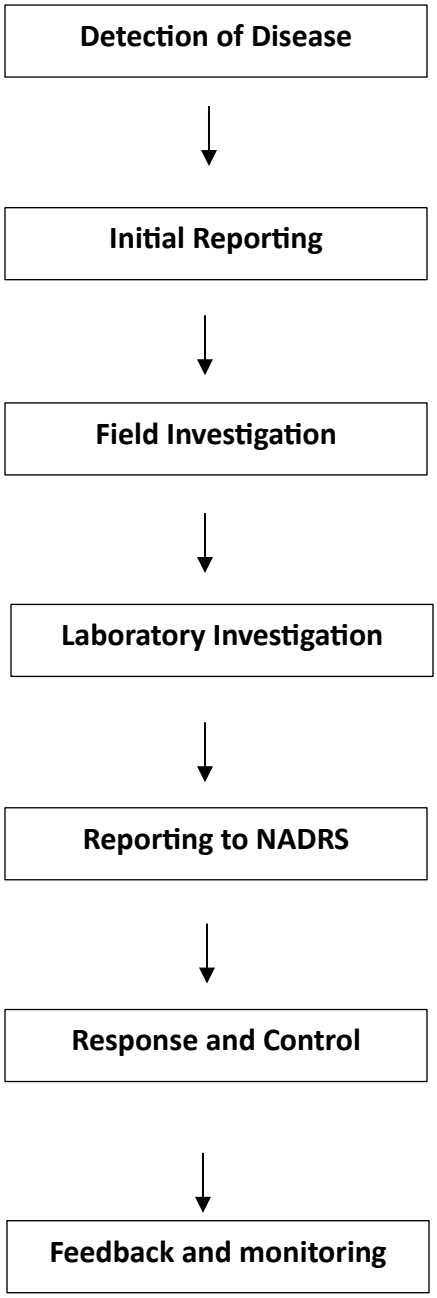
Disease Reporting Process:

The disease reporting process in India typically follows these steps:
Detection: Farmers or local veterinarians detect signs of illness in livestock.
Initial Report: The case is reported to the local veterinary officer.
Field Investigation: The veterinary officer investigates the case, collects samples, and provides a preliminary diagnosis.
Laboratory Confirmation: Samples are sent to state or regional laboratories for confirmation.
Reporting to NADRS: Confirmed cases are reported to the NADRS, which updates the national database.

Response and Control: Based on the severity and type of disease, control measures are implemented, including quarantine, vaccination drives, and culling if necessary.

Feedback and Monitoring: Continuous monitoring and feedback mechanisms are in place to ensure the effectiveness of the response.

Disease reporting workflow at District and Local Levels :



Challenges in Disease Reporting

Despite the robust framework, there are several challenges in the livestock disease reporting mechanism in India:

Infrastructure: Lack of skilled veterinary personnel, limited diagnostic facilities forms the limited infrastructure in remote areas which further can delay reporting and response.

Awareness and Training: Farmers and local veterinarians may lack awareness and training on disease identification and reporting protocols.

Resource Constraints: Insufficient funding and resources for disease control programs can hinder effective implementation.

Data Accuracy: Ensuring accurate and timely data collection and reporting is an ongoing challenge.

Recent Initiatives and Future Directions

To address these challenges, the Indian government has undertaken several initiatives:

Strengthening NADRS: Enhancing the technological capabilities and reach of NADRS to ensure comprehensive coverage.

Capacity Building: Conducting training programs for farmers and veterinary professionals to improve disease recognition and reporting.

Public-Private Partnerships: Engaging private sector players in disease surveillance and control activities.

One Health Approach: Integrating livestock health with human health initiatives to tackle zoonotic diseases more effectively.

Conclusion

A robust livestock disease reporting mechanism is vital for maintaining the health of India's vast livestock population. Continuous improvements in infrastructure, training, and technology are necessary to overcome existing challenges. By fostering a coordinated effort among all stakeholders, India can ensure the health of its livestock, safeguard public health, and strengthen its economy.

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Technical guidelines to the states for implementation of various components of centrally sponsored schemes " Livestock Health & Disease Control " (LH & DC)

Chapter 12

Biosecurity in Scientific Pig Production

Introduction

Biosecurity is a collective term of action. It may be defined as the implementation of measures that reduce the risk of disease-causing agents being introduced and spread. Maintaining a "farm-biosecurity" is a proven managemental intervention to restrict, reduce, and remove the infectious pathogens in a farm.

Biosecurity in scientific pig farming requires the adoption of a set of attitudes & behaviors by people and operational procedures for restricting the disease. The biosecurity measures adaptable at the field level depend on the type of production system (viz., intensive production system or backyard piggery), type of stock maintained (viz., breeder unit or finisher unit), and epidemiological factors. In addition to the practices in a conventional piggery, implementation of biosecurity measures may include infrastructural improvisations, amendments in the farm operation and imparting training to human resources.

Routes of entry of pathogens

Disease-causing organism or pathogen reaches an individual animal from outside the farm or from within the farm.

From the outside, the disease may enter through

1. Animal movement from outside: In the case of finisher farms, new stocks of weaners or growers are brought from breeder farms for rearing purposes. In breeder farms, pigs are brought as replacements for old stocks. The incoming or outgoing animal may harbour pathogens even though they are asymptomatic and act as a source of infection to other animals.
2. Anthropogenic routes: Another possibility could be through visitors, animal attendants, or veterinarians who have attended to a diseased animal or animal in carrier status, before entering the farm.

3. Fomites: Pathogens may also enter the farm through clothes, shoes, and even vehicle tyres.
4. Contaminated feedstuffs and soiled roughages: Contaminated feedstuffs and soiled roughage could be another risk factor. Swill feeding, mainly with meat products or animal slaughter wastes, is another risk.
5. Stray/Wild animals or parasites: Diseases may also enter the farm through other animals like wild boars, bovines, stray animals, rodents, and migratory birds. Ectoparasites are also a source of pathogens to farm animals.
6. Air and water: Some diseases are airborne and some are waterborne.

Within a farm, the disease spread through

1. Pig to Pig contact: Infected animals are a potent source of infection to pen mates and nearby sheds.
2. Farm staff: Attendants, who attended infected animals, may carry pathogens through their clothing and utensils.
3. Body fluids: Pathogens may be present in the secretions, excretions, semen etc., of infected animals.
4. Carcass and slaughter wastes: Improperly disposed of carcass materials and slaughterhouse wastes are a potent source of infection.
5. Poor shed design: Overcrowding, poor ventilation, insufficient space allocation, poor housing plan, and mixing of animals of different age are risk factors favouring the spread of diseases.

Implementing biosecurity in a farm

1. Farm layout

- A farm should ideally be located at an isolated place.
- Establishing a boundary fence will control the movement of man, animal & vectors from the "Risk zones"
- Offices, farm-houses etc., may be located in the "Buffer zone", where monitored entry is allowed
- Confine pigs to the "Core zone", where strict biosecurity is in place.
- Restriction of entry from outside

2. **Restriction of entry from outside**

- Display boards giving clear directions at the gate
- Control entry of stray/wild animals & birds
- Maintain visitor's records & restrict those exposedto diseased animals
- Disinfection of vehicles from outside
- Purchase replacement stock only from reliable farms with healthy vaccinated animals
- Adoption of artificial insemination for breeding purpose

3. **Biosecurity inside a farm**

- Visitors should wear protective clothing
- Staff should take bath, change dress & wear gumboots before entering farm
- Hand sanitization & foot bath are indispensable
- Diseased animals should be segregated
- Prompt diagnosis & treatment are vital

Routine farm operations should include the following biosecurity considerations for the prevention of diseases.

Vehicle movement

The most practical approach is to have clear instructions to visitors and staff on biosecurity, right from the front gate. Display boards giving clear directions should be placed at the entry point itself. The display boards should be placed so that they should attract the attention of every person entering the campus.

It is always recommended to minimize the number of entry points. Vehicles requiring their delivery up to the farm area may be cautiously and selectively directed to the farm and that too, only after performing the required sanitization procedures. The procedures should include mandatory tyre dipping, pressure washing, etc. If the vehicle has been used for transporting other animals in recent days should be initiated. A format for the vehicle decontamination record is provided in the annexures. Decontamination procedures including washing, cleaning, and disinfection of the vehicle should be carried out outside the farm premises. If the driver or loading workers were exposed to any biosecurity risk in the preceding days, the entry of such personnel may be restricted.

Checklist for vehicle entry

- Examine each vehicle entry and exit point for any risk
- Keep a visitor/vehicle register
- Disinfection log book of animal cages entering the campus
- Source and quality declaration of vendor in case of the vehicle carrying feed
- Display biosecurity signs at all vehicle access points.

Biosecurity protocol for farm workers

Farm workers

Farm workers should take bath, change their dress, and wear gumboots before entering the farm. Separate change rooms are preferred, where they can keep their belongings from home during their working hours. For veterinary doctors visiting the farm, additionally, they need to sanitize the instruments if they have used them in other pig farms.




Visitors

Visitors to the farm area should seriously follow strict biosecurity measures. Normally visitors should not be allowed to enter the core biosecurity zone. Most of the vehicles and visitors should be restricted to the office area or farmhouse area. In conditions that warrant authorization of a farm visit by a visitor, strict adherence to biosecurity protocols is required.


- Foot dipping, hand washing, etc., are mandatory.
- Visitors should change dress and wear caps, masks, aprons, and gumboots.
- Visitors should record the date of the last visit to other pig farms or slaughterhouses.

Checklist of biosecurity accessories for staff and visitors

- Visitor record maintenance
- PPE, including gloves, masks, goggles, and protective clothing for visitors
- Change room facilities
- Farm uniform, Gumboots, Gloves for staff
- Foot dip and sanitation at each checkpoint
- Disinfection SOPs and weekly follow-up charts

- Sprayers for disinfectants
- Tyre dips and vehicle wash facility

Self-declaration format for visitors at the farm gate

Farm Biosecurity – Visitor's Declaration			
1	Have you visited any farms, livestock premises, livestock fairs and abattoirs during the last 7 days	Yes	No
2	Are you rearing any animals in my home (Yes/No)		
	If yes, do your herd have any incidence of diseases during the past 30 days	Yes	No
3	Has your vehicle/equipment contacted livestock or materials of animal origin during the last 7 days	Yes	No
4	Have you visited or travelled any overseas country in the past 30 days (Yes/ No)		
5	If Yes, did you visit any livestock farm or abattoir or livestock fairs during the overseas travel	Yes	No

I declare that the information provided above are true to the best of my knowledge.

Signature

Cleaning: Cleaning involves the removal of all organic waste matter from sheds. An unhygienic premise predisposes the incidence of disease in a herd. Adherence to routine removal of excreta and adopting proper disposal methods to minimize environmental concerns is very important. In addition to the routine disposal of bedding materials, dung and urine, there should be detergent washes before introducing new batches. In the event of any unusual death of pigs, carcasses should be buried, composted, or burned biosecurely.

Disinfection: Disinfectants are compounds used to kill germs (bacteria, viruses, and parasites). The application of a suitable disinfectant destroys the infectious or parasitic agents of animal diseases, including zoonoses. Application of disinfectants should be done on premises, vehicles and different objects which may have been directly or indirectly contaminated. Its choice & strength depends on surfaces to be cleaned, disease-causing microbe etc. The various disinfectants and their specific uses are mentioned in table 8.1, for easy reference. Cleaning surfaces before disinfection is recommended.





Table : Description of disinfectants in Pig farm

Sl No	Disinfectant	Strength	Suitable surface
1	Lime (Calcium hydroxide)	1% Solution	Floors, drains & ground
		As powder	Passages, pavements
2	Bleaching powder	30% available chlorine	Dusting floors, drains & ground
3	Caustic soda (Sodiumhydroxide)	2% solution	Sheds, Premises
4	QuaternaryAmmoniumCompounds	0.1-0.2%	Sheds, feeding troughs
5	Potassium peroxymonosulfate	1% solution	Sheds, feeding troughs, premises
6	Sodium hypochlorite	2% solution	Tyre wash, footbath, shed & premises
7	Potassium permanganate	3-5 g/Litre	Tyre wash, footbath
8	Formaldehyde	1% solution	Tyre wash, footbath
9	Phenol	2-5% solution	Vehicles, cages, premises
10	Boric acid	5-6% solution	Skin, equipment
11	Chlorine tablets	0.2-1mg/L	Chlorination of drinking water

Standard Operating Procedure (Cleaning and disinfection)

- ✓ Clean heavily soiled areas by initially softening dirt and manure with a low-pressure water spray, allowing it to soak.
- ✓ Use high-pressure sprays (preferably between 750 psi to 2,000 psi) to thoroughly remove all dirt and organic material.
- ✓ Begin cleaning from the back of the pen or building, progressing towards the front.
- ✓ Start by spraying the ceiling, followed by the walls, and finally the floor.
- ✓ Utilize sprayers and nozzles capable of reaching difficult-to-access areas, including the undersides of troughs, feeders, and flooring whenever possible.
- ✓ Once the pen is clean, rinse all surfaces to remove accumulated aerosol organic material.
- ✓ Apply a surfactant or emulsifying agent to eradicate residual organic materials, then rinse all surfaces again.
- ✓ For effective disinfection, ensure surfaces are thoroughly cleaned beforehand, as disinfectants only work on clean surfaces.
- ✓ Disinfectants work best at temperatures above 18°C (65°F), but not above 43°C (110°F). Adhere to the manufacturer's application instructions for the disinfectant product being used.

- ✓ Apply the disinfectant with pressure, ideally through a pressure washer, to ensure penetration into pores, cracks, and crevices. Alternatively, fog or aerosol application can serve as a secondary method.
- ✓ When applying, proceed systematically from back to front and from top to bottom of the room.
- ✓ Provide proper time for drying.

Biosecurity protocol for Disposal of manure and effluents

Manure Storage Area: Establish a designated area for storing manure and effluents, located away from water sources, residential areas, and animal housing facilities. Ensure the storage area is properly constructed with impermeable surfaces, such as concrete or lined pits, to prevent seepage into the soil or groundwater. Implement measures to control odours and minimize fly breeding, such as covering the stored manure or using effective odour management techniques. Monitor the manure storage area regularly to ensure it is not overfilled and has proper ventilation. Prevent the accumulation of

stagnant water in the storage area to minimize the risk of disease transmission and breeding sites for pests.

- Manure Handling and Collection: Regularly collect manure from the animal housing areas and transfer it to the designated storage area using appropriate equipment and containers. Minimize the risk of cross-contamination by using dedicated tools for manure collection.
- Safe Disposal Methods: Consider implementing anaerobic digestion or composting techniques to effectively treat and manage the manure. If spreading the manure on agricultural land then, avoid spreading manure on areas prone to runoff, steep slopes, or environmentally sensitive areas.

Biosecurity protocol for Animal movement:

Procurement of replacement stock

Live pigs represent the greatest risk for disease introduction to a pig farm. Current production systems necessitate the periodic replacement of breeders to maintain optimal productivity thresholds. In most cases, a renewal of the whole breeding population every 2–2.5 years may be required. Replacement stocks can be produced internally or purchased from reputed breeder farms.

In farms practicing external replacements, especially the finisher farms, the higher the frequency of new entries increases the probability of pathogen entry. Similarly, if breeding using a male from other farms or using semen doses from outside is practiced, there can be a risk for the introduction of new pathogens as well. Internal replacements may be convenient for farms maintaining a closed breeding system and relying on their own males (semen). However, internal replacement has limitations in genetic improvement and eradication of endemic diseases. In this case, the most efficient way of organizing production is by adopting batch mating/ farrowing (usually by planning breeding in a period of 3 weeks).

For procurement of replacements, the biosecurity measure should invariably include disease testing based on a list that classifies diseases based on the risk they pose to the farm. This will enable discarding the stock at the supplier's end itself.

Checklist for procurement of replacement stock

- All purchases should be made from a reliable, quality-assured source.
- Perform disease testing.
- Procure vaccinated stock, if possible.
- All the new pigs may be purchased from the same source rather than from multiple or unknown sources.
- A health certification by an authorized veterinarian at the source will reduce risks.
- Transportation should ensure animal comfort and abide by the state rules.

Request a record of treatments including medications, vaccines, and other chemicals administered

Quarantine:

In all instances, a meticulously devised and vigilantly executed quarantine regimen represents the most efficacious strategy for mitigating risks associated with external pathogen introductions. The quarantine involves the isolation and acclimatization of incoming stock from other animals on the farm. This is important because an animal may not exhibit symptoms of a disease for a period, termed the incubation period, even after the entry of the pathogen. So, following an observation period under veterinary supervision, at an intermediate station, will minimize the risk due to asymptomatic animals and animals in the incubation period. Vaccination against endemic diseases, deworming, and testing for diseases like such as brucellosis, PRRS, PCV2,ASF and PPV infections, etc may be performed during the period.

Quarantines must be designed as bio-contention units, to avoid the spillover of any undesired pathogen brought by the incoming animals. Typically, this entails constructing the quarantine at a considerable distance from the principal farm units and treating it as an autonomous entity, akin to an external facility.

Ideally, a quarantine shed should be located at least 500 meters away from the core zone or main farm unit. The quarantine facility should be equipped with separate clothes and equipment for the staff. A minimum quarantine period of 21 days is recommended. Stocks in quarantine sheds should follow an all-in, all-out strategy, where the new animals are brought together and moved out together. Proper disinfection should be followed during each cycle.

Labour management in a quarantine facility:

- Establish a controlled access point for the quarantine shed, preferably with a footbath and hand-washing facilities.
- Restrict entry to authorized personnel only, and maintain records.
- Implement a strict biosecurity protocol, including wearing protective clothing, such as coveralls, boots, and gloves, when entering the shed.
- Ensure that visitors and vehicles are disinfected before entering the premises.

Cleaning and disinfection of quarantine facility:

- Develop a regular cleaning and disinfection schedule for the quarantine shed.
- Detergent wash is preferred to remove all organic material, including manure and bedding, from the shed before cleaning.
- Use appropriate disinfectants effective against common pathogens, following recommended dilution rates.
- Pay special attention to areas, such as feeders, waterers, and walls, during cleaning and disinfection.

Animal management in quarantine facility:

- Keep animals in the quarantine shed separate from the main herd to prevent disease transmission.
- Ensure All-In-All-Out strategy
- Retain for a minimum of 21 days
- Perform disease testing.
- Perform vaccinations and deworming.
- Monitor for any signs of illness or abnormal behaviour during the quarantine period.

Waste Management in quarantine facility:

- Implement proper waste management practices, including the safe disposal of manure and other organic waste from the quarantine shed.
- Ensure that waste disposal areas are located away from water sources to prevent contamination.

Record keeping in quarantine facility:

- Maintain accurate and up-to-date records of animal movements, health status, treatments, vaccinations, and any other relevant information.
- Regularly review and update records to facilitate traceability and disease management.

“All-in-All-Out”

Ideally, a pig farm should operate an “All-in-All-Out” protocol, where all animals are bought in together and sold together. In this management strategy, the transmission of diseases can be minimized and sanitation is easy. Practically in finisher farms, the market demand need to be considered while adopting this strategy. For breeder farms “All-in-All-Out” can be practiced in farrowing pens by adopting batch farrowing. In quarantine sheds “All-in-All-Out” strategy is mandatory.

Biosecurity Zonewise displaying of Instruction board is mandatory in all scientific piggery unit

Chapter 13

Disposal of Wastes from Farms

Introduction

Waste management in swine farms gained significant importance due to the implementation of larger production systems, labor shortages, and stricter environmental regulations. Waste management presents a critical issue due to the concerns of public nuisance and odour related issues, public health, animal health, and even biosecurity. Moreover, farm licensing and pollution control board certification require waste management as an important factor to be considered. The waste management systems suited to Indian conditions will be discussed in this chapter. The goals of manure management differ amongst producers. 1) The best use of nutrients; 2) the reduction of land, labour, or capital; 3) odour control; 4) animal or human health and performance; or any combination of two or more of these are possible examples. The management of livestock manure can benefit greatly from treatment technologies, which offer a more flexible approach to land application and acreage limitations. They can also solve specific issues like pathogens, odours, water pollution, ammonia emissions, greenhouse gas emissions, phosphorus, and heavy metal contamination of soils. Furthermore, a lot of work has already been done on the sustainability of using biomass as a fuel source in relation to the use of fossil fuels.

Types of wastes

1. Animal Manure
2. Washed away water
3. Feed wastes
4. Bedding material
5. Carcass of dead/infected animals
6. Animal slaughter wastes

Waste management plan

The plan of disposal depends on the quantity of wastes produced, extend of intensification, land availability for disposal and comparative economics. Animal manure contributes the major quantity of wastes produced in a farm.

1. **Solid manure handling**
    - **Pit system**: Manure is collected by using pit system, scrapers or flushing systems. Solid-liquid separation can be done by mechanical and gravity separation.
    - ***Mechanical drying***: Mechanically drying can be performed by conventional sun drying or mechanical drying machines.

    - ✓ Sun drying require more land and has a disadvantage of seasonal rains.
    - ✓ Various mechanical dryers which can reduce moisture levels upto 20%-40% are available, making the manure easy to handle.
    - ✓ Dried manure can be used directly or can be further processed for making compost manures.
    - ***Compost manure***: It improves soil structure, water holding capacity and destroy pathogenic microbes. Aerobic composting of pig manure is done with a mix of ingredients, from dead leaves, kitchen scraps and dried grass. Mix the pig manure in with the ingredients. Keep the pile moist, but not wet, to get the decomposition action going.
    - ***Vermicompost*** utilizes similar procedure but with the addition of earthworms. Alternate layers of manure and household organic wastes can be topped with earthworms. This accelerates the speed of compost formation

    - ✓ Manure first composted, then supplemented with 4% calcium

sulphate (Gypsum) before feeding to worms (Chan & Griffiths, 1998)

- ✓ Biowaste to manure ratio = 8:1 to 5:1
- ✓ For 200 tonnes per annum capacity: 15 m x 8m x 5.5 m(LXBXH)
- ✓ Worms at the rate of 350 worms per m3 of manure is used
- ✓ Species eg. Eisenia foetida, E. eugeniae are used
- ✓ 70 Kg Vermicompost can be prepared from 100 kg substrates and 2 kg earthworms (E. fetida) in 30 days

- ***Deep burial method***: It is the simplest and oldest method, wherein the manure is disposed off in a deep pit before burial. The method is useful for small holders with adequate land availability. In case of intensive farming this method leads to environmental degradation and even contamination of nearby water sources.

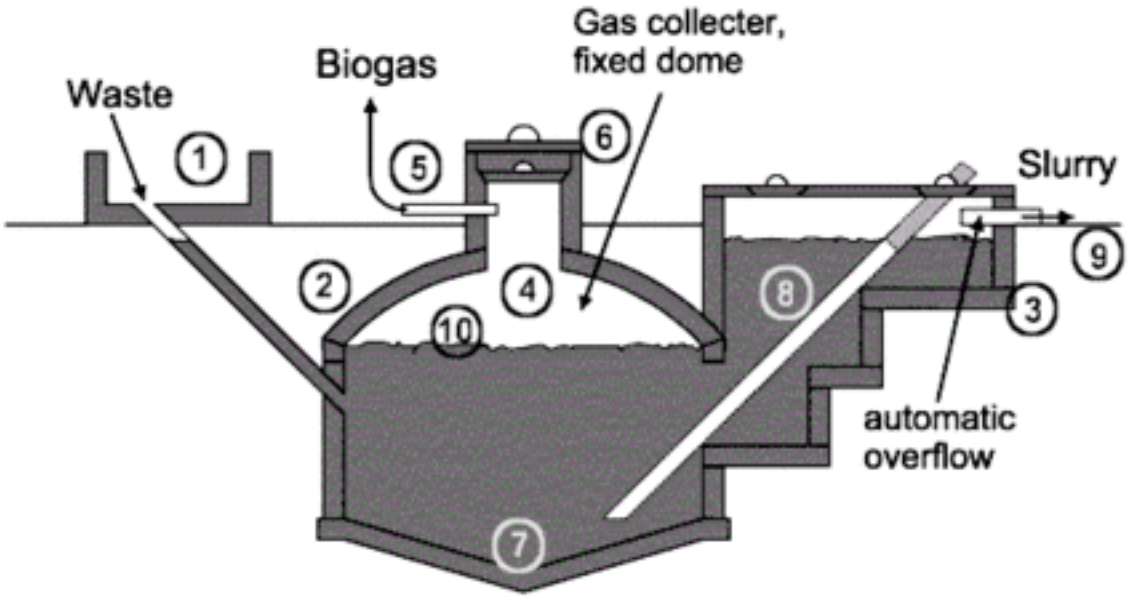
2. Liquid handling

- ***Waste water treatment*** : The typical waste water treatment methods used in pig farms are soak pit systems, septic tanks, and biogas plants. These will be available on every farm. An effluent treatment plant (ETP) may be required in large farms located in sloppy terrain or where there are valid environmental concerns about water body contamination exists.

- ***Direct field application***:

- ✓ Pig manure along with the washed off water can be directly collected in a tank before applying directly on the agricultural fields.
- ✓ The process is labour intensive. Moreover, continuous use of pig manure may degrade soil quality.

- ✓ Pasture loading rates in humid areas should not exceed 7 sows and its litters per acre or 40 market pigs per acre.



Anaerobic digestion: Anaerobic digestors can utilize the manure for biogas generation. In biogas plants microbes convert organic matter to biogas and nutrient rich digester slurry.

- ✓ There is reduction in odour and production of 50-75% methane.
- ✓ From 500Kg waste, upto 20 Kg methane gas can be produced.
- ✓ The slurry produced as a bye-product can be pumped into agricultural fields

3. Disposal of animal carcasses:

In addition to the standard manure issues related to the pork industry, disposing of dead carcasses is a recent worry. In swine Burial, composting, and rendering are the most commonly used methods of carcass disposal.

Regulations and jurisdiction

The Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009, and the Prevention and Control of Infectious and Contagious Diseases in Animals (Form of Vaccination Certificate, Manner of Post Mortem Examination and Disposal of Carcass) Rules, 2010 provide the requirements for disposing of carcasses and other potentially contaminated foods in the event of

infectious and contagious diseases. According to the Act, proper carcass disposal is required, and authorities from the Animal Husbandry Department must document the destruction and disposal of the animals and materials. States may also work with NGOs and cooperatives and adhere to the guidelines in the India Code for the Proper Disposal of Dead Animals.

Pit burial

Pit burial is the most popular method for disposing of carcasses

Points to be noted

- ✓ The optimum places to use this disposal technique are those with a deep water table and nonporous soil.
- ✓ In areas with sandy soil, the pit's sides need to be strengthened. This can be done by installing end-to-end 3-foot-diameter concrete pipes, similar to those used under highways for drainage.
- ✓ Larger carcasses should have their thoracic cavities split after being buried to relieve gases that build up inside the body during decomposition and lessen the chance that bloat would expose bodies.
- ✓ For proper management, pits should be dug on a common land within the infected zone in limited numbers.
- ✓ The site should be on soils of low permeability with significant clay content (lining pits with clay soil may be considered).
- ✓ In areas with clay soil, at least 2 m above the highest water table should be the base of the pit.
- ✓ The groundwater table level should be minimum of 6 meters below the lower level of deep burial pit. The watercourse should be away from the burial sites such as lakes (1000 ft), rivers (400 ft), tube well (200 ft).
- ✓ Land requirement of 0.3 cubic meter for pig may be considered.
- ✓ All the remnant feed and soil upto 2 inches deep must be disposed off along with the carcass.
- ✓ The pits should not be on a slope greater than 6% and digging of 5 meter depth is possible.
- ✓ Each body should have at least 30 cm of earth surrounding it entirely as soon as it is placed.
- ✓ Burial pit should be at least 2.3 meter (not more than 3 meter) wide and 3 meter deep (7x9 ft). The length should be as per the number of carcasses.

- ✓ Burial pit should be covered with at least 2 m (6 ft) soil. Soil should not be compact.
- ✓ Pit should be 2 meter deep and half filled with waste, then covered with lime within 50 cm of the surface, before filling the rest of pit with soil. On each occasion when waste is added to the pit, a layer of 10 cm soil shall be added to cover the waste.
- ✓ A floor space of 1.3 m^2 (15 ft^2): May accommodate 5 mature pigs. For each additional meter (3 ft) in depth, the number of animals per 1.3 m^2 of floor space may be doubled. The weight of dead animals in the pit should not exceed 2500 kg.
- ✓ No person should enter the trench more than 1.5 meters deep without stabilizing the sides.
- ✓ The buffer zone with green belt should be maintained in consultation with local bodies and pollution authorities.
- ✓ The pit sites should be fenced and permanent warning signboard should be fixed in all the pit sites. The pits should be monitored at regular intervals to check any sinking, water accumulation etc. and if necessary, steps be taken as mentioned above.
- ✓ There should be no accumulation of water during rainy season at the disposal site.
- ✓ No crop should be grown further for at least one year on the pit site.

Composting

The controlled decomposition of organic materials is known as composting, and it's a useful and hygienic way to get rid of carcasses that have grown in popularity recently. Bacteria break down the carcass during composting, leaving only bones and feathers. When done correctly, composting is safe and results in a relatively odourless, porous material that resembles humus and is an important soil additive. Cattle and pig carcasses must compost for nine to ten months in order to be intact (sander et al., 2002). With the exception of spores, tissues should be properly composted when they reach 130 degrees Fahrenheit for three days.

Recommended composting parameters

Parameter	Acceptable range	Optimum range
Carbon : N ratio	15–40:1	25–30:1

Moisture content (%)	45–65	50–60
Core temperature (°C)	40–65	55–60

Points to be noted

- ✓ Composting should be at least 100 meter away from water sources and residence and 300 meter away from roads. It involves layering/mixing carcass with co-compost material (sawdust, silage etc) with at least 60 cm covering of composting material.
- ✓ Material should be removed from the compost pile after the carcass/related material is completely composted with minimum odours.
- ✓ Compost piles kill most pathogens in 10-14 days in case of small carcasses, longer in large carcasses.
- ✓ Assume land area as 3.5 square meter for pig carcass. The site should be 120 cm above seasonal high-water level and at least 1 meter above bed rock. The site should not be located on flood plains.
- ✓ On the base of litter, the carcass and related material alongwith bulking agent are added in layers so that the carbon-to-nitrogen ratio is in the range of 15:1 to 35:1 (optimal 23:1).
- ✓ Necessary measures should be taken to minimize odour, flies, rodents, bird menace and fire hazard.
- ✓ Leachate should be re-circulated in the compost plant for moisture maintenance.
- ✓ Turning piles may increase the rate of decomposition. First stage of composting normally completed within 12 weeks. Second stage composting takes additional 8 months.
- ✓ The volume of dead animal(s) in the compost pile must not exceed 25% of the total volume of the compost pile.
- ✓ Finished product can be recycled, stored or added to the land as a soil amendment subject to the fulfilment of standards prescribed by Fertilized Control Orders.

Rendering:

By cooking the carcasses, rendering eliminates infections and yields useful byproducts including meat, bones, and blood meal that may be added to animal diets. It is a safe and environmentally friendly way to dispose of dead

animals. Prior to rendering, freezing stabilises the carcass and slows down decomposition, which may lower the grade of the protein (Sander et al., 2002).

Points to be noted

- ✓ Rendering is done in a dry (yield 20% more) or wet process.
- ✓ Carcass should be processed immediately before putrefaction.
- ✓ Carcass cooker with operating pressure of 35-40 psi and a capacity of 250 kg is preferred.
- ✓ Chlorination should be adopted for the treatment of effluent before discharge.
- ✓ Proper pollution control measures as per pollution control norms should be adopted for chimney gases, liquid and solid waste disposal.

Incineration:

On farms, correct incineration is rarely possible. It needs costly specialised equipment, to dispose of carcass waste.

Advantages

- It achieves complete reduction of volume with rapid oxidation to carbon and water
- It is environmentally safe.

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Glossary of Terms

Biosecurity: The measures and protocols put in place to prevent the introduction and spread of infectious diseases in livestock populations.

Boar: An uncastrated male pig.

Disease surveillance: The systematic collection, analysis, and interpretation of data on the occurrence, distribution, and trends of diseases in animal populations.

Disinfectant: A chemical agent or solution used to kill or inactivate pathogens on surfaces, equipment, or materials.

Disinfection: The process of killing or inactivating disease-causing microorganisms on surfaces, equipment, or materials to prevent the spread of pathogens.

Footbaths/Foot dips: Containers filled with disinfectant solution placed at the entrance of livestock facilities to disinfect footwear and prevent the introduction of pathogens.

Gilt: A female pig which has not farrowed.

Isolation: Separating sick or infected animals from healthy ones to prevent the spread of disease.

Litter: A group of piglets born to a sow.

Mortality: The number of deaths within a population, often used as an indicator of disease severity or impact.

Pen: A part of the sty for housing a single or group of pigs having a covered place and an adjoining open yard; the covered place providing feeding and watering troughs and dunging spaces.

Piglet: A young pig before weaning.

Quarantine: Isolating animals or groups of animals that have been newly introduced or suspected of being infected to prevent the spread of diseases to the rest of the herd.

Signage: Clearly visible signs or labels placed in strategic locations to remind and inform individuals about biosecurity protocols and practices.

Sow: A female pig that has farrowed at least once.

Sty: A dwelling place consisting of one or more of pens for pigs.

Weaners: Piglets which have been separated from the mother for the purpose of independent rearing.

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