
UNIT 7 HOUSING OF PIGS UNDER FARROW TO FINISH INTENSIVE SYSTEM

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7.1 LEARNING OUTCOMES

- a) **Knowledge and Understanding:** After studying this Unit you will be able to:
- Know the five varieties of pens in a farrow to finish intensive pig farm.

- Understand why extra source of heat is essential for piglets and the need for creation of brooding facility?
- b) Practical and Professional Skills:** After studying this Unit you will be able to:
- Differentiate between slatted and solid floors with welfare implications.
 - Describe the housing requirements and minimum floor space for different categories of pigs in a farrow to finish intensive pig farm.
 - Calculate the number of pens required for different categories of pigs and piglets in farrow to finish intensive pig farm.

7.2 INTRODUCTION

Dear Learner,

In the previous unit, you were introduced to the standards and good practices in housing, feeding, breeding, identification procedures and healthcare of pigs in semi-intensive systems. During the last one decade, commercial pig farming has gained momentum in the country. Many entrepreneurs particularly from north eastern States, Punjab, Haryana, Uttar Pradesh, Kerala etc. started the pig farms under commercial intensive system. Very often, the entrepreneur is facing problems in designing the pig house in welfare friendly way, as there is lack of understanding on modern pig housing systems suitable to our climatic conditions. In this unit, scientific housing of 50 sows farrow to finish intensive pig production system is discussed, which will take care of animal welfare, environment and durability factors.

7.2.1 Types of Pens

In a farrow to finish intensive pig farm, there should be at least five varieties of pens to house the following categories of pigs and piglets:

- 1) Farrowing/lactating sow and nursing piglets (sow stays during farrowing and lactation)
- 2) Nursing/suckling piglets
- 3) Dry and pregnant sows (where pregnant and non pregnant sows are kept)
- 4) Weaners and fatteners (from weaning to end of rearing)
- 5) Gilts, boarlings and boars

It is always better to have separate sheds for the above types of animals in any pig farm for their welfare.

If explained with an example, it will be easier for you to understand the welfare requirements related to housing. The assumptions for calculation of housing requirement for a 50 sow capacity farrow to finish pig farm is summarised in Box 7.1.

Box 7.1: Fifty Sow Capacity Farrow to Finish Pig Farm: Assumptions for Calculating Housing Requirements

- 1) Farm litter index is 2.1 (average 2.1 litter production per sow per year).
- 2) Average litter size at birth is 10.
- 3) 10 per cent piglets may die during suckling (lactation length 35 days-weaning age), 3 per cent may die during rearing period (35 to 77 days) and 2 per cent may die from day 77 to day of sale of fatter pigs (260 days of age). Total mortality is less than 15 per cent.
- 4) Mortality rate of adult animals/year is 2%.
- 5) Mode of breeding is natural service and boar to sow ratio is 1: 6.
- 6) Dry and pregnant sows are reared under group housing system with certain restrictions.
- 7) Farrowing takes place uniformly throughout the year.

7.3 HOUSING REQUIREMENTS FOR LACTATING SOWS AND NURSING PIGLETS

During the first few days, the piglets should be protected from crushing by the sow, and should be protected from cold. The new born piglets feel comfortable at 32 to 34° C. Therefore, farrowing pens are to be designed in such a way that, newborn piglets are protected from crushing and cold and are reared very hygienically.

7.3.1 Transfer of Pregnant Sow to Farrowing Pen

It is always better to shift the pregnant sows to farrowing pens 14 days before the expected date of farrowing. When piglets are inside the mother's womb, the active immunity produced in sow against the microorganisms of surrounding environment don't pass through the placenta, rather they are deposited in the colostrum and are passed to the newly born piglets if they consume it after birth. Production of such immunity requires around 14 days time.

7.3.2 Pig Production Cycle

The gestation period of sow is 115±2 days. Lactation length in commercial pig production is usually around 28 to 35 days, with minor variations considering health of piglets and sows. Sow usually comes in to heat within 5–7 days after weaning-and the period is called as "Grace Period". Beyond the 7 days, if the sow is not coming in to heat or not pregnant, the period is called as "Loss Days". Days sows neither pregnant nor in lactation, excluding grace period is considered as loss days. If a sow is served, but it is coming in to heat again, the period between two services will also be considered as loss days. Therefore, production cycle of a sow producing 2.1 litter/year with a lactation length of 35 days, will consist of the following components:

- Length of one production cycle : 174 days ($365/2.1=174$)
- Gestation period : 115 ±2 days
- Lactation length : 35 days

- Grace Period: 7 days
- Loss days: 17 days (174–115–35–7)

7.3.3 Calculation of Farrowing Pens Required for 50 Sow Units

In one production cycle a sow will remain in farrowing pen from 14 days ahead of expected farrowing till the day of weaning at 35 days post farrowing. In other words, we can say that a farrowing pen will be occupied for minimum 49 days (14+35) per production cycle. After removing the sow, 3 days are needed to clean the farrowing pen thoroughly and dry it. Therefore occupation period of one farrowing pen per production cycle is 52 days. Therefore, in a year, one farrowing pen can be utilised for 7 ($365/52=7.02$) production cycles approximately. With litter index/farrowing index 2.1, we can expect 105 (50×2.1) farrowings or production cycles per year in a farm of 50 sows. Therefore we require minimum of 15 ($105/7$) farrowing pens in the farm. Although we assume, farrowing will take place uniformly throughout the year, in practice, it may not always happen. It is better to construct 10% extra farrowing pens to address this issue of uncertainty. Therefore, a total of 17 ($15+10\%$ of 15) farrowing pens will be sufficient to house all the pregnant sows and manage all the farrowings in a year.

7.4 DESIGN OF FARROWING PENS

7.4.1 Slatted vs. Solid Floor

The slatted floor is better than the solid floor to maintain cleanliness and welfare (Box 7.2). The slates may be either plastic, cement concrete or of iron/steel. To protect crushing of piglets, sows are usually confined in crate during lactation. However, it is not preferred from animal welfare point of view. But to safeguard the piglets from crushing, confinement of sow is practiced. Readymade plastic or cement concrete slates are available. Dimension of 2.4m length and 1.8m width is sufficient for one slatted floor farrowing pen. To provide warmth, electric heating plate is best suitable for piglets. Otherwise, infrared bulb or ordinary bulb of higher wattage can be used for providing the brooding temperature comfort to the new born piglets (Fig. 7.1).

Box 7.2: Slated vs. Solid Floors in Farrowing Pen – Welfare Implications

In most of the pig farms in India, the floor of farrowing pen is made up of cement concrete (Fig. 7.1). In such condition, the sow usually gets dirty with urine and faeces. With regular washings, it is not possible to clean the sow completely. The udder along with teats gets dirty. There is every possibility of infection for the piglets from such unclean udder.

In majority of cases, after washing with water, little amount of water along with faeces and urine retained in small holes of damaged floors. Piglets usually don't drink water up to 7 days, if milk production of sow is optimum. However, if milk production is low and inadequate, they may drink water before 7 days of age. The piglets pick up infection, if they lick or drink such contaminated water from the floor.

The passive immunity obtained through intake of colostrum protects the piglets normally up to 14 days of age and later the piglets are more vulnerable for infections. However, certain amount of immunoglobulins present in milk

also protects the piglets to some extent when they are in nursing stage. On the other hand, when sow milk production is not sufficient to supply all the nutrients required for piglets after 7 days of lactation and the piglets start searching for feed or other liquid. Intake of feed or liquid by the piglets increases when milk production of the mother declines after third week of age. Therefore, if floor is unclean, which is a normal case in solid floor, and intake of colostrums and milk is not up to the mark, piglets suffer from infection (mostly diarrhoea) resulting in high mortality, which may go up to 40%.

To maintain the cleanliness, slated floors are used (Fig.7.1). Through slated floor, urine is readily passed to manure pit placed below the pen which helps the pen to remain dry.. Some amount of dry solid faeces also slowly passes through slates and frequent removal of dry faeces helps to keep the floor of the pen very clean. There is no room for water logging in slated floor and piglets don't get the chance to lick such dirty/contaminated water. The sow cannot turn in farrowing crate and don't get the chance to lie over its faeces or urine, which keep the udder and teats remain clean and chances of infection is minimized. Occasional cleaning of hind quarters of sow with removal of faeces is enough to keep the sow and the pen clean. But, confining sows in such narrow crates is a welfare issue.



Fig.7.1 : Cement concrete farrowing pen (left) and modern farrowing pen with farrowing crate, slated floor and infra-red lamp (right)

7.4.2 Farrowing Crate in a Farrowing Pen

Accidental crushing of the piglets by the sow during first two days after farrowing causes 10 to 20% death of new born piglets. To avoid crushing, farrowing pens are used in intensive production systems (Fig. 7.2). Two loose bars placed along the side of a crate prevent lying of sow directly over the piglets and minimize the chances of crushing. In most of the developed countries



Fig.7.2: Farrowing crate

(Source: <https://infograph.venngage.com/p/188613/sow-farrowing-crates>)

farrowing crates are used. In the farrowing crate, sow is kept confined and cannot turn inside the pen, which is a major welfare issue.

Farrowing pen without crates and slatted floor can also be used in pig farms. However, as mentioned earlier, chances of mortality and diarrhoea in piglets will be more in solid concrete floor. Moreover floor space and manpower requirement (for cleaning) will be higher as compared to slatted floor pens. Dimensions of such farrowing pen may be 3 metres × 6 metres (3mx3m -lying area and 3mx3m-open area). A creep area should be provided inside the farrowing pen for brooding and feeding of piglets. Creep area should be provided in such a way that sows cannot get access to it.

Before we proceed, please complete activity 1.

Activity 1: Visit a nearby intensive/commercial pig farm. Discuss with the farm supervisor about the farm capacity and farrowing pens they have. Compare it with the discussion given in the above section and write your observations.

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Check Your Progress 1

- Note:** a) Use the spaces given below for your answers.
- b) Check your answer with those given at the end of the unit.

- 1) Why the farrowing pens are to be designed in such a way that, newborn piglets are protected from crushing, cold and hygiene related issues?
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- 2) Why the pregnant sows are to be transferred to farrowing pen 14 days before farrowing?

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- 3) Differentiate between the 'grace period' and 'loss period' in intensive pig production.

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7.5 HOUSING REQUIREMENTS FOR NURSING/ SUCKLING PIGLETS

7.5.1 Why Extra Source of Heat Essential for Piglets?

In adult animals thermoregulatory system is well developed and hence, to some extent they can withstand temperature fluctuation in the environment. However in piglets, this system is not well developed and hence, they are more vulnerable to fluctuations in environmental temperature. Providing extra source of heat or brooding of young piglets is highly essential to maintain their internal body temperature. It is also necessary for the following reasons:

- Normal internal body temperature of piglets is around 39°C. At this temperature, all the body processes function properly and we can expect good welfare, growth and less diseases in piglets.
- Pig is a homoeothermic (warm blooded) animal. That means, due to different metabolic reactions taking place in living cells of the animal, heat is constantly being produced, which keep the animal warm and maintain the required internal body temperature.
- Amount of heat produced inside the body will depend upon the weight of the animal. The birth weight of newly born piglet usually varies from 1 to 1.3 kg, and range of the lowest and highest may even vary from 0.5 to 2.5 kg. Therefore, very less amount of heat is produced in newly born piglets.
- After maintaining internal body temperature of the animals, the extra heat produced is generally dissipated to the environment through the body surface of the animals. Higher the body surface of the animals, higher will be the rate of heat dissipation. When we compare the body surface of an adult pig

weighing 150 kg and a one kg newly born pig, the surface area in relation to body weight is much higher in a piglet, and therefore rate of heat dissipation is more in piglet than in a pig when kept in same environmental temperature.

- The amount of heat loss from the animal body also depends upon the environmental temperature where the animal is being reared. If the environmental temperature is too low, rate of loss of heat from animal body will be more and vice versa.
- Fat layer beneath the skin acts as heat insulation for the animal and reduces the rate of dissipation of heat from the body to the environment. In young piglets, fat cover beneath the skin is almost nil and therefore body heat conservation is very less in them.
- Glycogen present in the body at the time of birth provides the readily available source of heat in the piglets. Compared to other livestock, the glycogen present in young piglet is very less which limits the heat production.
- When required temperature is not maintained, to conserve heat, the rate of evacuation of bowel or rate of removal of undigested feed from the intestine is lowered. When these undigested particles are retained inside the intestine for long period, there are chances of infection and the piglets may suffer from diarrhoea, which will further aggravate their condition..
- Immune system to fight against diseases is not well developed in young piglets up to three months of age. When, animals are suffering from cold stress, the thermoregulatory system will not function normally which further increases the chances of infection.

The optimum environmental temperatures which meet the welfare requirements for different type of animals are summarised in Box 7.3.

Box 7.3: Optimum Environmental Temperature for Piglets and Adult Pigs		
Type of animal	Live weight (kg)	Optimum environmental temperature (°C)
Suckling Piglets	Less than 2	32
	Less than 5	28
Weaners	Less than 8	28
	Less than 10	26
	10–15	22
Growers	15–30	20
Finishers	30–60	18
	60–120	16
Pregnant Sows	Feed restricted	18
	In groups on straw	15
Lactating Sow	-	16
Boars	-	18

(Source: Whittemore, 1998)

7.5.2 Creation of Brooding Facility for Young Piglets

From Box 7.3, it is clear that lactating sow feels comfortable at much lower temperature than that of young ones. Therefore, within the farrowing pen, there should be a provision for extra source of heat for piglets. This area is called creep area, where creep feed (first feed to piglets) and source of heat are placed. Two 200-watt electric bulbs could be used as heaters, especially during winter. If available, infrared bulb can also be used, which provide more heat. Other types of heaters available in the market can also be used.

The right temperature for piglets is shown by their behaviour:

- If piglets stay close to the sow or to the heat source or huddle together, then the temperature is too low.
- If piglets stay close to the sow but stay away from the heat source and still huddle together, then the heat source might be too high.
- If piglets are evenly distributed in the pen and in the brooder, then the temperature is just right to keep them comfortable.

Rough hair coat may indicate sickness or cold temperature in animals. Always keep the brooder or creep area warm, dry and clean. Clean dry paddy straw may be used as bedding material in the creep area where heating source is located. Electric heating plates are also available, which can be fixed in the creep area (Fig.7.3 & 7.4).



Fig.7.3: Cement concrete solid floor farrowing pen with creep brooding boxes



Fig.7.4: Modern farrowing pen with heating plate (left) and infra-red lamp (right)

7.6 HOUSING REQUIREMENTS FOR DRY AND PREGNANT SOWS

In intensive production systems, sow completes her whole life in farrowing, dry and pregnant pens alternately. All the 50 sows will be distributed in these pens only at any moment of time. In section 7.3, we calculated that for a 50 sow capacity farm, a total of 17 farrowing pens will be sufficient to accommodate all the pregnant sows for farrowing in a year. Therefore, requirement of dry & pregnant sow pens or places (depending upon individual or group housing) will be 33 (50–17). On the day of weaning, the sow is shifted to dry & pregnant sow pens from farrowing pen.

7.6.1 Number of Dry and Pregnant Sow Pens/Places

Theoretically, for a 50 sow farm, we need 33 places for dry and pregnant sows. While deciding the number of places, we need to consider replacement of old sows with gilts. Generally sows are culled when their performance is going down. Usually after 5–6 farrowings, performance of sow goes down, with great variations. Sows are generally culled after weaning. However, if the body condition of some sows is not fit for sale, they are reared for another 20 to 30 days after which they are sold. For keeping such sows for extra period of 20–30 days we need space. Another issue is that, when sow is replaced by gilt, the gilt may not be in the same stage of reproduction with the culled sow—that is dry and will be bred within 5 to 7 days. In such a situation we might have to bring the replacement gilt from gilts pen some 20 to 30 days ahead of its expected date of breeding. Considering the above two aspects, it will be wise to have 20% extra number of dry and pregnant sow places. Therefore, the total number of dry and pregnant sow places required will be about 40 (33+20% of 33=39.6H'40).

7.6.2 Design of Dry and Pregnant Sow Pens

Dry and pregnant sows can be reared either individually or in groups. As dry and pregnant sows are fed on restricted diet (on an average 2kg concentrate/day/sow), they should be fed individually, otherwise, some sows will be overfed and some will be underfed. Therefore, in group housing system, provision of individual feeding should be made. Another important point to remember in managing pregnant sows in a group housing system is that, there should be minimal fight among the pregnant sows, otherwise it might affect the litter size. Therefore, it is better to rear the weaned sow individually from weaning to service and from service to first 40 days of pregnancy (for proper implantation of foetus). Thereafter, sows can be reared in groups of 15 to 20 with individual feeding system till they are shifted to farrowing pens.

Concrete slates are one of the best floor materials for housing of dry and pregnant sow pens. However, to minimize the capital expenditure, they are housed on cement concrete solid floors. Solid floor require daily cleaning with water. To provide feed individually, feeding boxes made up of galvanised iron bars may be placed in one side of the compartment. In developed countries, electronic sow feeding systems are used, wherein supply of feed to the sows is being controlled electronically. At the time of feeding, the sow should be confined to feeding boxes and thereafter, they should be released. The recommended dimensions of a feeding box are 2.25 metres × 0.6 metre. These feeding boxes are ideal to

confine the sows from weaning to service and from service to first 40 days of pregnancy. Thereafter they should be kept confined only during feeding time.

An area for wallowing during summer months will be of great help to cool down the animals. Fixing overhead water sprinkler will also be helpful during summer months. Apart from area required for feeding boxes, 2.4 sq.m/pig is required as lying and dunging area. Therefore for a group of 20 sows, total area required for dry & pregnant sows under group housing will be 75 sqm $[(2.25 \times 0.6 \times 20) + (2.4 \times 20)]$. Two compartments will be required for 40 places and total area required for that will be 150 sq.m (Fig.7.5). In smaller sized farm, grouping of sows of similar stage of reproduction is quite difficult. In such a situation, dry and pregnant sows may be housed individually in feeding lying boxes or in a compartment of 2.5m \times 3m size.



Fig.7.5: Feeding lying boxes for dry and pregnant sows

7.7 HOUSING REQUIREMENTS FOR WEANERS

Piglets are generally weaned between 28 to 35 days of age. At this age, piglets immune and digestive systems are not mature enough to cope up completely with solid feed and challenging rearing conditions. On the other hand, when piglets are weaned, they are deprived of the nutrition and immune protection from mother's milk. Usually weaned piglets are exposed to new surroundings and new set of microorganisms when removed from farrowing pen and reared in weaner pen. Piglets when separated from mother, and sometime mixed with other litters, they also suffer from social stress. In view of the above factors, weaning is one of the most stressful welfare issue in piglet's life. Under stress, the immune system of the piglets becomes weak which make them vulnerable to infections.. Therefore, keeping the weaner pigs in a clean and thermo comfort environment is of utmost importance for their welfare. Like suckling piglets, they may also require brooding when environmental temperature is below the comfort zone. When piglets are reared at low temperatures, peristaltic movement of the intestine is reduced, resulting more retention time for undigested feed particles which act as substrate for growth of micro-organism causing digestive problems in piglets. By keeping them warm is of great help to withstand the weaning stress. Otherwise, low microclimatic temperature will further aggravate the stress leading to diseases.

7.7.1 Weaner Pen

Like the farrowing pen, slatted floor instead of solid floor will immensely help to keep the weaner pen dry and clean (Fig. 7.6).



Fig.7.6: Modern weaner pen with plastic slatted floor

If plastic slates are not available, iron or wooden slates can be used for weaner pen (Fig. 7.7). If slates are not available, solid floor with proper brooding facility can also be used for rearing weaners. A combination of slates and solid floor can also be used as weaner pens. Brooding facility must be installed in lying area to keep them warm. Floor space requirement for a weaner is 0.4–0.5 sqm per piglet (Fig. 7.6 and Fig. 7.7).



Fig.7.7: Wooden (left) and iron (right) slatted floor weaner pens

7.7.2 The Weaner Cage (Battery)

In this system, piglets are moved into the battery cage immediately at weaning. The cage consists of a floor of metal/plastic/wooden slats and mostly plastic or wooden partitions (0.60 m high). The dimensions are about 1.50 x 120/150 m. The floor is raised to 0.60 m above the floor level. This system has been proving to be successful as it helps to keep the weaner dry which is very important to avoid post weaning stress and infections.

7.7.3 Number of Weaner Pens Required for 50 Sow Units

After weaning (35 days), weaned pigs will be taken to weaner pen, wherein they will be reared up to 77 days. Therefore, total occupation period will be 45 days (including 3 days for cleaning). It is also assumed that, weaner pigs of one litter will be kept together in a weaner pen. In case, litter size is less than 10 piglets, two or more litters may be mixed. Weaner pen space requirement is taken in such a way that 13–14 piglets of one litter can be easily reared in one pen. In one year, one weaner pen will be used for 8.11 times ($365/45=8.11$). There will be

maximum production of 105 litters (2.1x50) in one year in a farm of 50 sows. Therefore, the number of weaner pens required will be 12.95(105/8.11=12.95) i.e.13. Considering longer rearing period required for weaner with poor growth, an allowance of 10% more number of weaner pens must be given. Therefore, total number of weaner pens required will be 15 (12.95+10% of 12.95=14.25H”15). To minimize the number of weaner pens, litters weaned on same day can be housed together and 30 to 40 piglets can be reared in one weaner pen. Usually in big size farm, wherein many litters are weaned on same day, such weaner pen is useful. However, in small farms, weaning age may not be same for many litters, and in such scenario, it is always better to rear one litter in one pen instead of mixing different litters on different days.

Considering floor space requirement of 0.4 m²/piglet, area for a weaner pen to accommodate maximum of 14 weaners will be 5.6 m². Roughly a weaner pen with 2 m width and 3 m length will be sufficient to accommodate 14 weaners of one litter. Therefore, total area required for 15 number of weaner pens will be 90 m² (6x15 m²).

7.8 HOUSING REQUIREMENTS FOR FATTENERS

Pens for fattening pigs must be simpler than those for breeding pigs. If more fatteners are to be reared, a separate house consisting of two rows of pens with a feed alley between them is recommended. Daily activities like feeding, watering, cleaning etc. require much labour, therefore construction should be in such a way that it facilitates easy work. Like weaner pigs, slated floor system will improve welfare and reduce the daily work of cleaning with water. Also the floor space requirement is also less as compared to solid floor. However, capital expenditure will be more in constructing such a house for fatteners.. Otherwise cheaper constructions like cement concrete solid floor can be used to rear fattener pigs (Fig.7.8).



Fig.7.8: Cement concrete floor fattener pen (left) and open dunging area (right)

7.8.1 Floor Space Requirements and Trough Length

The amount of space required depends on the size or age of the animals, the environment temperature and the number of animals per pen (Box 7.4).

Box 7.4: Floor Space Requirements with Solid Floor for Fatteners			
Live weight (kg)	Trough length (cm)	Minimum lying area (m²)/animal	Minimum dunging area (m²)/animal
20– 40	20	0.40	1.00
40– 65	25	0.60	1.00
65– 90	32–35	0.90	1.20

7.8.2 Number of Fattener Pens Required

Besides more available space, a limited number of fatteners per pen have a positive effect on the welfare and productivity. It is advisable to keep 8 to 12 pigs per pen.

It is assumed that the average litter size at birth will be 10 piglets. Out of this, 10% mortality will be there up to weaning at 35 days, leaving 9 piglets per litter at weaning. Then, there will be further mortality of 3% during rearing period (from weaning to 77 days). That means, from one litter of 10 piglets born, we will have $8.73[9-(0.03 \times 9)]$ numbers of weaner pigs at the age of 77 days and from 105 farrowings we will get 917 ($8.73 \times 105 = 916.65 \approx 917$) weaner pigs at the age of 77 days. From these weaner pigs, replacement stock will be selected. Normally 40% of the sows (assuming productive life of 2.5 years for sows) and 50% of the boars (assuming a productive life of 2 years for a boar) are to be culled every year. That way, every year we have to replace 20 (50×0.40) old sows with new pregnant gilts and 4 old boars with new young boars. When replacement stocks are selected at 77 days of age, we have to select at least 32 gilts ($20 \times \text{correction factor} - 1.6 = 32$) and 7 ($4 \times \text{correction factor} - 1.6 = 7$) young boars every year. Therefore we require housing for 878 fatteners ($917 - 32 - 7$). However, it is assumed that there will be another 2% mortality from 77 days to 8.5 months of age (roughly 260 days of age and will attain 90–100 kg body weight at which animals will be sold). After deducting 2% mortality rate, total fattener sold per year will be 861 [$878 - (0.02 \times 896) = 860.44 \approx 861$]. Therefore we need space for 861 fatteners.

Let's assume that in one fattener pen 10 pigs will be reared. A fattener will remain in the fattener pen from 77 days of age to 255 days (8.5 months) of age. With another two days required for cleaning, total occupation period will be 186 days ($260 - 77 + 3$). Number of batches of fattener we can rear in a fattener pen in one year is $365 / 186 = 1.96 \approx 2$ batches. In one batch, we can rear 10 fattener, that means in one fattener pen we can rear 20 fatteners per year. Therefore, for 861 fattener we need, $43 (861 / 20 = 43.05 \approx 43)$ fattener pens. Although space calculation is made for only live animals, the animals which die during growing period will be smaller in size and can be reared in pens which are designed for mature fatteners.

Combining lying and dunging area (in solid floor house), total floor space required for mature fattener is taken as 2.1 square metre / animal ($0.9 + 1.2 = 2.1$). Therefore, area of a fattener pen accommodating 10 fatteners will be 21 square metre. Total area required for 43 fattener pens will be 903 square metres (21×43).

The floor space requirement under stated floor housing is much lesser ($1 \text{m}^2 / \text{animal}$) and manpower requirement is also reduced, as daily cleaning with water

is not required. However, slated floor housing requires higher capital investment. Considering many aspects, it is advantageous to use fully slated or partially slated floor as compared solid floor for fatter pigs.

7.9 HOUSING REQUIREMENTS FOR GILTS AND BOARS

7.9.1 Number of Gilt Pens Required

Gilts for future breeding are usually selected at the end of rearing period. It is assumed that at 77 days of age (end of rearing period), selected gilts will be reared separately in pens like fattener pens. Once they are ready for breeding (7.5 to 8.5 months) they will be shifted to pregnant sow pens and will be reared individually.

As calculated earlier, a total of 32 gilts will be selected at 77 days of age. Therefore we require housing for 32 gilts. These 32 gilts will be reared from 77 days to 260 days (roughly 8.5 months) similar to fatteners. Including three days for cleaning, total occupation period in gilt pens will be 186 days (260-77+3). The number of batches of gilts we can rear in gilt pens in one year is $365/186=1.96$ H² 2 batches. In one pen minimum of 6 gilts can be reared. In one year, 12 gilts can be reared in one pen. Therefore we need $32/12=2.67$ H² 3 gilt pens. However, once they are pregnant we have to house them individually for which provision for few extra individual pens are already made in dry and pregnant sow pens to accommodate these pregnant gilts.

Housing requirements for replacement gilts will be same like fattener (2.1m²/Gilt). Therefore, area of a gilt pen accommodating 6 gilts will be 12.6 m² (Fig.7.9).The total area required for 3 gilt pens will be 37.8 square metre.



Fig.7.9: Cement concrete floor gilt pen

7.9.2 Pens for Boarlings

It is always better to get good boarlings from other pig farm(s) to avoid inbreeding. If future boars are to be selected from the weaner pigs, they should be selected at the age of 77–90 days. If we have to select boarlings from the same farm, we have to select at 77–90 days of age and can be reared in a group up to 5 months and thereafter they should be reared individually. Boars are capable for breeding from 8–9 months of age, although they mature by 1 year of age and can be used

for another 1.5 to 2 years. Therefore, if we have to cull the mature boars (8 numbers) in two years, we have to select four new boars each year. If we select 7 boarlings (1.6x4) at 77 days of age, we can get 4 good boars (of 10-12 months age) each year. That means the boarlings selected at 77 days will be used for breeding after 10-11 months of age and will be reared in boarling pen for nearly 9 months. That means, one boarling pen can be used for rearing of 1.33 (12/9) boarlings in a year. Therefore to accommodate for boarling, we need a maximum 5.38 pens (7/1.33) H” 6 pens. The dimensions of a boarling pen will be smaller than for a boar pen and an area of 2 m x 3m space will be sufficient for one boarling pen.

7.9.3 Boar Pen

Boars are reared individually and housing requirements are similar like fattener. An area of 2.5 m x 3 m will be enough for accommodating one boar (Fig. 7.10). Therefore, for a farm having 8 boars, we need 8 boar pens and total area required is 60 square metres. Either solid or cement concrete slated floor will be ideal for housing boars.. In warm areas, a wallowing tank of the size 2m x 1m will be of great help to keep the animal cool.



Fig.7.10: Boar pen with cement concrete floor

7.10 OTHER HOUSING STRUCTURES

Depending upon farm size, the following few more housing structures are required in intensive pig farming:

Isolation Shed: At a corner of the farm a shed (with 5 compartments) with a size of approximately 5 m x 10 m will be sufficient to keep sick/diseased animals separately. This must be far away from the healthy animal pens to minimise the spread of infection.

Quarantine Shed: An isolated area (preferably away and outside the farm with approximately 5 m x 6 m shed) to keep newly purchased animals.

Changing Room: At the entrance of the farm, approximately 4 m x 5 m building will be sufficient for keeping clothes, shoes, bags etc. of the farm supervisor/workers.

Office Room: Approximately 5 m x 8 m building to serve as farm office, near to the changing room is required

Feed Storage and Feed Mill: Approximately 8 m x 25 m building for keeping and making of feed. Make sure that the vehicles that carry feed ingredients/feed on pass through farm complex.

Store Room: Building with an area of 6 m x 5m may be constructed to keep various items of the farm.

Accommodation for Workers: For a farrow to finish pig farm of 50 sows + 8 boars, with own feed making, manual feeding and with slated floor housing system (which don't require daily cleaning with water), 4 workers + one manager will be sufficient to manage the farm. Therefore, four accommodations inside the farm complex (preferably one corner) and another (for manager) outside the farm complex will be required. The office will have a guest room, which will be used as transit accommodation for the workers for the quarantine period. The farm manager and workers shall follow all recommended biosecurity measures while entering the farm.

The summary of housing requirements for a farrow to finish pig farm to meet the welfare requirements is summarised in Box 7.5.

Box 7.5: Housing Requirements for a Farrow to Finish Pig Farm (50 Sows + 8 Boars)					
Sl. No.	Type of animal	Individual or group housing	Space requirement/ animal or per pen	Number of pens/places	Total area (m ²)
1	Lactating sow with nursing piglets	Individual	2.4 x 1.8 m ² /pen	17 pens	73.44
2	Dry and pregnant sow	Group	3.75m ² /sow (feeding box -2.25 x 0.6 m ² + Lying and dunging area of 2.4m ² /animal)	40 places	150.00
3	Weaner pen	Group	2x3m ² /pen	15 pens	90.00
4	Fattener pen	Group	21m ² /pen (2.1 m ² /animal, with 10 fattener/pen)	43 pens	903.00
5	Gilt pen	Group	12.6m ² /pen (2.1 m ² /animal, with 6 gilts/pen)	3 pens	37.80
6	Boarling pen	Individual	2 x 3 m ² /pen	6 pens	36.00
7	Boar pen	Individual	2.5 x 3 m ² /pen	8 pens	60.00
				Subtotal	1350.24
Other structures					
1	Isolation shed	-	5 m x 10 m	1 shed	50.00
2	Quarantine shed	-	5 m x 6 m	1 shed	30.00
3	Changing room	-	5 m x 4 m	1 shed	20.00
4	Office room	-	5 m x 8 m	1 shed	40.00

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5	Feed storage and feed mill	-	8m x 25 m	1 shed	200.00
6	Store room	-	5m x 6 m	1 shed	300.00
7	Manager’s quarter	-	150 m ²	1 Quarter	150.00
8	Accommodation for workers	-	100 m ²	1 Quarter	100.00
				Subtotal	860.00
			Grand Total		2210.24

Note: Considering the degree of mechanization, topography and climate, minor variations can be made in the above housing requirements.

Before we proceed, please complete activity 2.

Activity 2: Based on your understanding of this unit and summary presented in Box 7.5, calculate the number of pens required for a 30 sow intensive farrow to finish pig farm:

- 1) Lactating sow with nursing piglets

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- 2) Dry and Pregnant sows

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- 3) Weaner pens

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4) Fattener pens

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5) Gilt pens

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6) Boarling pens

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7) Boar pens

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Check Your Progress 2

Note: a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

1) How to assess the right brooding temperature for piglets by their behaviour?

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2) Why are weaned sows reared individually from weaning to service and from service to first 40 days of pregnancy?

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3) What is a weaner cage? What are its dimensions?

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4) What are the housing requirements for boars?

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5) Name the other housing structures required besides the pens in intensive pig farm.

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7.11 LET US SUM UP

- In this unit, you were introduced to the five varieties of pens, housing requirements, minimum floor space and how to calculate the number of pens required for different categories of pigs and piglets in a 50 sows farrow to finish intensive pig farm.
- It is always better to have separate sheds for different categories of pigs in any pig farm for the welfare of the animals.
- Farrowing pens are to be designed in such a way that, newborn piglets are protected from crushing and cold and are reared very hygienically.

- In the farrowing crate, sow is kept confined and cannot turn inside the pen, which is a major welfare issue.
- The slatted floor is better than the solid floor to maintain cleanliness.
- Providing extra source of heat or brooding of young piglets is highly essential to maintain the internal temperature of piglets.
- The right temperature for piglets is shown by their behaviour in the brooding area.
- Depending upon farm size, few more housing structures that are required in intensive pig farming are isolation shed, quarantine shed, changing room, office room, feed storage and feed mill, store room and accommodation for staff.
- Weaning is one of the most stressful welfare issues in piglet's life. In intensive production systems, sow completes her whole life in farrowing, dry & pregnant pens alternately. Therefore, taking care of the piglets and sows in a clean and thermo comfort environment is of utmost importance for their welfare.

7.12 KEYWORDS

Boar: A male pig with sex organs intact and generally used for breeding.

Creep Area: An area of access to piglets which is separate from the sow lying area.

Creep: The first solid and palatable feed fortified with protein, minerals, vitamins and antibiotics that is provided to the young ones

Farrowing: Act of giving birth in pigs.

Gilt: A young female pig kept for breeding purpose which is either not yet conceived or going to farrow for the first time.

Litter: A group of piglets born to a sow/gilt in a single farrowing.

Pen: A house for keeping a single pig or group of pigs.

Piglets: Baby pigs upto 8 weeks of weaning age.

Sow: Female pig kept for breeding purpose, which has farrowed at least once.

Sty: House of pig/ living place having one or more pens for pigs.

Wallow: Water pool for pigs.

Weaner: Piglet separated from the mother for the purpose of independent rearing.

Weaning: Separation of young piglets from mother sow at 8 weeks of age.

7.13 BIBLIOGRAPHY AND FURTHER READING

Mavromichalis, I. (2006). Applied Nutrition for Young Pigs. CABI, Wallingford, UK.

OIE (2019). Animal Welfare and Pig Production Systems. Terrestrial Animal Health Code. World Organisation for Animal Health, Paris. Chapter 7.13.

Patel, B.H.M. and Kaswan, S. (2019). Floor Space Requirement for Housing and Welfare of Pigs under Indian Perspective. *Indian Journal of Animal Sciences*, 89 (10): 1062–1068.

Pond, W.G. and Mane, J.H. (1984). *Swine Production and Nutrition*. AVI Publishers, Westport.

Varley, M.A. (1995). *The Neonatal Pig-Development and Survival*. CABI, Biddles Ltd. Guildford, United Kingdom.

Varley, M.A. and Wiseman, J. (2001). *The Weaner Pig: Nutrition and Management*. CABI, Wallingford, UK.

Whittemore, C.T. (1998). *The Science and Practice of Pig Production* (2nd edition), Blackwell Science Ltd, Oxford, UK.

7.14 SELF ASSESSMENT EXERCISES

- 1) What are the general assumptions for housing requirement of 50 sow capacity farrow to finish pig farm?
- 2) How do you calculate the number of farrowing pens required for 50 sow unit?
- 3) Discuss the advantages and disadvantages of slated and solid floors in farrowing pen along with the welfare implications.
- 4) Why providing extra source of heat or brooding of young piglets is highly essential to maintain the internal temperature and welfare of the piglets?
- 5) Discuss the housing requirement for dry and pregnant sows.
- 6) What are the housing requirements for gilts?

7.15 ANSWERS/ HINTS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) During the first few days after birth, piglets should be protected from accidental crushing by the sow cold. The new born piglets feel comfortable at 32 to 34° C. So the farrowing pens are to be designed in such a way that, newborn piglets are protected from crushing, cold and hygiene related issues.
- 2) When piglets are inside the mother's womb, the active immunity produced in sow against the microorganisms of surrounding environment don't pass through the placenta, rather they are deposited in the colostrum and are passed to the newly born piglets if they consume it after birth. For production of such immunity, it requires around 14 days time. So it is always better to shift pregnant sows before 14 days of farrowing.
- 3) Sow usually comes in to heat within 5–7 days after weaning. This period is called as "Grace Period". Beyond the 7 days, if the sow is not coming in to heat or not pregnant, the period is called as "Loss Days or Loss Period". Days sows neither pregnant nor in lactation, excluding grace period is considered as 'loss days'. If a sow is served and it is coming into heat again, the period between two services will also be considered as loss days.

Check Your Progress 2

- 1) If piglets stay close to the sow or to the heat source or huddle together, then the temperature is considered to be too low; If piglets stay close to the sow but stay away from the heat source and still huddle together, then the heat source might be too high or far away; If piglets are evenly distributed in the pen and in the brooder, then the temperature is just right and comfortable to them.
- 2) In group housing of pregnant sows there should be minimal fight among them. Otherwise it might affect the litter size. Therefore, it is better to rear the weaned sows individually from weaning to service and from service to first 40 days of pregnancy for proper implantation of foetus.
- 3) Piglets are moved into a cage immediately at weaning which is called as weaner cage. The cage consists of a floor of metal/plastic/wooden slats and mostly plastic or wooden partitions (0.60 m high). The dimensions are about 1.50 x 120/150 m.
- 4) An area of 2.5 m x 3 m will be enough to accommodate one boar. Either solid or cement concrete slated floor is ideal for a boar pen. In warm areas, a wallowing tank of 2m x 1m will be of great help to keep the animal cool.
- 5) Other housing structures that are required in intensive pig farming are: isolation shed, quarantine shed, changing room, office room, feed storage and feed mill, store room and accommodation for staff.