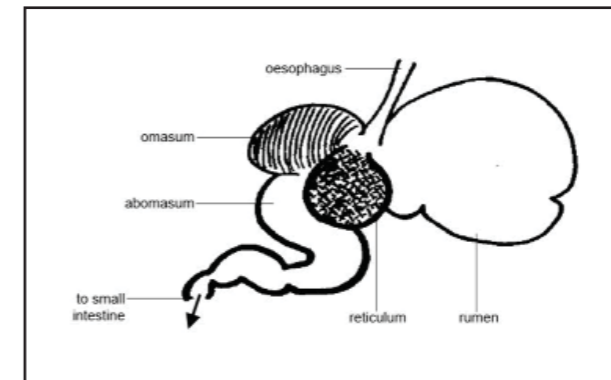
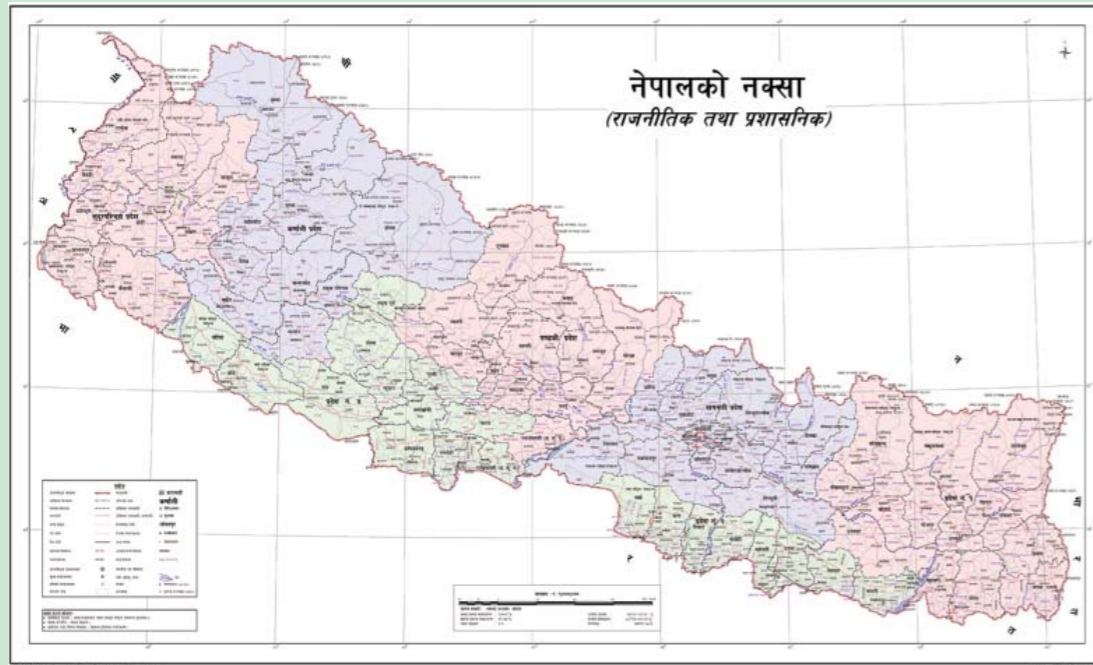


Non-Ruminants Production and Management



Government of Nepal
Ministry of Education, Science and Technology
Curriculum Development Centre
Sanothimi, Bhaktapur

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**Technical and Vocational Stream
Learning Resource Materials**

Non-Ruminants Production & Management (Grade 9)

**Secondary Level
Animal Science**



Government of Nepal
Ministry of Education, Science and Technology
Curriculum Development Centre
Sanothimi, Bhaktapur

Publisher: Government of Nepal
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Preface

The curriculum and curricular materials have been developed and revised on a regular basis with the aim of making education objective-oriented, practical, relevant and job oriented. It is necessary to instill the feelings of nationalism, national integrity and democratic spirit in students and equip them with morality, discipline and self-reliance, creativity and thoughtfulness. It is essential to develop in them the linguistic and mathematical skills, knowledge of science, information and communication technology, environment, health and population and life skills. It is also necessary to bring in them the feeling of preserving and promoting arts and aesthetics, humanistic norms, values and ideals. It has become the need of the present time to make them aware of respect for ethnicity, gender, disabilities, languages, religions, cultures, regional diversity, human rights and social values so as to make them capable of playing the role of responsible citizens with applied technical and vocational knowledge and skills. This Learning Resource Material for Animal Science has been developed in line with the Secondary Level Animal Science Curriculum with an aim to facilitate the students in their study and learning on the subject by incorporating the recommendations and feedback obtained from various schools, workshops and seminars, interaction programs attended by teachers, students and parents.

In bringing out the learning resource material in this form, the contribution of the Director General of CDC Dr. Lekhnath Poudel, Prof. Dr. D.K. Singh, Dr. Shambhu Sah, Dr. Yam Bahadur Gurung, Dr Kiran Pokharel Dr. Ganesh Gautam, Dr. Shishir Bhandari, dr. Sushila Shrestha, Dr. Garima Thapa, Dr. Bhumika Paudel is highly acknowledged. The book is written by Dr. Naresh Prasad Joshi and the subject matter of the book was edited by Badrinath Timsina and Khilanath Dhamala. CDC extends sincere thanks to all those who have contributed in developing this book in this form.

This book is a supplementary learning resource material for students and teachers. In addition they have to make use of other relevant materials to ensure all the learning outcomes set in the curriculum. The teachers, students and all other stakeholders are expected to make constructive comments and suggestions to make it a more useful learning resource material.

2076 BS

**Ministry of Education, Science and Technology
Curriculum Development Centre**

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Introduction

Zoological classification of poultry:

	Fowl / Chicken	Japanesequ ail	Turkey	Duck	Ostrich
Kingdom	Animalia	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata	Chordata
Subphylum	Vertebrata	Vertebrata	Vertebrata	Vertebrata	Vertebrata
Class	Aves	Aves	Aves	Aves	Aves
Subclass	Neornithes	Neornithes	Neornithes	Neornithes	Neornithes
Order	Galliforms	Galliforms	Galliforms	Ansariforms	Struthioniformes
Family	Phasianidae	Phasianidae	Meleagridae	Antidae	Struthionidae
Genus	Gallus	Cotunix	Meleagris	Anas	Struthio
Species	domesticus	Japonica	gallopavo	platychychos	camelus

Zoological clasification of swine

Kingdom – Animalia

Phylum – Chordata

Subphylum – Vertebrata

Class – Mammalia

Subclass – Utheria

Order – Ungulata

Suborder – Artiodactyles

Family – suidae

Genus – *Sus*

Species – vittatus, domesticus

Subspecies – *1. scrofa*

2. philipinesis

3. cristaqtus

4. strotzai

Scientific name of modern pig: *Sus domesticus*

Poultry industry in Nepal

- BS 2017 – First Hatchery at Parwanipur (inaugurated by king Mahendra) with around 1,000 New Hampshire poultry imported from the UK. (then other govt. farms at Khajura, Tarahara, Khumaltar, Pokhara etc.)
- Commercial poultry started from 2020s.
- BS 2037 first commercial hatchery in Kathmandu.
- BS 2047 first broiler hatchery in Chitwan (By Guna Chandra Bista)
- First poultry expo: BS 2052
- The First National Poultry Day was celebrated on 17 Poush 2070 (1st Jan 2014)
- **Government policy: Poultry policy 2068**
- **Production (2015):**
- Broiler chicks: 15 lakhs/week (6 lakhs from Chitwan)
- Layers chicks: 1lakhs/week
- **21,956 farms in 66 districts**
- 20,483 (93.29%) broiler farm, 1337 (6.09%) layers farm, 128 (0.58%) hatchery and 8 (0.04%) giriraj/koiler farm.
- **Major Production (chicken):** Chitwan – 10%, Kavrepalanchowk – 8%, Dhading-6%, Kathmandu – 5%, Kaski- 4%)
- **Major Production (Egg):** Chitwan -68%, Makwanpur – 5%, Nawalparasi-4%, Dang – 4%, Bhaktaur – 3%

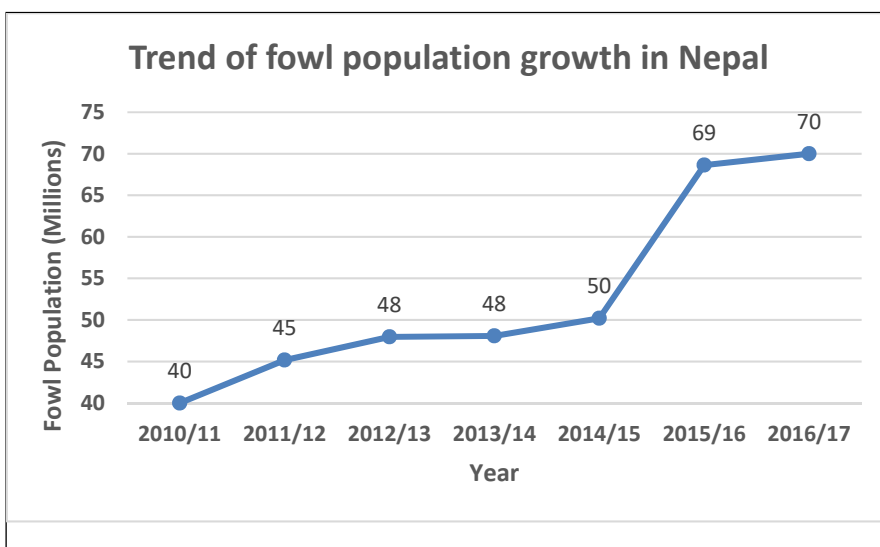
Table: Pig and poultry population in Nepal (2010/11 to 2016/17)

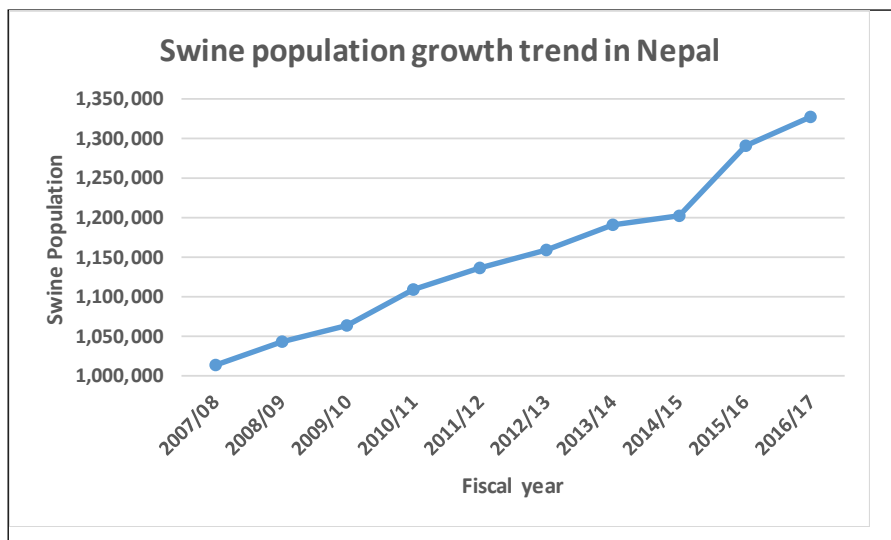
Table: Pig and Poultry population in different regions of Nepal (2015/16)*

	PIGS	FOWL	DUCK
E.MOUNTAIN	84,280	753,046	2,703
E.HILLS	318,036	3,052,033	15,908
E.TERAI	203,252	6,086,888	125,198
E. REGION	605,568	9,891,967	143,809

C.MOUNTAIN	21,781	1,290,393	7,443
C.HILLS	141,870	17,905,013	37,874
C.TERAI	80,515	20,352,118	62,469
C.REGION	244,166	39,547,524	107,786
W.MOUNTAIN	186	19,837	24
W.HILLS	113,800	6,275,210	47,615
W.TERAI	36,144	3,404,705	53,781
W. REGION	150,130	9,699,752	101,420
MW.MOUNTAIN	2,721	118,089	1,112
MW.HILLS	111,940	2,333,697	11,144
MW.TERAI	116,495	4,052,181	13,366
MW. REGION	231,156	6,503,967	25,622
FW.MOUNTAIN	4,202	141,578	1,061
FW.HILLS	5,364	270,751	926
FW.TERAI	50,722	2,575,099	11,631
FW. REGION	60,288	2,987,428	13,618
N E P A L TOTAL:	1,291,308	68,630,638	392,255

*MoAD, 2018





Pig Farming:

A pig is any of the animals in the genus *Sus*, within the even-toed ungulate family Suidae. Pigs include the domestic pig and its ancestor, the common Eurasian wild boar (*Sus scrofa*), along with other species (*ahoenobarbus*, *barbatus*, *cebifrons*, *oliveri*, *philippensis*). Pigs, like all suids, are native to the Eurasian and African continents. Pigs are highly social and intelligent animals. Pigs are omnivores and can consume a wide range of food. Biologically, pigs are very similar to humans, thus are frequently used for human medical research.

Domestic Pig:

The domestic pig (*Sus scrofa domesticus* or only *Sus domesticus*), often called swine, hog, or simply pig when there is no need to distinguish it from other pigs, is a domesticated large, even-toed ungulate. It is variously considered a subspecies of the wild boar or a distinct species. The domestic pig's head-plus-body-length ranges from 0.9 to 1.8 m (35 to 71 in), and the adult can weigh between 50 and 350 kg. Compared to other artiodactyls, its head is relatively long, pointed, and free of warts. Even-toed ungulates are generally herbivorous, but the domestic pig is an omnivore, like its wild relative. When used as livestock, domestic pigs are farmed primarily for the consumption of their meat called pork.

Zoological classification of pig:

Phylum: Chordata

Sub Phylum: Vertebra (with spinal column)

Class: Mammalia

Order: Artiodactyla (even toed hoofed)

Family: Suidae

Genus: *Sus* (2n=19)

Species: *scorfa* (wild pig found in Asia, Europe and America) *vittatus* (east Asia)

domesticus or *scorfa domesticus* (domestic pig/ domesticated *S. scorfa*)

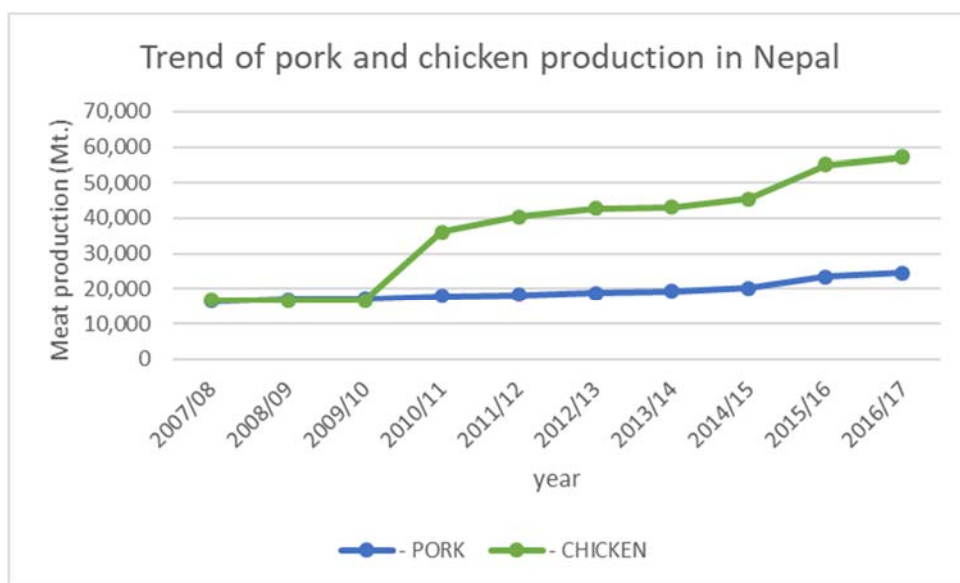
Swine industry in Nepal:

The total population of pig is 1.29 million (MoAD, 2017). The figure indicates that maximum number of pigs are concentrated in the eastern region which accounts for about 44% and lowest in the far-western region (< 5%) of Nepal. There is also preference of meat in different community. Certain tribes of people – Rai, Limbu, Magar, Sunuwar, Tamang, Majhi, Damai, Kami and Tharu Chaudhary etc, prefer pork (pig meat) more than meat from other animals. Pig meat has more demand in eastern Nepal and at urban centers however, pork production lacks far behind than buff, chevon and chicken. It shares only about 8% of national meat production.

Meat production status in Nepal (2016/17)*

Catogory	Production (Mt.)
BUFF	180080
MUTTON	2714
CHEVON	67706
PORK	24535

CHICKEN	57268
DUCK	241
TOTAL	332544



Poultry Farming:

Poultry are domesticated birds kept by humans for their eggs, meat or feathers. These birds are most typically members of the order Galliformes (birds with short wings and legs, toes adapted for scratching and running) and also form order Ansariformes (Aquatic birds, ducks and goose). Poultry also includes other birds that are killed for their meat, such as pigeons (*Columba livia* - Order: Columbiformes and Family: Columbidae). It also includes domesticated pheasants but does not include case birds such as parrots and other wild birds hunted for sport or food.

The domestication of poultry took place several thousand years ago. This may have originally been as a result of people hatching and rearing young birds from eggs collected from the wild, but later involved keeping the birds permanently in captivity. Selective breeding for fast growth, egg-laying ability, conformation, plumage and docility took place over the centuries, and modern breeds often look

very different from their wild ancestors. Although some birds are still kept in small flocks in extensive systems, most birds available in the market today are reared in intensive commercial enterprises.

Chicken is one of the most popular domesticated fowl in Nepal. The domesticated chicken originated from inter-mating between following four wild species a) The red jungle fowl (*Gallus gallus*); b) The ceylong jungle fowl (*Gallus lafayetti*); c) Gray jungle fowl (*Gallus sonneratti*); and d) Java jungle fowl (*Gallus varius*). The red jungle fowl inhabits in Nepal from the Terai foothills to upto 1,515 meters in the hills.

Poultry is the second most widely eaten type of meat globally and, along with eggs, provides nutritionally beneficial food containing high-quality protein accompanied by a low proportion of fat. However acceptance of chicken into the diet of Nepalese households has significantly increased over the last 4-5 decades. Rearing of chicken and consumption of chicken and chicken products are no more confined to certain ethnic groups but has been grown as an industry.

Poultry include several kinds of birds, such as chicken, ducks, geese, turkeys, and guinea fowls. Poultry production has many advantages for farmer who likes poultry and is industrious.

The advantages of poultry production are:

1. More food at less cost is the immediate requirement
2. Poultry require small space with modern confinement rearing. Poultry may produce in the backyards of cities and small towns, or on small farms.
3. The investment of poultry is relatively small. With many other types of agriculture, relatively large investments are required to start a business large enough to support a family.
4. One gets a profit much sooner from poultry than from many other farm products.
5. During periods when no work is available, it could prove profitable to consider a poultry farming operation since poultry readily adapts itself to a

full-time or part-time occupation, particularly for women, children or elderly people. A sizeable supplemental income may obtain from poultry production, even though the individual producer may have other employment.

6. Poultry is most efficient converter of low fiber feedstuff into highly nutritious, protective animal protein food. One and half-kilogram broiler can be produced on 3.25 to 3.63 kg. of food. Dozen eggs can be produced on 2.0 to 2.75 kg of feed.
7. Feed-by products and industrial waste can be diverted into poultry feed changes for efficient utilization.
8. Poultry may be considered a soil-building enterprise. Poultry manure is high in nitrogen and phosphorus than the manure from other livestock. By practicing confinement rearing, poultry manure can be saved and applied to the soil.
9. Farmers experience crop failure due to unfavorable weather condition, but poultry raising is not subject, in the same way, to losses associated with droughts or floods. Income from laying flock and from broiler production is distributed throughout the year. All of the income does not come once or twice during the year. This makes it easier to operate the family budget.

Problems in poultry production

The production of poultry birds, and eggs involves many problems. Certain limiting factors may be encountered.

1. **Disease and parasite problems:** While poultry birds are normally healthy, they are subjected to many disease and parasite. Losses may be heavy if proper methods of prevention and treatment have been followed.
2. **Problems in feeding and management:** Feed costs may become excessive and enterprise unprofitable, if the birds are not fed balanced rationing proper amounts. Housing, ventilation, disease and labor problems may also affect the profit from the enterprise.

3. **Problem in marketing:** the market influences the profit from the poultry enterprise. Eggs, broiler, ducks and turkeys bring more money during certain seasons.
4. **Selection of chicks, poults, and mature birds:** It takes well-bred stock to give profitable production. Chicks must be bred and selected according to the use to be made of them. The laying hens must be carefully culled, and birds used in breeding must be carefully selected from good laying stains.
5. **Size of enterprise:** The fact that a chick, hen, turkey or duck is short-lived and requires only a small investment may cause the production to become careless. The larger the unit, the more important it is to give the enterprise the care and management, which it should receive.
6. **Finance:** Specialized poultry farms require a large number of birds capable of efficient production; hence capital can be an important item on large farms.
7. **Surplus production:** Improvement in production efficiency may bring about surpluses. Producers must control production to maintain a satisfactory market.
8. **Quality of products:** Poultry products must compete with other food Products in the consumer market. Products of poor quality cause a loss of market, as the consumer becomes more quality conscious.

Scope of poultry

Poultry farming have emerged as a major income generating enterprise in agriculture sector over the last three and a half decades. Today, poultry production has become one of the most rapidly growing enterprises within the reach of the poor, women, marginal farmers and entrepreneurs, considering the trends of population growth, urbanization, road access, transportation linkages, increasing awareness on nutrition and growing demands for consumer products, it will be safe to assume that poultry sector will constantly grow in a foreseeable future. In addition, since poultry farming are within the reach of all classes of society, including women and marginal farmers, it could become one of the government's

strategic activities for poverty reduction and for reaching the most disadvantaged socio-economic groups, including women in the country.

Advantages of pig raising in Nepal

1. Pig is an efficient converter of concentrates into meat.
2. Quick and net high returns because of 6 months of market age.
3. Rapid expansion of enterprise than cattle buffalo, sheep and goat.
4. Relatively less investment on equipment's, sheds, herd.
5. Exotic breeds being more prolific may produce two litters per year and about 8 to 12 piglets per farrowing.
6. Highest fat storing ability as such no animal equals in this characteristic.
7. Pigs are efficient converters of many by products and feeds into pork.
8. Feed conversion ratio is most efficient in pig compared to other livestock. They need less feed per kg gain of body weight.
9. Pig requires less roughage and hence a small acreage of pasture for growing and fattening pigs.
10. Requirement of labor in pig production is low because pig are adapted to both self feeding as well as full feeding.
11. Fluctuations in prices of market hogs are less during the year.
12. Hogs have high dressing percentage (60 – 80 %) and are usually in demand, pig produces 65 to 80% of meat from feed consumed.
13. Hog meat is well suited to curing and smoking.
14. Pigs can very well utilize the kitchen garbage and left out feed articles of other livestock.
15. Pig skin are used for light leather goods.
16. More meat can be produced from pig per unit of time and cost.
17. Pork has higher energy due to higher fat content and slightly lower water content.

18. Nonrecurring expenses are relatively less.
49. Initial investment in setting up a piggery unit is very low.
20. By products of pig industry such as skin, bristles, teeth and hoofs etc. are increasing in demand.
21. More flexibility and expansion ability of enterprise due to most prolific and quick growing animals.
22. Pork is relatively richer in phosphorus and iron content.
23. Source of animal protein.
24. Conversion of inedible feeds to edible food.

Disadvantages of Pig Farming:

1. Utilization of large percentage of concentrates
2. Have direct competitions for cereals with human being.
3. Pasture are spoiled and rendered unsuitable for other livestock.
4. More problem of parasite infestation through pigs.
5. Control of diseases needs much time and labour.
6. Great variation in demand of pork in market.
7. More need of labour at farrowing time.
8. Have religious taboo.
9. Pigs not generally used for meat purpose by majority of meat eaters.

Scope of swine farming

Despite the fact that the swine rearing is a profitable enterprise most of the progressive farmers even today hesitate to adopt it due to prejudice sentiments in our society against pig farming. For many others there is religious taboo against pig. A majority of meat eaters also do not consume pork. In spite of these drawbacks, the consumption of pig meat has greatly increased in recent years due to nutritional awareness in people. Pig is highly prolific breeder and cheap source

of protein. High fertility in pigs gives an assured income to rearer round the year. Pork as source of animal protein is gaining popularity and pork products will be in greater demands in year to come.

The successful poultry man is very careful in buying chicks and birds for his breeding or laying flock, for these chicks are the foundation for the poultry enterprise. The poultry enterprise is something like a multi-story building. The building is no better than its foundation. If it is built on a poor foundation, the building is weak, requires considerable upkeep, and is a poor investment. Good feeding, housing, and disease control may compensate in part for poor foundation stock, but for maximum profits you must begin with good stock.

Carcass yield of pigs has been known to be highest among food animals. The high carcass yield would attract the farming community because of the better monetary return within the shortest possible time. Improvement in the pork quality apart from increasing pork yield would make the pigs more economical to rear. To bring about improvement in the productivity of pork and other piggery products, extensive crossbreeding program has been taken up to develop animals large size, better feed conversion efficiency, high dressing percentage and quality pork. Consequently a number of piggeries have come up where hogs are being raised in modern conditions such a program if encouraged would help in controlling the rising prices of mutton/chevon etc. It is hoped that swine development will go a long way in solving protein hunger prevailing in our country.

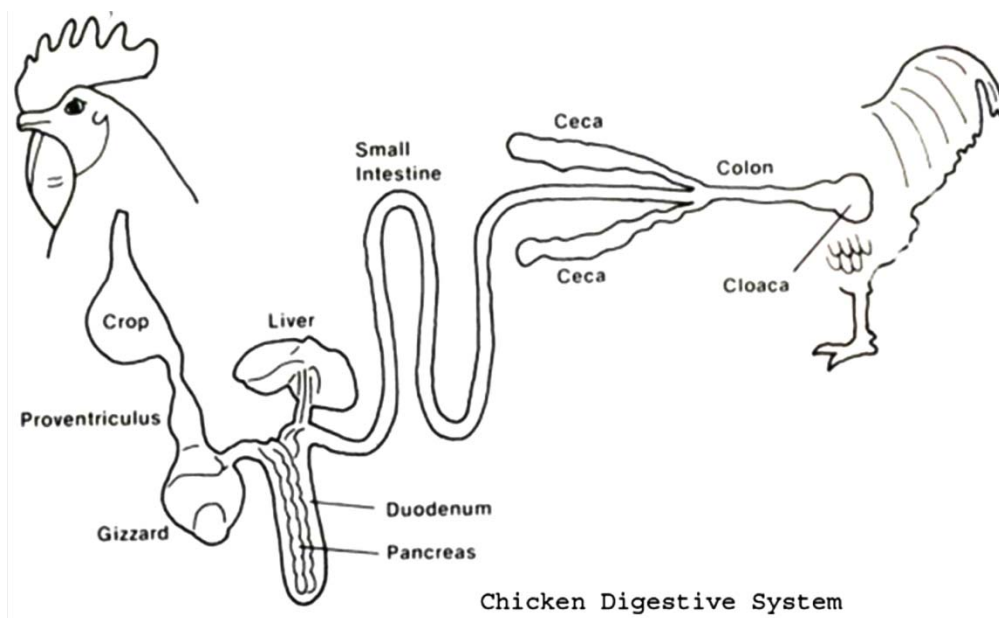
Differentiate between ruminants and non ruminants

S.No.	Ruminants	Non ruminant
1	Ruminant animals are mostly <u>herbivorous</u> .	Non ruminants include most of the <u>carnivores, omnivores,</u>
2	Complex stomach with 4 compartments	Simple stomach
3	Do not produce enzymes for digestion	Produce enzymes for digestion
4	Have two blunt canines	Have 4 sharp canines
5	Undergo regurgitation	Do not undergo regurgitation
6	Produce more saliva without carbohydrate digestive enzymes.	Produce less saliva with carbohydrate digestive enzymes.

7	Premolars and molars move in lateral direction	Premolars and molars move in vertical direction
8	Longer time to digest plant materials	less time to digest
9	Digest all plant carbohydrates including cellulose	Do not digest cellulose

2. Physiology of non-ruminants:

Digestive system of Poultry:



Parts of Digestive tract of Poultry:

1. Mouth

As with most birds, a chicken obtains feed by using its beak. Food picked up by the beak enters the mouth. Chickens do not have teeth, so they cannot chew their food. However, the mouth contains glands that secrete saliva, which wets the feed to make it easier to swallow. Also, the saliva contains enzymes, such as amylase, that start the digestion process. The chicken uses its tongue to push the feed to the back of the mouth to be swallowed.

2. Esophagus

The esophagus is a flexible tube that connects the mouth with the rest of the digestive tract. It carries food from the mouth to the crop and from the crop to the proventriculus.

3. Crop

The crop is an out-pocketing of the esophagus and is located just outside the body cavity in the neck region. Swallowed feed and water are stored in the crop until they are passed to the

rest of the digestive tract. When the crop is empty or nearly empty, it sends hunger signals to the brain so that the chicken will eat more. Although the digestive enzymes secreted in the mouth began the digestion process, very little digestion takes place in the crop—it is simply a temporary storage pouch. The crop evolved for birds that are typically hunted by other animals but need to move to the open to find feed. These birds can consume relatively large amounts of food quickly and then move to a more secure location to digest that food.

4. Proventriculus

The esophagus continues past the crop, connecting the crop to the proventriculus. The proventriculus (also known as the true stomach) is the glandular stomach where digestion primarily begins. Hydrochloric acid and digestive enzymes, such as pepsin, are added to the feed here and begin to break it down more significantly than the enzymes secreted by the salivary glands. At this point, however, the food has not yet been ground—this organ is called the proventriculus because its location in the digestive tract is before the ventriculus, where food is ground

5. Gizzard

The gizzard or ventriculus is a part of the digestive tract of birds, reptiles, earthworms, and fish.

Often referred to as the mechanical stomach, the gizzard is made up of two sets of strong muscles that act as the bird's teeth and has a thick lining that protects those muscles. Consumed feed and the digestive juices from the salivary glands and

proventriculus pass into the gizzard for grinding, mixing, and mashing.

6. Small Intestine

The small intestine is made up of the duodenum (also referred to as the duodenal loop) and the

Lower small intestine. The remainder of the digestion occurs in the duodenum, and the released

nutrients are absorbed mainly in the lower small intestine. The duodenum receives digestive enzymes and bicarbonate (to counter the hydrochloric acid from the proventriculus) from the pancreas and bile from the liver (via the gall bladder). The digestive juices produced by the pancreas are involved primarily in protein digestion. Bile is a detergent that is important in the digestion of lipids and the absorption of fat-soluble vitamins (A, D, E, and K). The lower small intestine is composed of two parts, the jejunum and the ileum. The Meckel's diverticulum marks the end of the jejunum and the start of the ileum. The Meckel's diverticulum is formed during a chicken's embryonic stage. In the egg, the yolk sac supplies the nutrients needed for the embryo to develop and grow. Right before hatch, the yolk sac is taken into the navel cavity of the embryo. The residual tiny sac is the Meckel's diverticulum.

Ceca

The ceca (plural form of *cecum*) are two blind pouches located where the small and large intestines join. Some of the water remaining in the digested material is reabsorbed here. Another important function of the ceca is the fermentation of any remaining coarse materials. During this fermentation, the ceca produce several fatty acids as well as the eight B vitamins (thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, biotin, folic acid, and vitamin B12). Because the ceca are located so close to the end of the digestive tract, however, few of the produced nutrients are absorbed and available to the chicken.

Large Intestine (Colon)

Despite the name, the large intestine is actually shorter than the small intestine.

The large intestine is where the last of the water reabsorption occurs.

Cloaca

In the cloaca, the digestive wastes mix with wastes from the urinary system (urates). Chickens usually void fecal material as digestive waste with uric acid crystals on the outer surface—that is, chickens do not urinate. The color and texture of chicken fecal material can indicate the health status of the chicken's digestive tract: the white, pasty material coating chicken fecal material is uric acid, the avian form of urine, and is normal.

The reproductive tract also exits through this area. When a hen lays an egg, the vagina folds over to allow the egg to leave through the cloaca opening without coming into contact with feces or urine.

Digestive system of Pig:

The pig has a digestive system which is classified as monogastric or nonruminant. Humans also have this type of digestive system. They have one stomach (mono=one, gastric=stomach). The monogastric differs from that of a polygastric or ruminant digestive system found in cattle and sheep. These animals have one stomach broken into four compartments. Due to the differences in the digestive systems, cattle can utilize different types of feeds than pigs. Cattle and sheep can live on hay and pasture, while pigs must eat grains that can be digested more easily. Digestion is the break-down of food occurring along the digestive tract. The digestive tract may be thought of as a long tube through which food passes. As food passes through the digestive tract, it is broken down into smaller and smaller units. These small units of food are absorbed as nutrients or pass out of the body as urine and feces. The digestive tract of the pig has five main parts: the mouth, esophagus, stomach, and small and large intestines. The following discussion explains how each part digests nutrients. The mouth is where food enters the digestive tract and where mechanical breakdown of food begin.

The teeth chew and grind food into smaller pieces. Saliva, produced in the mouth, acts to soften and moisten the small food particles. Saliva also contains an enzyme which starts the digestion of starch. The tongue helps by pushing the food toward

the esophagus. The esophagus is a tube which carries the food from the mouth to the stomach. A series of muscle contractions push the food toward the stomach. Swallowing is the first of these contractions. At the end of the esophagus is the cardiac valve, which prevents food from passing from the stomach back into the esophagus. The stomach is the next part of the digestive tract. It is a reaction chamber where chemicals are added to the food. Certain cells along the stomach wall secrete hydrochloric acid and enzymes. These chemicals help break down food into small particles of carbohydrates, protein, and fats. Some particles are absorbed from the stomach into the bloodstream. Other particles which the stomach cannot absorb pass on to the small intestine through the pyloric valve. The small intestine is a complex tube which lies in a spiral, allowing it to fit in a small space. Its wall has many tiny finger-like projections known as villi, which increase the absorptive area of the intestine. The cells along the small intestine's wall produce enzymes that aid digestion and absorb digested foods. At the first section of the small intestine (called the duodenum) secretions from the liver and pancreas are added. Secretions from the liver are stored in the gall bladder and pass into the intestine through the bile duct. These bile secretions aid in the digestion of fats. Digestive juices from the pancreas pass through the pancreatic duct into the small intestine. These secretions contain enzymes that are vital to the digestion of fats, carbohydrates, and proteins. Most food nutrients are absorbed in the second and third parts of the small intestine, called the jejunum and the ileum. Undigested nutrients and secretions pass on to the large intestine through the ileocecal valve. A "blind gut" or cecum is located at the beginning of the large intestine. In most animals, the cecum has little function. However, in animals such as the horse and rabbit, the cecum is very important in the digestion of fibrous feeds. The last major part of the digestive tract, the large intestine, is shorter, but larger in diameter than the small intestine. Its main function is the absorption of water. The large intestine is a reservoir for waste materials that make up the feces. Some digestion takes place in the large intestine. Mucus is added to the remaining food in the large intestine, which acts as a lubricant to make passage easier. Muscle contractions push food through the intestines. The terminal portion of the large intestine is called the rectum.

The anus is an opening through which undigested food passes out of the body. Food that enters the mouth and is not digested or absorbed as it passes down the digestive tract is excreted through the anus as feces. This was a general discussion of the digestive tract of the pig. The tract acts to digest and absorb nutrients necessary for maintenance of cells and growth. Efficient absorption of nutrients depends on each segment of the digestive system functioning to its maximum capacity.

Mouth: The mouth serves a valuable role not only for the consumption of food but it also provides for the initial partial size reduction through grinding. While teeth serve the main role in grinding to reduce food size and increase surface area, the first action to begin the chemical breakdown of food occurs when feed is mixed with saliva. There are three main salivary glands, which include the parotid, mandibular and sub-lingual glands. Saliva secretion is a reflex act stimulated by the presence of food in the mouth. The amount of mucus present in saliva is regulated by the dryness or moistness of the food consumed. Thereby in a dry diet, more saliva mucus is secreted while in a moist diet, only an amount to assist with swallowing is secreted. Saliva generally contains very low levels of amylase, the enzyme that hydrolyses starch to maltose.

Stomach:

The stomach is a muscular organ responsible for storage, initiating the breakdown of nutrients, and passing the digesta into the small intestine. The stomach has four distinct areas which include the oesophageal, cardiac, fundic and pyloric regions. The oesophageal region is located at the entrance of the stomach from the oesophagus. This region of the stomach does not secrete digestive enzymes but has significance in that this is where ulcer formation in pigs occurs. Irritation in this area due to fine particle size, stress or other environmental factors can contribute to ulcer formation in swine. Once food passes through this region, it enters the cardiac region.

In the cardiac portion of the stomach, mucus is secreted and mixed with the digested food. Food then passes into the fundic region which is the first major

portion of the stomach that begins the digestive process. In this region, gastric glands secrete hydrochloric acid, resulting in a low pH of 1.5 to 2.5. This reduced pH kills bacteria ingested with the feed. Other secretions in this region are present in the form of digestive enzymes, specifically pepsinogen. Pepsinogen is then broken down by the hydrochloric acid to form pepsin, which is involved with the breakdown of proteins.

Finally the digesta moves to the bottom of the stomach, which is the pyloric region. This region is responsible for secreting mucus to line the digestive membranes to prevent damage from the low pH digesta as it passes to the small intestine. The pyloric sphincter regulates the amount of chyme (digesta) that passes into the small intestine. This is an important function not to overload the small intestine with chyme so proper and efficient digestion and absorption of nutrients occurs. In addition, once the chyme leaves the stomach, the material is quite fluid in consistency.

Small Intestine:

The small intestine is the major site of nutrient absorption, and is divided into three sections. The first section is the duodenum. The duodenum is approximately 12 inches long and is the portion of the small intestine that ducts from the pancreas and the liver (gall bladder). The pancreas is involved with both exocrine and endocrine excretions. This means the pancreas is responsible for secretion of insulin and glucagon in response to high or low glucose levels in the body. In addition, it has exocrine functions of secreting digestive enzymes and sodium bicarbonate.

The digestive enzymes secreted break down (hydrolyse) proteins, fats, and carbohydrates in the chyme. In addition, the sodium bicarbonate serves a vital role to provide alkalinity so chyme can be transported through the small intestine without causing cell damage because of the low pH after leaving the stomach. The pancreas serves as the most vital organ in the digestive process for producing and secreting enzymes needed for the digestion of chyme and the prevention of cell damage due to pH.

In addition to the pancreas secreting into the duodenum, bile, which is stored in

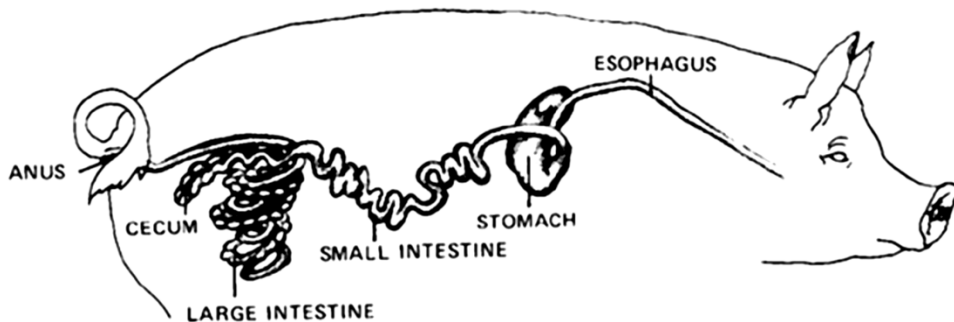
the gall bladder and produced by the liver, is secreted as well. Bile salts, which are the active portion of bile in the digestion process, primarily assist in the digestion and absorption of fat but also help with absorption of fat-soluble vitamins and aids pancreatic lipase in the small intestine. Finally, bile salts are necessary for the absorption of cholesterol, which takes place in the lower small intestine and are circulated to the liver via the portal vein. The second and third parts of the small intestine are jejunum and ileum where most food nutrients are absorbed.

Large Intestine:

The large intestine or hindgut encompasses four main sections. First, digesta from the small intestine passes into the caecum. The caecum has two sections, first a section that has a blind end, where material cannot pass through. The caecum has a second portion where it connects to the colon, where digesta is passed to the rectum and anus where the remaining digesta is excreted.

The main function of the large intestine is the absorption of water. The chyme that passes through the small intestine and into the large intestine initially is very fluid. The large intestine epithelium has a large capacity for water absorption.

MONOGASTRIC DIGESTIVE TRACT



Reproductive System of Poultry:

The avian **reproductive system** is heterosexual and requires both a male and a female, each to contribute half of the genetic constitution of the offspring. The male contributes his half by way of the sperm produced by the testes and carried in the semen. The female contributes hers in the ovum carried by the egg yolk

produced by the ovary. After release from the follicle on the ovary, the yolk moves into the oviduct where it is fertilized and has added to it the albumen, shell membranes and shell.

Male reproductive system

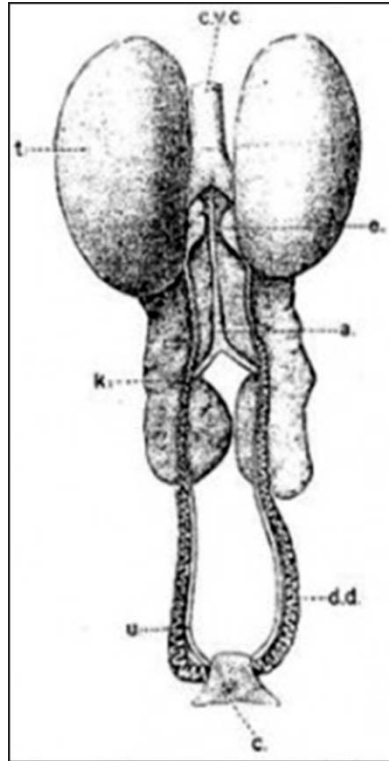
The male reproductive organs consist of two testes, each with a deferent duct that leads from the testes to the cloaca. The testes are bean shaped bodies located against the backbone at the front of the kidney. Their size is not constant and they become larger when the birds are actively mating. The left testis is often larger than the right. On the inside of each as they are located in the body cavity is a small, flattened area that is believed to correspond to the epididymis of mammals. The deferent duct starts at this flattened area.

Deferent duct

The deferent duct transports the sperm from the testes where they are formed to the cloaca from which they enter the oviduct of the female when mating. The deferent duct enters a small pimple like structure in the cloaca. The deferent duct is quite narrow at first but widens as it approaches the cloaca.

Testes

In the testes very twisted tubes called seminiferous tubules are found. The sperm carry half of the total chromosomes required to produce an embryo. The testes also produce hormones called androgens that influence the development of what are called secondary sex characteristics such as comb growth and condition, male behavior and mating.



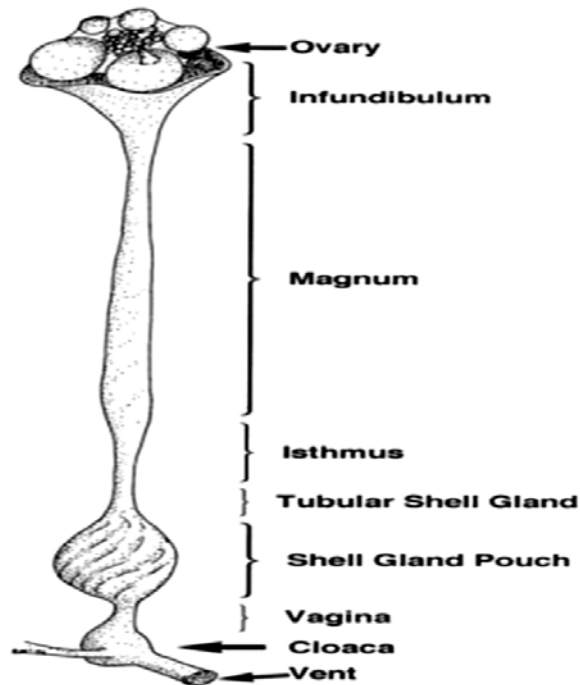
The urinary and reproductive organs of the male chicken

Female reproductive system

The female reproductive consists of the ovary and the accompanying oviduct. While the female embryo chicken has two sets of reproductive organs, only one of these, the left survives and reaches maturity to produce eggs.

Ovary

The ovary consists of a mass of yellowish, rounded objects called follicles, each containing an ovum or yolk. The size of the follicles will vary from very small to those approaching the normal yolk size in the egg – up to 40 millimetres in diameter and containing a fully matured yolk ready for release into the oviduct.



Yolk

It takes approximately 10 days for a yolk to develop from the very small to the normal size found in eggs and during this time it is contained in the follicle. The follicle acts as a sack during this period of development supplying it with the nutrients required for its growth. When a mature follicle is examined an elongated area virtually free of blood vessels will be found on the distal surface of it. This area, called the stigma, is where the follicle normally splits to release the yolk into the oviduct. If, for some reason, the follicle splits at other than the stigma, the numerous blood vessels that rupture will result in free blood being found in the egg i.e. a blood spot will form.

Oviduct

The function of the oviduct is to produce the albumen, shell membranes and the shell around the yolk to complete the egg. It is a long tube well supplied with blood via numerous blood vessels. There are many glands found in its walls that produce the albumen, the shell membranes and the shell. The oviduct consists of five distinct parts or sections, each having different functions:

1. **Infundibulum (or funnel):** located adjacent to the ovary and with long segments enclosing the ovary, the infundibulum collects the yolk after its release from the follicle as a funnel and directs it into the oviduct. This section has very thin walls and is 6-9 centimetres long. Fertilisation of the ovum by the male sperm occurs here.
2. **Ampulla or magnum:** at approximately 40 centimeters long it secretes more than 40% of the albumen.
3. **Isthmus:** at about 12 centimeters in length, it secretes some albumen and the shell membranes.
4. **Uterus or shell gland:** at approximately 12 centimeters in length it secretes about 40% of the albumen and the egg's shell.
5. **Vagina:** at approximately 12 centimeters in length, it secretes the egg's outer cuticle and possibly the shell pigment.

The formation of the hen's egg

- The normal egg consists of the following major parts:
- Yolk carrying the ovum – produced by the ovary
- Albumen or white – produced mainly in the magnum
- Shell membranes – produced in the isthmus
- Shell – produced in the uterus or shell gland

Ovary and yolk formation

The ovary is attached to the abdominal cavity wall by the meso-ovarian ligament. It carries anything from 2000 to 12000 small ova in miniature follicles on its surface, plus hormone producing cells in its body. Not all of the ova found on the immature ovary develop and only approximately 200 to 350 reach maturity under normal modern commercial practice. Each yolk or ova takes about 10 days to grow and reach maturity when it is approximately 31% of the weight of the egg.

The yolk is laid down in concentric rings of darker and lighter colored material, the color being produced by xanthophylls that are yellow/orange/red pigments

occurring in many plants, plant products and other naturally occurring materials.

The yolk is contained in a very thin, transparent membrane called the vitelline membrane. On ovulation the yolk is released and enters the oviduct where, as it passes along that organ, fertilization occurs and the remaining parts of the egg are added around it. The yolk is located on the ovary held in a sack called the follicle. The follicle, while being quite thin walled, is extremely well supplied with blood vessels.

Yolk development in the **maturing pullet** is initiated by follicle stimulating hormone (**FSH**) produced by the anterior lobe of the pituitary gland. The appropriate signal for this development comes from hormones– estrogen, progesterone and testosterone produced by the ovary after receiving the signal of the Follicle Stimulating Hormone. These ovarian hormones also provide the stimulus for the formation of the development of the oviduct.

Oviduct

The remainder of the egg i.e. the albumen, the shell membranes and the shell are produced by different segments of the oviduct. These segments are:

- Infundibulum
- Magnum or ampulla
- Isthmus
- Uterus or shell gland
- Vagina
- Cloaca

In the egg laying hen the oviduct is a tube like organ consisting of the previously named segments with one end lying adjacent to the ovary and the other entering the vent. It is approximately 70 centimeters long and is very glandular. The glands of the different segments produce the remaining different parts of the egg. Oviduct is well supplied with blood vessels.

Infundibulum

This segment is funnel shaped and lies adjacent to the ovary. It is up to 9 centimeters long in the laying hen and has the function of searching for and engulfing the yolk that has just been released from the follicle into the adjacent ovarian pocket or body cavity. The yolk remains in the infundibulum for about 15 minutes and it is in the infundibulum that fertilization takes place.

Magnum or ampulla

The magnum is the longest segment at up to 40 centimeters long. Its function is to add approximately 40% of the albumen to the developing egg that takes about three hours to move through. There are four different types of albumen in the normal egg:

The **chalazae** are two twisted chords of albumen extending from the opposite sides of the yolk into the remaining albumen in the broken out egg. These two cords extend into the ends of the egg along the longitudinal axis and are parts of a very thin envelope of special albumen that surrounds the yolk and holds it in its position. While the bird produces only dense albumen, as the egg moves along the oviduct, water is added thus making **liquid albumen**. The rotation of the developing egg causes the albumen to separate into different layers – the inner liquid and the **dense layers**. The outer liquid layer is caused by the addition of more water when in the uterus. The dense layer contains significant amounts of mucin that binds it together in a jelly like form.

Isthmus

The isthmus is approximately 12 centimeters long and has the functions of adding approximately 20% of the albumen and the shell membranes to the egg. There are two shell membranes:

- The inner shell membrane – laid down first
- The outer shell membrane – laid down last and about three times the thickness of the inner membrane

The isthmus takes approximately 75 minutes to carry out its tasks. While the egg

is still in the oviduct the shell membranes appear as one over the total surface of the egg so close are they associated with each other. The shell membranes consist of a fibrous protein material and act as a barrier to the penetration into the egg by bacteria and fungi.

The isthmus also lays down the foundation for the shell by forming the first **crystals of calcium** carbonate on the outer shell membrane.

Uterus (shell gland) and eggshell quality

The uterus is a relatively short, bulbous gland up to 12 centimeters in length. The developing egg remains in the uterus for 18-20 hours while approximately 40% of the albumen and all of the shell is added. It is for this reason that the organ is often called the shell gland. Shell formation really begins by the deposition of small clusters of calcium carbonate crystals onto the outer shell membrane while in the isthmus. These are the initiation grains for the subsequent calcium carbonate deposition in the uterus. The shell of an egg is formed in two layers:

1. Mammillary layer: a sponge like layer composed of soft calcite crystals (CaCO₃). This layer is the inner layer.
2. Palisade layer: formed of columns of hard calcite crystals – the longer the columns the stronger the shell. This layer is the outer layer.

The hen uses approximately 2.5 grams of calcium in the formation of one normal egg. The carbonate ions go with the calcium to form the calcium carbonate of the egg's shell come from the blood and from the shell gland. If anything should interrupt the supply of carbonate, thin-shelled eggs will result.

Vagina

The vagina is about 12 centimeters in length. While not known for sure, it may have the function of adding pigment to the outer shell to provide the egg with its color.

Cloaca

The egg is held in the cloaca immediately prior to being laid. It may be in the

cloaca for several hours, but usually is held there for a much shorter time. Although the egg usually enters this organ small end first, it usually rotates there to be laid large end first. However, if the bird should be startled at this time the egg may be forcibly expelled small end first.

The Process of Egg Formation

The formation of an egg is a remarkable process that takes just over a day, from ovulation to oviposition. The reproductive tract begins with a mature ovum, which is a bare yolk and germinal disc, and constructs a hard shelled egg, complete with its own protective membranes and the necessary nutrients for the developing embryo.

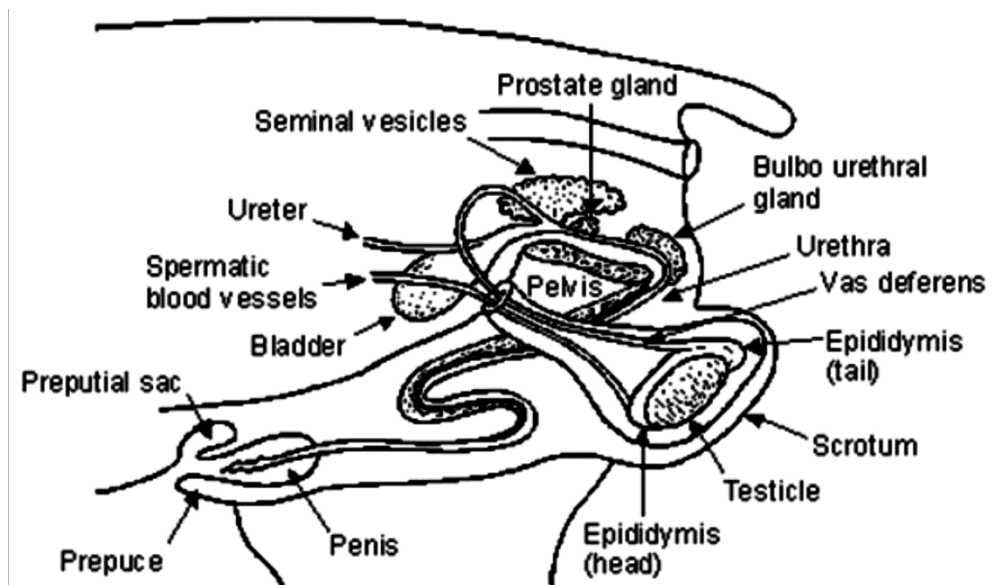
Major Events in Egg Formation

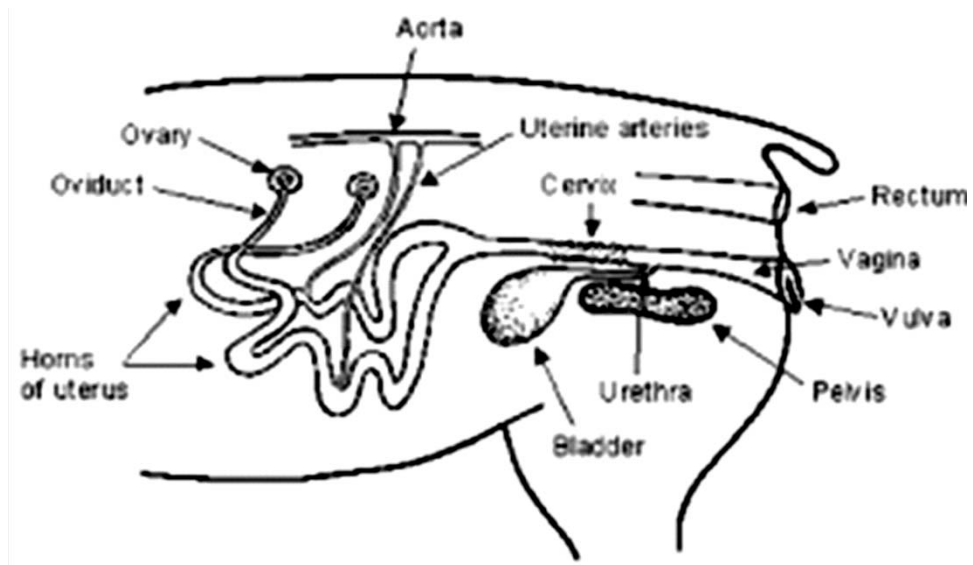
Ovulation is the release of an ovum from a ruptured follicle. The ovum drops into the ovarian pocket and within a few minutes is captured by the infundibulum. Ovulation generally occurs about a half an hour after the previous egg has been laid. Fertilization occurs in the infundibulum, which stores sperm for seven to fourteen days following insemination. Formation occurs as the egg travels down the oviduct and is encased in the various layers that make up a chicken egg. Oviposition is the laying of the egg. The uterus (or shell gland) contracts, forcing the egg out through the vent. Though the egg travels through the oviduct small end first, it is laid large end first.

Egg Formation Timeline

Section of oviduct	Time spend	Functions
Funnel (infundibulum)	15 min	Receives yolk from ovary. If live sperm present, fertilization occurs here (commercially produced table eggs are not fertilized)
Magnum	3 hrs	Albumen (white) is secreted and

		layered around
Isthmus	1 hr	Inner and outer shell membranes are added, as are some water and mineral salts
Shell gland (uterus)	20-21 hrs	Initially some water is added, making the outer white thinner. Then the shell material (mainly calcium carbonate) is added. Pigments may also be added to make the shell brown
Vagina/cloaca	less than 1 min	The egg passes through this section before laying. It has no other known function in the egg's formation.





Reproductive system of male pig:

The male pig's reproductive system is comprised of the testes, the epididymes, the ampullae and the seminal vesicles, all of which are paired. In addition there is the prostate gland, the bulbo-urethral glands and the penis.

Testes

The testes are the primary organs of reproduction in the male pig and they are responsible for producing hormones and sperm. They are contained in the scrotum and are comprised of a complex network of ducts known as seminiferous tubules.

Urethra and Penis

The urethra is a canal that runs from the bladder to the end of the penis which consists of the root, shaft and glans. Both semen and urine are excreted via the urethra. Semen is formed when seminal plasma joins with sperm and is transported through the urethra during ejaculation. In the pig, the average number of sperm per ejaculation is a whopping 8,000 million compared to 280 million in humans.

Reproductive system of female pig:

Reproductive success is measured primarily by pigs produced per sow per year

and is dependent upon both farrowing rate and litter size. In order to achieve optimal reproductive rates, both the anatomical and physiological workings of the reproductive system must function properly. A basic understanding of the anatomical and physiological function of the female pig reproductive system can aid producers in anticipating and troubleshooting reproductive problems, and in facilitating decisions which impact performance of the breeding herd. This article introduces the reader to the anatomy and physiology of female reproduction and how this acts to enhance or inhibit performance.

The female reproductive tract is composed of paired right and left ovaries, oviducts, and uterine horns. It contains only a single cervix, vagina and vulva (external genitalia). Collectively, these structures are supported by the broad ligament and hang loosely suspended below the rectum in the both pelvic canal and lower abdomen. The broad ligament is made of tough connective tissue, attaching near the point of the spine, and running continuously with the inner most layer of the abdominal cavity. Many of the blood vessels and nerves travel through this large piece tissue in order to supply the reproductive tract with blood, hormones and neural stimuli. In prepubertal gilts, the ligament is short, paper thin, and almost transparent. However, in late pregnancy it becomes very long as it stretches and thickens in order to support the increasing weight of the pregnant reproductive tract.

Ovary

The ovary of the pig is primarily important because it is the source for both reproductive hormones and eggs. The ovary is particularly responsive to important hormones that are released from other organs, especially those of the pituitary. The pituitary is located near the base of the brain and is the source of Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH). It is these two hormones which are responsible for initiating and stimulating the ovary to become active in order to begin reproduction.

Oviduct

The oviduct is a short convoluted tube that connects the ovary to the uterus. This

short tube is very important since it must propel the eggs in one direction and the sperm in the opposite direction. Fertilization takes place in the mid portion of the tube, called the ampulla. Most of the eggs reach the site of fertilization within 30 min to 1 h after ovulation. The eggs will remain viable and fertilizable in the tube for approximately 8-12 h after ovulation. Therefore it is important that insemination occur prior to ovulation so that sperm are waiting for the egg.

Uterus

The uterus is the largest single portion of the female reproductive tract and is capable of considerable change in size from the non-pregnant to the pregnant state. The uterus is composed of paired uterine horns with the cervix at one end and the oviducts at the other. The uterus has four layers, an inner most layer which is glandular, two additional inner layers which are muscular, and the fourth layer, which forms the outer surface. The large muscle layers are important for propelling sperm to the oviduct, moving and spacing embryos before attachment, and for delivery of piglets at farrowing. These layers are responsive to many of the reproductive hormones and how and when contractions will occur depend upon which hormones are present. The other important layer is the inner most glandular layer which produces and secretes hormones and nutrients for the developing embryos.

Cervix

The cervix is approximately one inch in diameter and about 6-8 inches in length, and connects the vagina and the uterus. It is made of tough connective tissue and contains limited amounts of glandular and muscular tissue. It contains a series of five interdigitating pads which provide pressure points for locking of the penis (or AI catheters). Its primary functions are to serve as a locking mechanism for the penis. The cervix is also a flexible structure and can open and close under the influence of hormones. The cervix is important for protecting the fetuses and will remain tightly closed except at estrus and at farrowing, when it will dilate to accommodate the boar's penis and to allow passage of the piglets through the birth canal. The cervix is also the primary source of mucus. Under estrogen stimulation,

such as that which occurs at estrus, the mucus becomes watery and can sometimes be seen seeping from the vulva. This mucus serves as a lubricant for the penis of the boar. Under progesterone stimulation during pregnancy, the cervical mucus will thicken and form a plug to prevent any contaminants from entering the sterile uterine environment. This cervical plug will dissolve just prior to farrowing.

Vagina

The vagina is approximately 12-18 inches long and connects the cervix to the external genitalia of the pig. There is limited muscular and glandular tissue in the vagina and it serves primarily as a copulatory organ for the boar and as a passageway from the uterus to the outside. The vagina does have some immunoprotectant function since antibodies such as IgA are present to prevent any uterine contamination. The pH of the vagina is also acidic and is unfavorable to sperm and microbe survival.

The bladder empties into the vagina on the floor of the vagina approximately two inches from the external opening. This is important because many types of spiral AI catheters can mistakenly be inserted into the urethral opening of the bladder. The vagina also houses the clitoris, an organ analogous to the male penis, which when stimulated may induce hormones responsible for initiating muscular contractions in the reproductive tract.

Vulva

The external genitalia of the female pig is composed of some connective and fatty tissues. The vulva is endowed with blood vessels and in gilts the vulva is often observed to swell and change color near the time of estrus. This swelling and color change are not as evident in sows, and color changes are not observable in dark skinned pigs.

Estrous Cycle, Estrus and Ovulation in Pig:

Non-pregnant and non-lactating sows and gilts display estrus or standing heat on a regular basis throughout the year. The estrous cycle is normally 21 days and is defined as the time between the onset of one estrus to the onset of the next. The

cycle length can range from 18-24 days.

Lactation or the nursing stimulus inhibits the estrous cycle and sows will not, as a rule, return to heat until the litter is weaned. Days from weaning until estrus is influenced by such factors as length of lactation, parity, season and nutritional level, but should range from 4 to 7 days.

As estrus or heat approaches, 6-10 follicles or "blister like" structures form on each ovary. Follicular growth accelerates about 3 days before estrus and is influenced by FSH or follicle stimulating hormone released from the pituitary gland, located at the base of the brain. A maturing ovum is held within each follicle. Granulosa cells within the follicle secrete estrogen, a hormone, which among other things is responsible for the typical signs of estrus. Ovulation, or release of the ova, is stimulated by LH. Ovulation occurs about 40 hours after the onset of estrus, but this interval is variable.

Several factors can influence ovulation rate or number of ova shed.

1. Age. Sows may ovulate 18-20 ova while gilts may ovulate 12-14 ova.
2. Nutrition. Flushing (increased energy levels prior to estrus) may increase ovulation rate yet may have little effect on the ultimate litter size.
3. Breed. The white or maternal breeds generally have a higher ovulation rate. Crossbred females generally have a higher ovulation rate than either of the parent breeds.

The onset and disappearance of estrus and estrus behavior is gradual and there are individual differences among females (see Fig. 3). The primary sign, and most reliable sign, of estrus is "standing" while another sow or the boar mounts. Many females will stand for the "back pressure test" when applied by the herdsman. A higher percentage of females will respond to the "back pressure test" if there is a boar present. Therefore, use of an intact or a vasectomized boar is an important part of a regular heat detection program. Boars secrete pheromones (odors) in their salivary glands which elicit the standing reflex of the female. Mature boars are superior to young boars in stimulating this response.

Secondary signs of estrus include:

- Red, swollen vulva which is usually more pronounced in gilts than in sows.
- Increased nervous activity.
- Desire to seek the boar.
- Loss of appetite.
- Male-like sexual behavior (pursuing, nosing and mounting other females).
- Change in vocalization (grunts and growls).
- Increase in vaginal mucous (thumb check)

3. Swine Production and Management

Native breed:

Wild

- Jangali bandel/ wild boar
- Pygmi Bandel

Domestic

- Chwanche
- Hurrah
- Bampudke

Developed / synthetic breed

- Pakhribas Black/ Dharane kalo Bangur
- Nagpuri / Pundi local / Puri (**Under study**)

Exotic Breed in Nepal:

- Yorkshire
- Landrace
- Hampshire

- Duroc
- Tibetan
- Tameworth
- Meishan
- Large black

A. NATIVE BREEDS:

The indigenous breeds in the country cover more than 80% of pig population. The exotic origin represents 19% of the total pig population (Rasali *et al.*, 1998). However, the population of the exotic breeds has been increased significantly and has reached to 40% (DLS, 2011/12). The identified indigenous breeds are Hurrah, Chwanche and Bampudke. The indigenous pig breeds are good in terms of reproductive characters such as litter size and farrowing intervals but they have lower body weights as compare to exotic breeds.

1. Chwanche (*Sus domesticus*)

Chwanche pigs are located in low to mid hills and are good scavenger animals. Amongst the native breeds, Chwanche constitutes 58% of the population and are located in the hills. They are black in colour. They are hardy and well suited to local environments. They have been characterized at phenotypic level and chromosomal level. They are not at risk from conservation point of view (Shrestha, 1996).

Table: Production parameters of indigenous pigs (values are means \pm standard errors)

Traits	Hurrah pigs	Chwanche pigs	Bampudke pigs
Age at 1 st puberty (months)	10.8 \pm 0.99	7.3 \pm 0.85	6.2 \pm 0.12
Age at 1 st farrowing (months)	14.0 \pm 0.96	10.7 \pm 0.80	11.5 \pm 0.23
Farrowing intervals (months)	5.57 \pm 0.57	7.4 \pm 0.6	4.6 \pm 0.0.28
Gestation length (days)	114.5 \pm 0.66	114.5 \pm 0.52	-
Litter size at birth (nos.)	7.04 \pm 1.26	7.33 \pm 1.28	4.7 \pm 0.27

Litter size at weaning (nos.)	5.73±1.25	6.0±1.0	3.4±0.30
Birth weight (Kg)	0.8±0.08	0.7±0.06	0.6±0.08

Sources: Annual report, ABD (1997); Pradhan (1999); Pandit et al. (2001); Neopane (2004).

Table: Body weights of indigenous pigs at different ages (values are means ± standard errors)

Traits	Hurrah pigs	Chwanche pigs	Bampudke pigs
Birth weight (Kg)	0.8±1.2	0.7±0.06	0.6±0.08
Weaning weight (6 wks)	6.1±0.09	5.7±0.08	NA
6 month weight (Kg)	22.7±0.09	18.8±0.07	NA
9 month weight (Kg)	32.6±0.08	26.2±0.09	NA
12 month weight (Kg)	41.6±0.09	33.2±1.28	NA
Adult weight (Kg)	45(40-55)	35(30-40)	20(18-25)

Sources: Annual report, ABD (1997); Pradhan (1999); NA: Not available.



Chwanche

Hurrah

Bampudke

Jangali Bandel/ Wild Boar

- Throughout country
- For commercial production payment of Rs. 10000 per piglet to DNPWC as seed stock
- Height: 90-95 cm; Weight: 200-500 kg; Colour: Brown black with thick hair
- Herd: 6 – 30 heads up to 3 generation,
- Conceive: Oct – Dec ; Farrowing: Feb – April,
- Gestation period: 115 days, Litter size; 4 – 6

Synthetic Breed:

Pakhribas Black (*Sus domesticus*): Pakhribas pigs are black in colour and are mainly found in eastern hills. They have been developed by crossing Fayuen, Tamworth and Saddleback (Triple crossing) at Pakhribas Agriculture Center (PAC) to meet the demand of local people. They are prolific and have good mothering ability. Mature boar weighs about 350 kg and the sow 250-300 kg. It is a pork type breed and preferred by many farmers of eastern region of Nepal. They are very popular breed in the Eastern hills. They have been highly inbred and development of its second generation is required.

Nagpuri or Pundi local: Nagpuri is popular with the name of 'Pundi local' in Eastern Nepal. Mostly Rai, Limbu, Magar, Mushahar, Tharu are rearing this breed of pig in Eastern Terai traditionally. The farmers of economically disadvantaged and some middle class farmers are also rearing Pundi (Dhaubadhel and Ghimire, 2002). This synthetic breed is supposed to be evolved from the crosses of Meshain with local pig population.

A. EXOTIC BREEDS:

1. Landrace:

Originally it is a Danish pig popularly bred to produce highest quality bacon in the world. It is a white pig characterized by long and deep body with short legs and drooping ears to the front above the eyes. The carcass is leaner with less back fat and lard. The breed is popular for its high prolificacy, average litter size of 11 with a good weaning rate and for efficiency of feed utilization. In Nepal Landrace is used for developing crossbred foundation. Mature boar weighs about 310-400 kg while the sow weighs 250-330 kg. It is widely used for cross breeding in Nepal.

2. Yorkshire:

1. Large White Yorkshire:

This is a popular English bacon breed having noted mothering quality. It farrows and raises many liters at a time as the mother yields more milk. The

pig is white in color with moderately long head, face slightly dished, snout broad and identical erect ears. Mature boar weighs about 300-450 kg while the sow weighs 250-350 kg. It is widely used for cross breeding.

2. Middle White Yorkshire:

Comparatively, it is slightly smaller and less prolific than the Large White. It is white in color, head moderately short, erect ears, good walker and mature boars have 270-360 kg live weight while the sows have 180-270 kg.

3. Duroc:

It is an American breed, red in color with shades varying from a golden to cherry red color. It is popular for its excellent growth rate and feed efficiency. It is an early maturing, farrows many litters and has a good mothering property. Mature boar weighs about 300-400 kg and sow 250-350 kg. The carcass is considered as a good meat type. It is widely used for cross breeding in Nepal.

4. Hampshire (Saddleback):

It is a medium type English breed popular for pork production. It is a black pig with white strip around the back. It is well known for excellent growth rate and feed efficiency. It matures early, farrows 8-10 litters and is a good mother. Mature boar weighs about 400 kg and sow 350 kg. It is also widely used for cross breeding. Also known as Saddleback due to presence of white belt on back.

5. Tamworth:

It is also an English breed, Ginger, golden red to dark red colored breed with a long head, long, narrow body; prick ears, a straight face and snout and is a popular bacon type. They produce smaller litters than other commercial breeds. Body weight ranges from 200-350 kg.

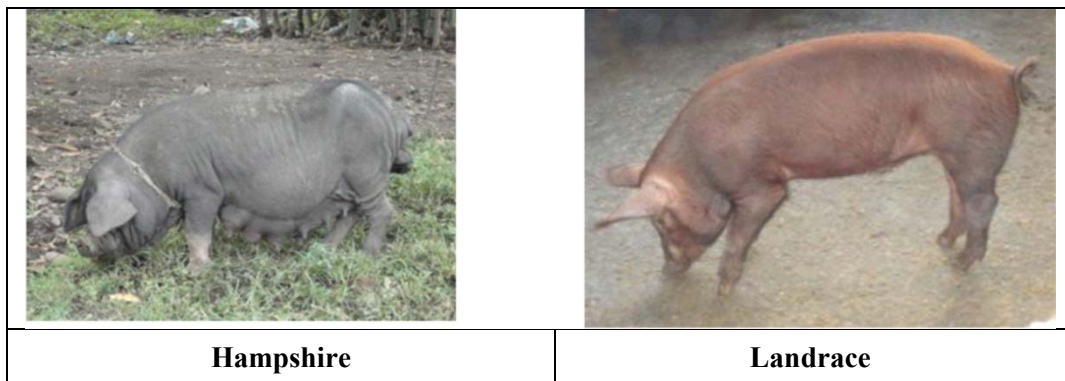
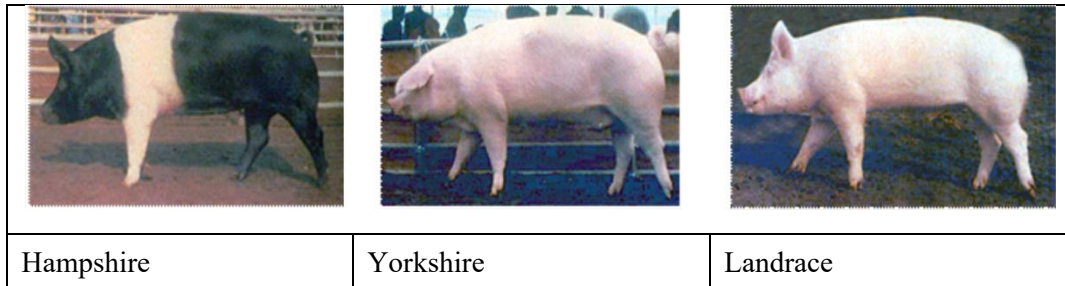
6. Meishan:

This breed was developed in China and it is a black breed with short legs,

big stomach, deep back and ugly face. It has very high prolificacy with a litter size of 14 -17 with average birth weight 900gm, weaning of 11 - 12, and having 8-9 pairs of teats. With a good FCR an adult male weight about 450 kg and female weight 350 kg average.

7. Tibetan:

This breed is especially adapted to the high hills, cold climate and to being on pasture all year round. It has light body weight (35 kg) with black hair coat, long and dense bristles; highly developed digestive organs; and ability to deposit fat in the body. The internal and visceral fat is about 15 percent of body weight . Its muscles is with a marble appearance and meat with a special flavor. However it has low prolificacy, with average litter size of 5.

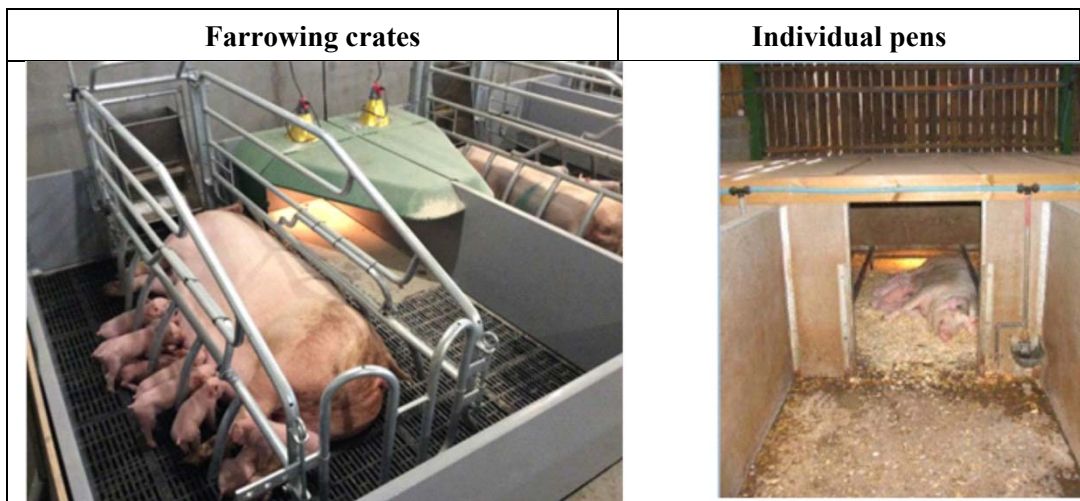


CARE AND MANAGEMENT OF NEWBORN PIGLETS

Healthy pigs start with a healthy sow

- Good maternal line

- Careful attention to nutrition
- Parasite control
- Manage the environment
 - Reduce stress by acclimating sows to human contact
 - Move to farrowing pen 3-4 days before expected farrowing
 - Temperature and humidity control (ventilation)
 - Provide nest material (saw dust/cut straw) and place cover over farrowing crate before and after farrowing



Cause of Piglet death:

- 65% of all post-farrowing deaths occur in the first 4 days of life
 - 40% of these are from crushing (mostly weak/splay-legged)
 - so move them away until they are stronger
- Baby pigs are born immunologically ‘naked’
 - Disinfect farrowing area
 - Make sure they get colostrum
- Baby pigs have very little body fat

- Provide heat (85-90°F), eliminate drafts
 - Lighter, smaller pigs need extra attention
- Chilling starvation Overlying disease complex
 - Suboptimal temperature and chilling
 - Causes lethargy
 - Reduced colstrum intake disease
 - Starvation
 - Overlying
 - Death
- Immediately after birth of the piglets, clear the mucus from the mouth and nostrils and secure the piglets if necessary.
- Dry piglets, provide warmth, stimulate breathing and stop bleeding from naval cord (tying and dipping) and feed colstrum.
- Each piglet should be rubbed carefully, dry with a cloth.
- Piglets are born without any antibody protection, their bodies contain fat energy for about one day of life, and they cannot regulate internal body temperature well until they are a few days old.

How to warm piglets?

- Provide zone heating in the farrowing quarters beginning 24 hours before expected farrowing.
- Heat lamps, heat pads, radiant heat devices, and hovers are common ways to provide zone heating in farrowing houses.
- Keeping an additional heat lamp at the rear of the sow during farrowing reduces piglet mortality.
- The extra heat source assures the piglet of immediate warmth following birth

Clipping and treating umbilical cord

- A few minutes after the birth the umbilical cord may be pulled gently away or cut if necessary (to about 5 cm length).
- After cutting, the navel of each piglet should be soaked in a cup of iodine solution to prevent infection.



Feeding of colostrum to piglets


- Piglets must be allowed to suckle milk from mother for about 8-10 times in 24 hour initially.
- Colstrum:
 - rich in immunoglobulins and quality of colostrum declines over time.
 - important factor related to a piglet's survival and long-term health.
 - need assistance to obtain enough colostrum for late born and weak piglets.

Prevention of anaemia

- Add 25 mg of iron and 5 mg of copper per day per pig to prevent piglet anaemia.
- Paint the udder of sow daily with the following mixture

- iron sulphate – 500gm
copper sulphate – 70 gm
sugar – 500 gm
- Intramuscular injection of iron dextrose compound on 4th and 14th day of age.

Creep Feeding

- **Creep feeding** is one way to smooth the transition at weaning with minimal performance check
 - Creep feeding piglets rarely actually increases their weaning weight, but it does produce pigs who eat better later in life.
 - The younger the age at which creep feed is offered, the stronger the effect is.
- 
- Sow's milk usually declines at 12-16 days
 - Use palatable feed – flavoring agents
 - Make water available
 - Young piglets from 7 days onwards should have high protein feed available to them.s
 - This has to be fed in a small area where the mother cannot eat the feed.
 - The feed conversion rate of young piglets is very high and thus creep feeding is particularly economic.
 - Creep feeding helps the piglets to get used to feeding at an early age.
 - It is recommended beginning at 7- 10 days of age.

Castration:

- Castration, the surgical removal of the two testicles, is a routine management practice for male piglets
- The best time to castrate a piglet is when it is 4 to 14 days (1-3 weeks) of age.
- Young piglets are easier to hold or restrain, bleed less from surgery, and have antibody protection from the sow's colostrum and milk.
- Why not before 4 days?
 - Chances of scrotal hernias and the testicles may not have descended.
- Scrotum is washed with the antiseptic solution.
- Holding the testicle between the thumb and first finger with the stretched skin, an incision with the sharp knife is given first cutting the skin and then the tunica.
- The exposed testicle is then pulled out, the cord is twisted twice and cut towards testicles then wash the wounds thoroughly with a disinfectant like iodine to prevent infection.
- The other testicle is also removed in the same manner.
- If done early in the life there is very little bleeding and no ligation of the spermatic cord is needed. The wounds are filled with an antiseptic powder.



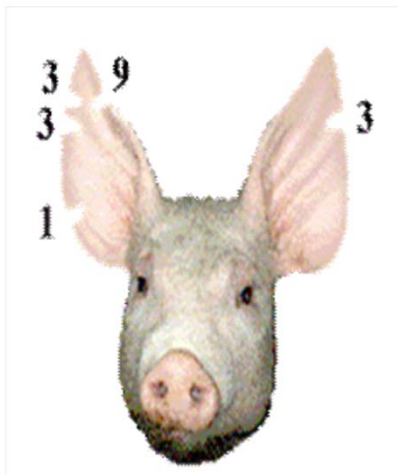
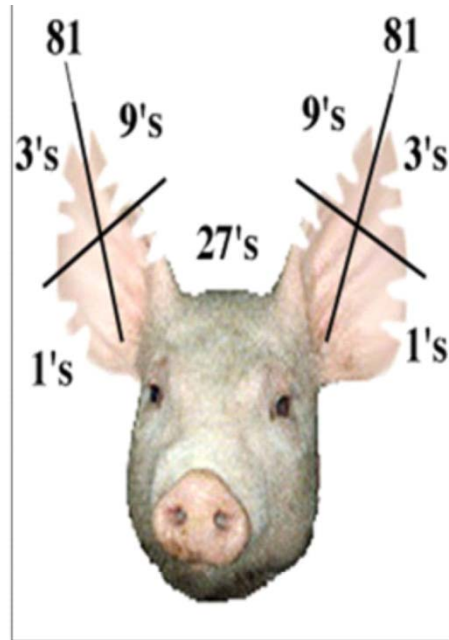
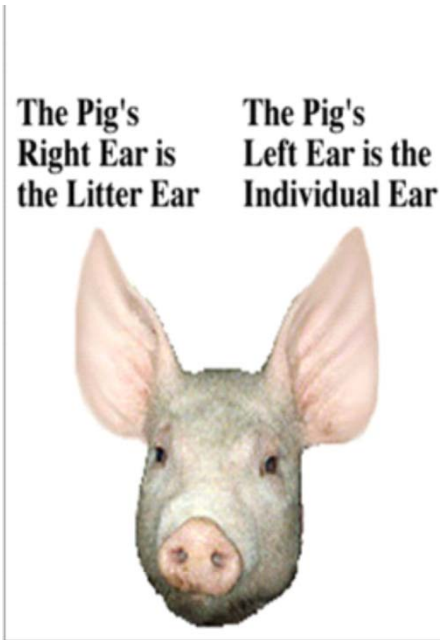
Post-Castration Care:

- Observe castrated animals for excess bleeding or the presence of tissue or intestines (hernia).
- Apply pressure to the wound for about two minutes to stop any bleeding.
- Cut off any cord that may be protruding from the incision as this may serve

as a wick for infection, but make sure it is not intestine.

Piglet Identification:

- Permanent identification includes ear notching or tattooing.
- Ear notching is the more common method.



The right (litter) ear is equal to $9+3+3+1=16$

The left (pig) ear is equal to 3

This is the 16-3 pig.

Rearing motherless piglets

- If the sow dies whilst farrowing, the colostrum will have to be taken from another farrowing sow for the piglets.
- If they get no colostrum, their chance of survival is very small. Cow's or goat's milk can be given to the piglets
- The milk should not be diluted, as sow's milk is very concentrated.
- It should be warmed up to slightly above body temperature ($37^{\circ} - 40^{\circ}\text{C}$) in a pan lowered into a larger pan containing boiling water.

Feeding program

Day	No. of feeding times	Quantity each time (ml)
1	5	30
2	5	40 – 45
3	4	60
4	4	70
5- 7	3	80 - 100
8- 9	3	120
10- 11	3	140
12- 14	3	160

- As soon as possible, the orphan piglets should move onto regular food.
- This should be of good quality, protein-rich, and easily digestible.

Note-despite the amount of care they receive, hand-reared piglets will never grow as fast as those reared by a mother sow.

WEANING

- Weaning is the process of gradually introducing a mammal infant to what will be its adult diet and withdrawing the supply of its mother's milk.
- The process takes place only in mammals, as only mammals produce milk.
- The infant is considered to be fully weaned once it no longer receives any breast milk (or bottled substitute).

Weaning a piglet

- Traditionally: at 5-6 weeks of age or older
- Modern production setting: 3-4 weeks
- Can be weaned much earlier, provided that they've received colostrum, but must remember that:
 - weaning is very stressful for pigs, and
 - need management skills, better facilities, and well-trained personnel.

Reasons for Early Weaning

- Can produce more litters/sow/year, consequently more pigs/sow/year, and thus can improve sow productivity.
- May improve pig's and piglets' nutritional status.
(sow's milk may not satisfy their requirements completely)
- heavier and uniform piglets at 8 weeks of age
(milk production peaks at 3-4 weeks & then starts to ↓)
- Reduce health problems
(less transmission of diseases and parasites from sow)
- Can keep sows in a better condition for rebreeding or selling.

Disadvantages of Early Weaning

- Management - Sows can cause "poor" management practices to a certain extent.

(thus, if it's not possible to manage young pigs as well as or better than the sow, then pigs should remain with the sow.)

- Must provide nutritionally balanced and palatable diets.
- Must have better facilities, equipment and sanitary conditions

FACTORS TO CONSIDER

- Health,
- Nutrition,
- Sow Productivity &
- Environment/facility
- Management skills and

willingness to spend extra time caring for pigs

Health

- A. Protection from colostrum for diseases: 1) high during week to 10 days after birth, and then 2) starts to decline thereafter.

Active immunity- low until 6 to 8 weeks n “Ig production” may not be fully competent until at least 5-week old.

Pigs can be weaned after . 10 days if all potentialstressors at weaning are minimized.

After 5 to 6 weeks, can protect themselves much better.

Nutrition:

- Enzyme profile – upto 3 or 4 weeks is geared.
- digesting milk sugar (lactase) and milk fat (lipase).
- Enzymes for starches (e.g., amylase & maltase) and plant proteins (proteases) are increasing, but still not adequate.
- Thus, complex diets, not be used.
- Also, diets must be highly palatable and digestible.

Sow productivity:

Weaning Age: Generally, can not breed sows while they are lactating, thus with earlier weaning, we can expect more litters/year, thus more pigs/sow/year

Weaning before 3-4 weeks

- Similar farrowings/year and pigs/sow/year.
- Earlier weaning can ↑ days from weaning to estrus & ↓ conception rate and litter size, (i.e., an inverse relationship between weaning age and pregnancy rate)
- Why? - “Uterus involution” 15-16 days

Thus, no advantage in weaning earlier than 3 weeks.

Also, after 4 to 5 weeks, can expect progressive ↓ in the No. of farrowings/year and pigs/sow/year.

Environmental facilities:

- Early weaned pigs need 85°F during the first 1 or 2 week
but “optimum” temperatures depend on many factors:
- Surface area - 3-week-old pig has 10% more
- Surface area to loose heat than a 4-week-old, and 20% more than a 5-week-old.
- Drafts (device for air flow or circulation) increase a pig’s heat loss
- Flooring materials affect heat loss

Post-Weaning Lag or Growth Check: Slight loss of weight after weaning

CARE AND MANAGEMENT OF PREGNANT SOW AND BREEDING BOAR

Care and Management of Pregnant sow

Introduction:

- Care and management of sow is the major part of successful swine production programme.
- The time period between breeding and farrowing is known as Pregnancy period/gestation period.
- The gestation period is 114 days (3 months, 3 weeks and 3 days).
- Successful conception is characterized by -failure to return to estrus 3 weeks following mating.

Factors to be considered more during pregnancy

1. Housing 2. Feeding 3. Health

Housing

- Pregnant sows should be housed separately in special pens with sufficient floor space.
- Pig sty should be clean, dry and non-slippery. If space is available exercise is strongly recommended.
- Slippery floors may lead to falling and causing accidental abortions.
- Bedding of 8-10 cm chapped straw under covered area might be provided.

Feeding:

- Sows gain more weight during pregnancy
- If the sows become over fat after parturition, they will be heavy and clumsy and piglets will be easily crushed.
- Balanced ration of 16% C.P., 0.8% Ca and 0.6% P must be provided for uniform litter with more birth weight.

- Fetuses grow rapidly towards the end of pregnancy and nutrient requirements increase.
- Most swine producers will feed 2.0-2.5 kg mixed feed during the breeding period, and then decrease to about 1.5kg during the major part of gestation.
- Then they increase feed intake to 2.5 kg during the 3 or 4 week period prior to farrowing.
- Slightly change amount according to animal's condition (animals becoming "over fat" or "thin").
- The gilts and sows should be kept in a thrifty condition, not too fat nor too thin, but somewhere between.
- Feed bulky feeds from 4-5 days before and after farrowing by substituting with wheat bran, ground legumes, which may help prevent constipation and reduce problems with Mastitis- Metritis- Agalactia.

Health:

Abortion: Pregnancy may be terminated before term and the fetuses ejected

Causes:

- diseases like swine fever and salmonellosis, may cause abortion .
- Mouldy feed may be responsible.
- Deficiencies in vitamin A and calcium may cause repeated abortions.
- Vaccination (Swine fever in first month)
- Vaccination against swine fever during the first month of pregnancy may provoke viral infection of the placenta resulting in abortion.
 - If there is a problem with the pregnancy or with piglets after conception and up to around 30 days, the sow could reabsorb the fetus(s).
 - After around 30 + days the piglets bones begin to develop and calcify. If the problem develops after around 30 days the piglet(s) can't be

fully absorbed and she will deliver mummified piglets.

Fetal mummification: shriveling or shrinkage of fetus by absorbing all fluid of fetus

Care of sows and gilts during the final two weeks before farrowing

- Pregnant sows and gilts should be dewormed 10-15 days before farrowing date.
- washed and placed in a clean and disinfected farrowing pen 4-5 days before farrowing date.
- Disinfect farrowing pens
- On the day of farrowing check to see if everything is ok. provide bedding in the farrowing pen.
- Offer a very little or no feed on the day of farrowing
- Ensure that clean fresh water is always available.
- In commercial operations, the sow should be transferred to the farrowing house one week before farrowing to provide her time to adjust to new environment.
- Watch out for the following signs for farrowing:
 - the abdomen swells
 - the sow becomes restless and nervous
 - the vulva is swollen with possible mucus discharge
 - milk is present in the teats if pressed

Care of sow at Parturition

Attention may be paid to the following:

- To prevent crushing of piglets place the sow in farrowing crate or provide ground rail 20-30 cm above the ground and 30-30 cm from the wall.
- Prevent piglets from being suffocated by placental membranes by removing and cleaning.

- Sows usually farrow without trouble. If farrowing time exceeds 8 hours, it may be necessary to call a vet.

Caring for the sow and litter at farrowing time

An individual pen is needed for each sow and her litter at farrowing time and at least 7 days following farrowing.

Disinfection of Pregnant sow

- Before moving in to the farrowing pen, the sow should be thoroughly scrubbed with the soap and warm water, especially in the regions of sides, and underface of the body.
- This will remove the adhering parasite eggs and other disease germs. The isolation of the sow should be practiced about 3-4 days prior to expected farrowing date.

Disinfection of the farrowing pen

- The farrowing pen should be thoroughly cleaned and disinfected to reduce possible infections.
- This may be done by scrubbing the walls and floors with the phenyl water.
- All the cervices and angles should be disinfected with the disinfectants.
- Similarly in the earthen floor, 2-3 inches of the top layer should be removed, then replaced with the fresh soil.

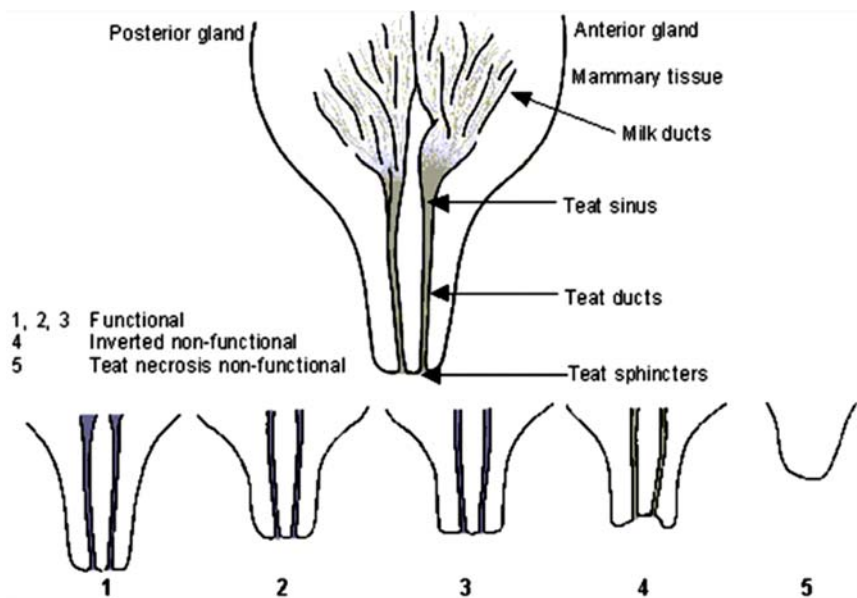
Other care:

- Bedding
- Ground rail
- Good housing management
- Artificial heat (brooding)

CARE AND MANAGEMENT OF GILT, SOW AND BOAR

Selection of breeding Gilts

- Have at least 12 teats so as to accommodate a large litter.
- Should from sow which wean 9 -10 or more piglets per litter , first farrowing at one year of age and farrowing interval of not more than seven month.
- Select breeding gilts at weaning period, further selection should be done 5-6 months of age.
- Select fast growing weaners. These will likely consume less feed per unit live weight gain and less costly to keep.
- Select gilts which have developed hams and comparatively light heads.
- The selected gilts should have good body confirmation i.e. strong legs, sound feet etc.
- Not having supernumerary and inverted teats, and fat deposited at the base of the teats
- Must be at least 8 months old at first service.



Age to breed gilts: 8 months

Weight of breed gilts: 100-120 kg

Length of heat period: 2-3 days

Best time to breed in heat: Gilts:1st day and Sows:2nd day

Number of services per sow: 2 services at an interval of 12-14 hrs

Period of oestrous cycle: 18-24 days (Average 21 days)

Occurrence of heat after weaning: 2-10 days

Gestation period: 114 days

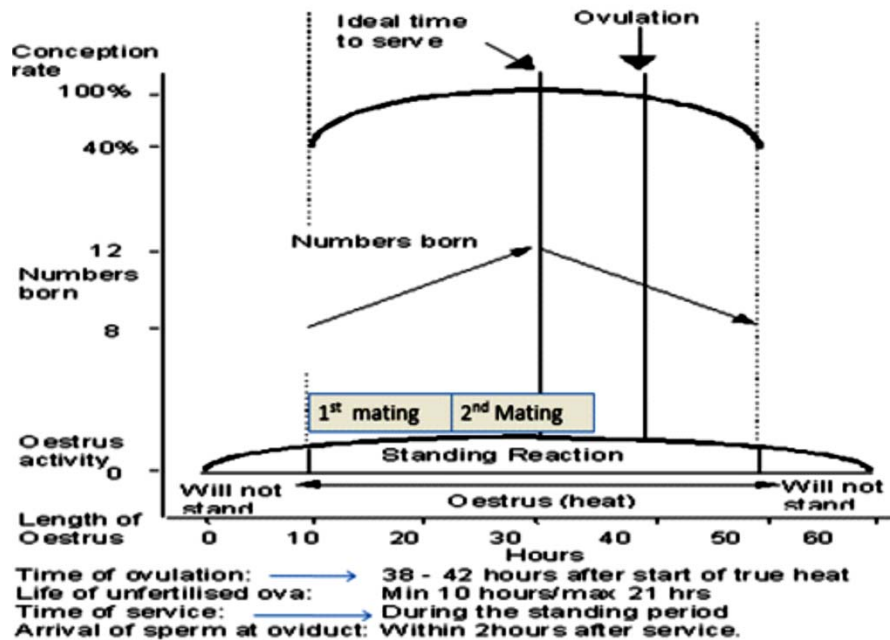
Selection of Breeding Boar

- Boar to have sound feet with good, full hams, uniform curve at the back and of good length.
- Have at least 12 nicely placed rudimentary teats so as to pass on this characteristic.
- Selected from sows, which wean 8 -10 or more piglets per litter and are known to be good mothers.
- Having normal sex organs, active, healthy and strong.
- Selection to be done before castration. Select biggest from the litter.
- Boar must be at least 8 months old at first service.

Stimulating regular heat

- Weaning early (at 3-4weeks of age) and all at once.
- Put the sow close to a boar, in a way that makes direct contact (hear , see, smell) possible
- The sow should not be given any feed on the day of weaning.
- The next day feed about 4 kg/day and should be done for a maximum of 10 days or until the service takes place (flushing)
- Put the sows in groups (stress stimulates heat)
- Maintain a good climate and sufficient light in the house.
- Sows should not be too fat or too thin when they are served. (More care

during lactation diet)



When sow is in gestation ?

- after 21 days of serving she does not show heat signs
- Pregnancy detection at 23 - 35 days by echo scan gives positive results

Culling

- Sows that are difficult to get pregnant and only have small litters should be sold off.
- Boars which are infertile or moderately infertile should be culled

Care & management of breeding Boar

- High priority should be given to the management of animals newly introduced into the breeding herd to achieve maximum reproductive efficiency.
- Good reproductive and nutritional management pays dividends through an increased number of pigs farrowed live and weaned.
- Upon completion of test, boars should be fed at a level of energy that will

prevent excessive fat deposition. This practice should help ensure that they are physically adept and sexually active.

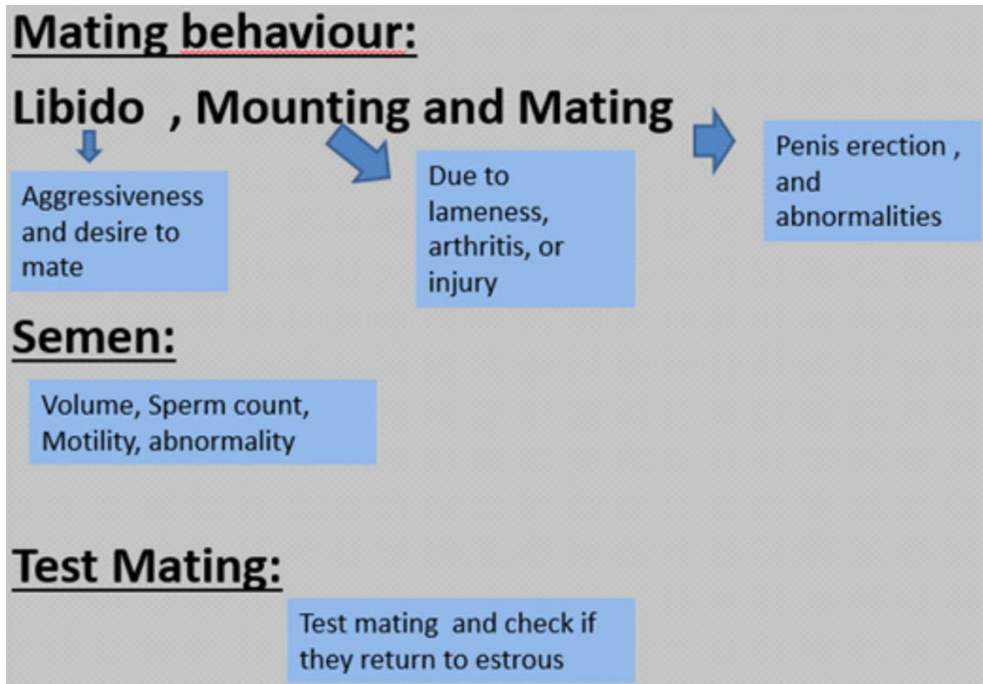
- Nutrients other than energy should be provided to meet the minimum daily recommended allowance of the National Research Council.
- To develop physical hardening and to stimulate sexual arousal and libido:
 - a) Shifting boars to different locations.
 - b) Providing fence-line contact with cycling females.

This may be especially important where the aggressiveness of the boars prevents mixing them together.

Evaluation of breeding Boar

- To be evaluated for reproductive soundness, boars should be at least 7.5 months of age and should be completed before the breeding period so that, problematic boars can be identified and culled.

Breeding Boar Evaluating Criteria



Care& management of Breeding Sow

- Energy intake of selected gilts should be restricted to prevent overweight conditions.
- Moving gilts to new pens, increased exercise, and daily exposure to boars beginning between 160 and 180 days of age will help 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.
- During gestation, gilts should be fed to gain about 75 lb and not become overly fat.

Culling:

- Gilts that do not conceive after mating at two estrous periods should be marketed.
- Likewise, gilts that have not expressed heat by 9 months of age should be culled.

Selection of Replacement

- Boars must be replaced when they become too large to serve most of the sows on the farm.
- Boars usually have a maximum working life of between 18 and 24 months. This means they should be replaced when they are 30 to 36 months old.
- Look for head to head, sniffing, nosing, mounting attempts and standing reactions before selection
- It is very important to keep record of the boars' use so that infertile ones can be detected and replaced as soon as possible.
- A low sex drive (libido) can also be a problem. Some boars are slow workers and are sometimes reluctant and only now and then willing to work. So, Attention must be given to these boars so that they can be replaced if necessary.

Culling of Sows

- As soon as the sow's udder has returned to normal after weaning it is wise to send her to the abattoir. Replacement gilt can then be brought into the herd immediately.
- Reasons for removing sows from the herd are usually not known beforehand. Therefore, replacement gilts should always be available so that the number of breeding sows on the farm always remains the same.
- Sows that farrow regularly with larger litter size and are free of other problems and diseases should rear five to six or even more litters before culling. (2 successive smaller litter size and not coming to post wean heat easily)

Reasons for culling

- Not pregnant,
- Do not come on heat,
- Lameness,
- Old age,
- Lack of milk
- Failure to conceive at service,
- Abortions,
- Poor performance (small litters, etc),
- Disease,

HOUSING MANAGEMENT OF PIG

Elements of good housing system:

- Separate house for breeding boar/Pregnant Sow
- Separate house for gilts and dry sow
- Provision for farrowing pen
- Heating and cooling arrangements
- Arrangements for piglets nests
- Suitable size of drinkers and feeding trough
- Suitable floor space and sufficient space for exercise

Selection of housing location

- The site should be at an elevated place that cannot be flooded by rain water.
- The site should be protected from the sun (shade from trees) and have ample fresh air.
- Away from residences (around 8-10 meter away downwind).
- In case of a large scale pig farm, the site selected needs also to be: well connected to roads throughout the year,
- Suitable for manure disposal, connected to reliable water and electricity sources.

Construction Plan for good pig shed

- The floor of the house must be raised about 60 cm above the ground.
- The floor boards (if used) should have spaces of 2 cm between them.
- The roof must be rain, proof.
- The high side of the roof should face in a direction where some sun can shine a little way into the house on this side: but there must always be shade in some part of the house.
- The house must be strongly built.
- constructed cheaply by using locally available materials according to climatic conditions and pig production system.
- comfortable for the pigs: good ventilation and ample shade, no overheating, no smells, no draft and no dampness.
- constructed with its length axis in an East-West direction (protected from sun and rain).
- Building needs to be divided into different pens for each phase of the production cycle. The number and the size of the pens depend on the expected numbers of pigs to be housed in each production phase.
- The costs of constructing the pigsty should fit the pig production systems. An efficient pig production is required to cover high construction costs.

SPACE REQUIREMENTS FOR DIFFERENT CATEGORIES OF PIGS:

Table: Space requirements (sq. m. /pig) for different categories of pigs – With open space

Categories of pig	Area (sq. m.)	Length × breadth (m.)	Open space (m)	Max. no. of pigs in one shed
Boar	6.25 - 7.5	2.5×2.5 – 2.5×3.0	8.8 – 12.0	1
Sow	7.5 - 9.0	2.5×3.0 – 3.0×3.0	8.8 – 12.0	1
Weaned piglets	0.96 - 1.8	0.8×1.2 – 1.2×1.5	8.8 – 12.0	10 – 12
Culled sow	1.8 - 2.7	1.2×1.5 – 1.8×1.5	1.4 – 1.8	2 - 10

Source: Adhunik Bangur Palan , NARC, 2071

Table: Space requirements (sq. m. /pig) in closed house without open space

Boar	Minimum	4.40 sq. m. /pig
Sow	Minimum	1.32 sq. m. /pig
Farrowing pen	Minimum	3.60 sq. m. /pig
Brooding box	Minimum	0.04 sq. m. /pig
Piglets	Minimum	0.30 sq. m. /pig
Weaned piglets	Minimum	1.00 sq. m. /pig

Source: Swine production standards of Thailand

- **Male female ratio: 1 boar per 10 – 20 sows**

Common Diseases and Parasites of Swine:

1. Swine fever/Hog cholera

Symptoms

- Lesions on the body

- Fall in temperature before onset of clinical signs.
- Reddening of skin and ears.
- Incoordination of hind limbs.
- Constipation diarrhoea, anorexia.
- The animal dies the next day after the
- attack. 95 - 100% mortality.

Prevention and treatment

- Quarantine.
- Boiling of swill.
- Restriction of movement of meat from infected areas.
- Vaccination
- Disinfection
- No therapy (treatment)

Anthrax

Rare in pigs and associated with contaminated feed containing meat.

Symptoms

- Oedema and swelling of the neck region.
- Dyspnoea (breathing difficulty).
- Fever, anorexia and passage of bloody faeces.
- Sudden death.

Prevention and treatment

- Use antibiotics (penicillin) as prescribed by a veterinary doctor.
- Thorough disinfection of the farm and burning of carcasses.

Foot and mouth disease (FMD)

Foot-and-mouth disease is an acute, febrile, highly contagious, viral disease of

cloven footed animals such as cattle, water buffalo, goats and pigs.

Symptoms

- Sudden onset of severe lameness, fever, formation of vesicles on coronary bands.
- Blisters can be found on thin-skinned areas like udder, teats, anal area and eyelids. These blisters rupture within one day.
- There may be frothy saliva, anorexia, sometimes hooves become loose and fall off.
- Sows may abort.

Prevention and treatment

- Vaccination
- Quarantine
- Proper cooking of swill.
- Slaughter and burial.

Porcine Respiratory and Reproductive Syndrome (PRRS)

Symptoms

- Blue ears and forced breathing
- Lactating sows have rough hair coat.
- Gilts have problem getting on heat and early abortion.
- High mortality in weaners
- In boars, high percentage of ulcerated (shapeless) sperms, low sperm mortality and less libido

Prevention and treatment

- Use of antibiotics as prescribed by a veterinary doctor.
- Vaccination helps but it is so expensive that it may not be cost effective.

Influenza

Symptoms

- Affected animals are apathetic.
- Anorexia
- High fever, coughing and sneezing, difficulty in breathing
- Red eyes with discharge
- Loss of condition.

Prevention and treatment

- Good ventilation.
- Vaccination.
- No specific treatment. To prevent secondary infection, use antibiotics as prescribed by a veterinary doctor.

Swine Dysentery

Known by a number of names, including bloody diarrhoea, hemorrhagic enteritis bloody scours and black scours. It affects pigs of all ages, sometimes causing death.

Symptoms

- In acute cases wasting and passing of diarrhoea containing varying amounts of mucus, blood and necrotic material.
- Fever.
- In chronic cases, pigs have greyish or brownish faeces, rough hair coat and low growth rate.

Prevention

- Delay reusing the pens of infected animals.

- Disinfect pens.

Treatment:

- Some herbal medicines (moringa tree leaves) can be used to relieve the symptoms of diarrhoea and dehydration
- Use antibiotics as prescribed by a veterinary doctor

Salmonellosis

Symptoms

- High fever, dullness, anorexia, weakness, nervous symptoms.
- Bluish-red coloring of the ears, limbs and the centre of the belly.
- Bloody spots all over the body.
- Wasting and persistent grayish diarrhea sometimes mixed with blood and shreds or necrotic material from the gut.

Prevention and treatment

- Normal hygienic measures, pelleted feed, thorough cooking of the swill.
- Remove feed for two days and provide clean water.
- Use antibiotics as prescribed by a veterinary doctor.

Mastitis

Bacterial infection causes an inflammation of the mammary organ and results in changes in milk production. These bacteria enter the wounds in the udder.

Symptoms

- Swollen, hot and painful udder.
- Absence or reduction of milk in the affected udder.
- Sow refuses to suckle her piglets. As a result, piglets squeal due to hunger.
- Sow has depression and often fever.

Prevention

- Provide adequate bedding
- Keep pig pens clean, dry and free of sharp objects, clip milk teeth of baby pigs.

Treatment

- Gently massage the affected udder with lukewarm water.
- Do not allow the young to suck milk from the infected sow.
- Remove the milk from the infected udder and discard.
- Separate sow from piglets and reduce access to teats (allow a few piglets to suckle at a time). If possible, foster piglets to lactating mothers.
- Use antibiotics. Inject penicillin-streptomycin into the muscle of hip or neck.

Endometritis (bacteria)

Symptoms

- Vulval discharge of vaginal or uterine origin during urination.
- In case of metritis, fever and agalactia may occur.

Prevention and treatment

- Antimicrobial by injection or locally by irrigation of the uterus and vagina, oxytocin can be given to stimulate uterine contractions once or twice a day. Hygiene.

Birth diarrhoea

Symptoms

- Acute diarrhoea in piglets is watery, yellowish grey and within a very short time
- piglets become thin with sunken eyes due to dehydration.
- Death can occur within 2 - 3 days. Death in piglets can occur even within

oneday before any sign of diarrhoea is observed.

Prevention

- Keep pens, feed and watering troughs clean.
- Separate affected animals from healthy animals.
- Do not change abruptly an animal's ration.
- Make sure that piglets have sufficient colostrum within 36 hours of birth

Treatment

- Vaccination
- Plenty of drinking water with electrolytes
- Use of antibiotics.
- Herbal medicine: Fresh leaves of guava or star apple. This will treat the symptoms only.

Parasitic diseases

Parasites are divided into external and internal parasites.

Internal parasites (Worms)

Worms are one of the most serious threats to pig keeping. There are more than 30 types affecting the intestines of pigs. The most important two are the intestinal roundworm and the tape worm.

Roundworm

Roundworms live in the gut and take food from the pig. The pig can therefore become thin. Giant intestinal roundworms (*Ascaris lumbricoides*) are common around the world, especially in warm, moist climates. These worms are large, about the size of a pencil. The infection begins with the ingestion of eggs which are usually present in contaminated soil, or on fruits and vegetables grown in infected soil.

Symptoms

- Anorexia in advanced stages.
- Anaemia loss of condition.
- Weight loss in later stages.
- When the worms die suddenly after treatment, they can block the gut and cause sudden death

Prevention

- Control with medicine in the food is useful and provide clean and dry pens.
- Rotational grazing and periodic disinfection of pastures.
- Separation of young ones from adults.
- Washing sows before farrowing.
- Periodic deworming
- Herbal treatment: herbs such as moringa are considered to be antihelmintic(able to kill intestinal worms)

Tapeworm

Tapeworms are flat and long ribbon like creatures which are common in all parts of the world. Tapeworms do not have a digestive system so they receive their food through their skin as they absorb our nutrients. They especially absorb folic acid and vitamin B-12. These parasites may cause what is referred to as “verminous intoxication” as they put out and leave dangerous waste products in our bodies.

These tapeworms can roll themselves into a ball and can be felt on the right side of the abdomen under the liver.

Pork measles is caused by tapeworms which live in the muscles of pigs. They do not usually affect the pig, but can lead to pain and the pig may find it difficult to move around. When people eat undercooked measly pork, the worms develop inside the people, and can make them very sick.

Symptoms

- Poor growth
- Rough grey hair coat
- Swollen belly
- Emaciation
- Anaemia

Prevention

- Prevent the pigs from wandering about where they can feed on human faeces
- Make sure that people working with pigs use toilets (hygiene and sanitation)
- Deworming

External parasites

External parasites mainly include mange, lice and myiasis.

Mange

- It is caused by small parasites called mites that live in the skin. They provoke severe itching and irritation. Nowadays sarcoptic mange in pigs has been reported in all major swine producing countries and is prevalent in Brazilian swine herds. Lesions, or scabs, on the animals may start on any part of the body, but usually appear first on the head, around the eyes, nose, or ears; lesions may progress to hyperkeratosis and exfoliation of epidermal debris.
- The pig becomes itchy, and scratches and rubs against the walls of the sty and other objects with the skin between the legs, around the eyes, ears and neck being principally affected.
- The coat looks dull, and there are bare patches, heavy crusts, and lines on the body that look like ribs
- Restlessness and itching which can be very severe

- Red pimples on skin, which turn into crusts and scabs. Later the skin looks very rough, is thickened and covered with flakes scratching. Skin may show red spots or bite wounds
- Thick skin and rough hair coat
- Anaemia in severe cases especially in piglets
- Death in severe cases

Prevention

- Wash the sow before farrowing at least twice at a one week interval.
- Boars should be washed at least four times a year.
- Treat gilts upon entering the farm and before serving.
- Wash all pigs at the beginning of fattening if mange is already a problem.
- Maintain proper animal nutrition and health program to reduce severity and spread of mange. Recommended control products are: ivermectin (1% injectable), or malathion (1% spray).
- General cleanliness.

Treatment

- Remove scales and dirt with soap and water and a stiff brush.
- Afterwards the pig should be washed with organophosphate compounds.
- Repeat this treatment several times
- Ivermectin injection is a very effective treatment against mange and all other parasites. Spraying the animals with cattle dip also kills many parasites on the skin
- Herbal treatment: Smearing with coconut oil can be an effective control in cases of light contamination

Lice

These are blood suckers that also cause irritation of the skin. The hog louse is the

largest louse species (6,4mm) commonly associated with domestic animals. It is found most frequently in the folds of skin behind the ears and between the legs. The blood-sucking activity of hog lice results in much irritation and discomfort to swine

Symptoms

- Itching
- Skin may show red spots or bite wounds.
- Thick skin and rough hair coat.
- Anaemia in severe cases especially in piglets.

Prevention

- General cleanliness
- Treat piglets before putting them in fattening house. Fatteners don't need to be treated
- Treat gilts before first service
- Treat boars twice a year
- Treat new stock on arrival and seven days later. Piglets below three weeks should not be treated

Treatment

- The insecticide benzene hexachloride is a very effective remedy (0.1 - 0.25% solution) against lice. Treatment should be repeated after 7 days since the insecticide only kills adults and not eggs.
- Lice can be kept away to a certain extent by planting a pole sturdily in the ground at an angle of 45° with an old sack wound around it immersed in crude oil or used motor-oil.

Myiasis

Disease caused by flies, which lay eggs in the wounds. The eggs hatch into larvae

which live and feed on the flesh and developed into pupate, and fall off when they mature, creating more wounds.

Symptoms

- Infected wounds look very wet and dirty and the edges can be covered with grey mass which are the eggs of flies.
- Later on, larva can be seen as screw-shaped pinkish worms crawling through the wound.
- The pigs show annoyance and try to find a shady place.
- Death may occur.

Prevention and treatment

- Clean the wound daily with water and disinfectant then apply insecticide on wound to cover edges too.
- Best working insecticides are the long-acting ones e.g. diazinon or supona.
- Good mange control program to prevent wounds smooth walls and floors.
- Do not use sharp objects.
- Avoid overcrowding to reduce fighting.
- Tail docking, ears notching and castration should be handled properly and the umbilical cord disinfected.

Deworming

Those dewormers that are currently approved for use are effective and usually safe when given according to label directions. These include ivermectin (Ivomec®), fenbendazole (Safe-Guard®), levamisole (Tramisol®, Levasole®), pyrantel (Banminth®), dichlorvos (Atgard®) and piperazine. The deworming schedule should include prebreeding for all breeding stock and pre-farrowing for gilts and sows, prevention of Strongyloides and roundworms in baby pigs, and one or more dewormings in weanling and growing pigs. Specific strategic schedules should be arranged with your veterinarian.

- Boars - every 6 months
- Sows - 2 weeks before farrowing and after weaning
- Piglets - 1 week after weaning
- Fatteners - 1 week after weaning and 3months latter
- Gilts - 1 week after weaning, 3 months and at 7months of age at least 2 weeks
- before service

Poultry Production and Management:

Classification of Fowl:

	Fowl / Chicken	Japanese quail	Turkey	Duck	Ostrich
Kingdom	Animalia	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata	Chordata
Subphylum	Vertebrata	Vertebrata	Vertebrata	Vertebrata	Vertebrata
Class	Aves	Aves	Aves	Aves	Aves
Subclass	Neornithes	Neornithes	Neornithes	Neornithes	Neornithes
Order	Galliforms	Galliforms	Galliforms	Ansariforms	Struthioniformes
Family	Phasianidae	Phasianidae	Meleagridae	Antidae	Struthionidae
Genus	Gallus	Cotunix	Meleagris	Anas	Struthio
Species	domesticus	Japonica	gallopavo	platychychos	camelus

Common Breeds of Fowl and their Charecteristics:

Poultry includes several kinds of birds, such as chicken, ducks, geese, turkeys, and guinea fowls. poultry production has many advantages for farmer who likes poultry and is industrious. For success, a poultry ma must good judgment in managing the enterprise. The following are the desirable features of poultry production.

CLASSIFICATION OF CHICKEN BREED:

1. Based on Utility

- a. **Egg type:** 1. Leghorn 2. Minorcas 3. Anconas 4. Campines
- b. **Meat type:** Brahma, Cochins, Langshan, Cornish, Jersey Giants
- c. **Dual Purpose (General Purpose):** Rhod Island Red, Plymouth Rock, Australop, Wyandotte
- d. **Fancy:** Polish, Hamburg
- e. **For Pleasure:** Brahma, Cochin
- f. **For Game:** Assel
- g. **Miscellaneous:**

KEY FOR DIFFERENTIATION OF POULTRY BREED

1. WHITE PLUMAGE:

- a. Ear lobe white: White leghorn
- b. Ear lobe red:
 - i. Single comb: White Plymouth Rock
 - ii. Pea comb: White Cornish
 - iii. Rose comb: White Wyandotte

2. BLACK PLUMAGE:

- a. Shank Feathered:
 - i. Single comb: Black Langshan
 - ii. Pea comb: Dark Brahma
- b. Shank non-feathered:
 - i. Pea comb: Dark Cornish
 - ii. White ear lobe: Black Minorca
 - iii. Dark slate shank, red ear lobe, Single comb: Australop
 - iv. Yellow shank, red ear lobe, single comb: Jersey black Gaint

3. **BROWN/RED PLUMAGE:**

- a. Rich red brown: Rhod Island Red
- b. Chest nut red: New Hampshire

2. **Based on origin**

- a. **Indigenous:** Sakini, Ghati khuaile (Naked Neck), Pwakh Ulte (Dumse)
- b. Foreign:
 - i. **Asiatic:** Bahma, Langshan, Cochin
 - ii. **English:** Sussex, Australop, Orpington, Dorking, Cornish
 - iii. **Mediterranean:** Leghorn, Minorca, Ancona
 - iv. **American:** RIR, NH, JG, Plymouth Rock, Wyandotte

Important poultry breeds

Most fowls in Nepal are non-descript. The number of improved fowls in Nepal is increasing day by day. The common local fowl show a great variation in their color, size, and are poor layers of small-sized eggs. These are, however, ideal mothers, good sisters and excellent foragers. They are hardy and possess natural immunity against common diseases. Among the local breeds, which are said to be more or less pure, are the

INDIGENOUS POULTRY BREED IN NEPAL

- i. Sakini:
 - principal chicken breed in the country.
 - hardy and dual purpose suitable for meat (reputed for delicious meat) and eggs.
 - found throughout the country.
 - The local shakini is small in body size, different feather colour, hardy in nature.

- The egg production capacity is 70-80/ year.
- The average adult body weight is 1.5-2.0kg.

2. **Ghanti Khuile (Naked neck):**

- hardy and dual purpose
- good for scavenging condition.
- found throughout the country.
- Their population is very low and needs conservation attention.
- No feathers in neck, different feather color,
- The egg production capacity is 60-80/year.
- male is 1.6 and female is 1.30 kg

3. **Pwankh Ulte (Dumse):**

- Dumse chicken is hardy and dual purpose suitable for meat and eggs.
- They have ruffled feathers.
- found throughout the country in a small number.
- need immediate conservation attention.
- outward growth of feathers.
- The average adult body weight of male is 1.0 kg and female is 0.9kg

White Leghorn

it is one of the one most popular egg breeds of fowls all over the world. The breed originated in Italy and as far there are 12 varieties out of which only three varieties however, have become popular. The white Buff and Brown variety are subdivided further on the basis of the character of comb. i. e ; weather it is rose or single comb. It is small and very compact in form, carries the tail rather low and has a small head with well set comb and wattle.They are: (i) single comb white, (ii) single comb Buff; and (iii) single comb light Brown. The breed is small, active, and reputed for the harmony of its various parts. It is an excellent layer,

but not very much favored for table purposes. The Shape of comb is quite important to leghorn fanciers. The single comb of the male should be of medium size and should stand erect, with five uniform, deeply serrated points. The average weight of a cock of this breed is 2.7 kg and a hen is 2 kg.

Rhode Island Red

It is originated from Rhode Island in New England after crossing with the red Malay Game, Leghorn and Asiatic native stock and has some what long, rectangular body, which is also broad and deep. The usual colour of the breed is brownish red, but buff, white and brown are not uncommon. The back is flat and the breast is carried well forward-characteristics which make it good meat producing bird. The single comb is the more popular of the two. The plumage of the Rhode Island Red is rich dark or brownish red in colour, evenly distributed over the entire surface, and is well glossed. The wing when spread shows black both in primaries and secondaries. There are two varieties of this breed (i) single comb and (ii) Rose comb. The characteristics of the varieties are identical aside from the type of comb. In both cases the skin and shanks are yellow and the ear lobes red. Rhode Island Red is one of the best all-round breeds of poultry. the quality and yield of flesh are good. It is an excellent layer. Among the exotic breeds introduced in Nepal, Rhode Island Red is by far the most popular. It is the hardiest of all breeds. It can withstand extreme climatic conditions in cold, wet and heavy rainfall regions. The average weight of the cock is 3.8 kgs and of hen 3 kgs cockerel 3.4 kg and pullet 2.5 kg colour of egg shell, brown to dark brown.

Plymouth rock

It is one of the most popular breeds in America, largely because it is a bird good size, with excellent fleshing properties and good egg laying abilities with have long bodies and have good depth of body. Mature birds weigh from 3.5 to 4.5 kg. There are seven varieties of Plymouth rocks, each distinguished by its plumage. They are (i) Barred, (ii) White, (iii) Buff, (iv) Silver pencilled, (v) Blue (vi) partridge, and (vii) Colombian. They have single combs.

In general the plumage is grayish white, each feather crossed by almost black bars

which should be even in width, straight and should extend down to the skin. Each feather should end with a narrow, dark tip with the alternate dark and light bars, give a bluish cast or shade to the surface colour. Solid black or partly black feather may occur in some birds of practically all stains in this variety. Black spots on the shanks are also common, particularly in females. All these strains indicate purity of breeds.

Australorp

It is considered a good all-round breed and was developed in Australia where for many years it has been bred principally for egg production rather than meat with very fleshy which makes it a good dual-purpose breed. It has a good depth of body, and more closely feathered than the Orpington. The back is somewhat long, and the body slopes gradually towards the tail. The comb is single, the body is black, plumage is lustrous greenish black in all the sections, the under colouring is dull black. The standard weight of the cock is 3.8 kg and of hen 3.0 kg Cockerel 3.4 kg pullet 2.5 kg.

Sussex

It was developed in England as table bird and has a long body, broad at the shoulder and with good depth from front to rear. There are three varieties of this breed i.e. Light Sussex, Red Sussex and Speckled Sussex. The breast is well developed and the bird has excellent fleshing qualities. They have single comb, and horn-colored beaks, shanks and toes. The standard weight of cock is 4.5 kg and of Hen 3.5 kg. Cockerel 3.5 kg pullet 3 kg.

New Hampshire

The New Hampshire was developed from the Rhode Island Red, apparently with some crossing with one or more other breed in 1930 for both meat and egg production, is relatively a new breed developed in the United States. The characteristics features of this breed are single com, Chestnut Red plumage, early maturity, rapid feathering etc. they are good producer of large brown shell egg and good quality meat. The lower neck feathers are distinctly tipped with black and the main tail feathers are black, edge with chestnut red. The under color of both

the sexes is light salmon. The standard weight of cock is 3.8 kg, and of hen 2.9 kg. Cockerel 3.4 kg pullet 2.5 kg.

Housing System of Fowl:

On the basis of operation on the poultry farms the following buildings are usually found in use:

- Hatchery
- Brooder House
- Broiler house
- Layer house
- Feed mill
- Poultry processing unit

FUNCTIONAL REQUIREMENTS OF POULTRY HOUSING

1. Temperature

- High body temperature (107°F) causes more heat loss on winter
- No sweat gland so pulse and respiration are higher
- More problem with higher temperature (critical 38°C)

2. Moisture control

- Avoids germs multiplication
- Maintains sanitation
- Promotes health conditions

3. Ventilation control

- Replacement of air by fresh air is called ventilation
- Expired air by birds have more moisture as they do not have sweat gland and metabolic rate is higher than other livestock

4. Sunlight

5. Sanitation

- Reduce germs multiplication
- Promotes better health condition
- Protection from ticks, lice, mites etc. and also reduce internal parasitic infestation

- Reduce mortality
- Reduces contamination of feed and water

ESSENTIAL OF A GOOD HOUSE

1. **Proper type:** Optimum width, height, roof and ventilation according to housing system.
2. Adequate floor space
3. Adequate ventilation
4. Sunlight
5. Distribution of lights
6. Well-arranged interior
7. Dryness in and around poultry house
8. Protection from predators and parasites
9. Sanitation in and around poultry house

FACTORS AFFECTING LOCATION OF POULTRY HOUSING*

- | | | |
|---------------------------------|---------------|-----------------|
| ● Soil (kind/ type / Condition) | ● Elevation | |
| ● Topography | ● Sunlight | |
| ● Protection from wind | ● Market | |
| ● Durability | ● Labour | ● Accessibility |
| ● Surrounding | ● Electricity | ● Others |

POULTRY HOUSE CONSTRUCTION

1. **Foundation:** Strong , solid of bricks, pucca to prevent rodents
2. **Floor:** According to needs, means and resources (mud, brick, concrete, slat floor)
3. Walls:
 - a. Water proof, wind proof and smooth finished with interior surfaces that are easier to clean and disinfect.
 - b. In Terai plains, the walls may be made of expanded metal wire mesh

on sides but end walls kept solid.

- c. Total height = 6ft. (1.82 m), which consists of 2ft. (60 cm) brick wall + 4ft. (1.22 m) expanded metal wire mesh.
4. **Roofs:**
 - a. Desirable type- asbestos sheet, zinc sheet or tile roof or cement asbestos
 - b. Height: Side=6ft. & Centre=10ft.
 - c. Fall of roof (extension beyond wall) = 3-4 ft. to provide shade and prevent rain water
 - d. No free space between roof and walls (prevent entry of other birds i.e. sparrows)
 5. **Doors:** Located in the end of side walls opposite to each other. Size= 1.2 × 2.13 m.
 6. **Windows:**
 - a. Covered with wire netting and enough size and number for proper ventilation & light, should open inner side.
 - b. At least 1.5 sq. ft. opening for each 10 sq. ft. of floor space. In winter and in hills it can be reduced to half.
 - c. Equal opening on both sides.
 7. **Insulation:**
 - a. In summer cover the roof with straw or thatched material and spray water on it to keep cool inside house. Also cover wire netting with gunny bags in and sprinkle water over it
 - b. Cover wire netting in extreme cold.
 8. **Ventilation:** Arrange and adjust windows/doors in such a way that house remains free from moisture, foul gas, pollution, ammonia smell etc. and litter dry.

9. Floor space per birds under different system:
 - a. Extensive system(Free range/ Scavanging): Unlimited space
 - b. **Semi intensive system (semi-scavenging system):** birds are let loose to roam freely for part of the day but, when necessary, they are shut in and supplemented with extra feed.
 - c. **Intensive system:** reared entirely on i. Deep litter system ii. Wire floor system iii. Battery/Case system

Space required in deep litter system

- a. Brooding house: 0.35-0.5 sq. ft. (325-465 cm²)
- b. Rearing house: 0.75 sq. ft. (697 cm²)
- c. Broiler house: 1 sq. ft. (929 cm²)
- d. Hen house: 2 sq. ft. (1858 cm²)

Battery/case system: upto 1/3rd of the space recommended for deep litter system.

10. **Design of poultry house:** It varies place to place depending upon number of birds, capital available, availability of raw materials and climatic conditions.

SYSTEMS OF POULTRY HOUSING

1. Extensive system (Free range/ Scavanging)): Unlimited space
2. **Semi-intensive (semi-scavenging system) system:** Housing with outside run; birds are let loose to roam freely for part of the day but, when necessary, they are shut in and supplemented with extra feed.
3. **Intensive system:** i. Deep litter system ii. Wire floor system iii. Battery/Case system

DEEP LITTER SYSTEM

The system in which floor of the house is covered with 15-20 cm. litter material and birds are reared on it all the times is known as deep litter system. In this

system fowl remains on litter day and night. The dropping fall and mix-up with litter. The scratching habit of birds helps in mixing material with droppings. The bacterial action commences. Within 2 months the material changes to a kind of dry compost. The important aspect of it is to keep litter dry.

1. Floor Space/bird

Broiler: 1 sq. ft.

Layers: 2 sq. ft.

2. Litter

Kind: Soft, clean absorbent type free from dust, moisture and mold

Type: Paddy husk, saw dust, dry leaves/grass

Depth: 12-15 cm

3. Deep litter house:

Floor: Plinth should be 60-75 cm higher than ground. Impervious to moisture, rodent proof and have slope towards door.

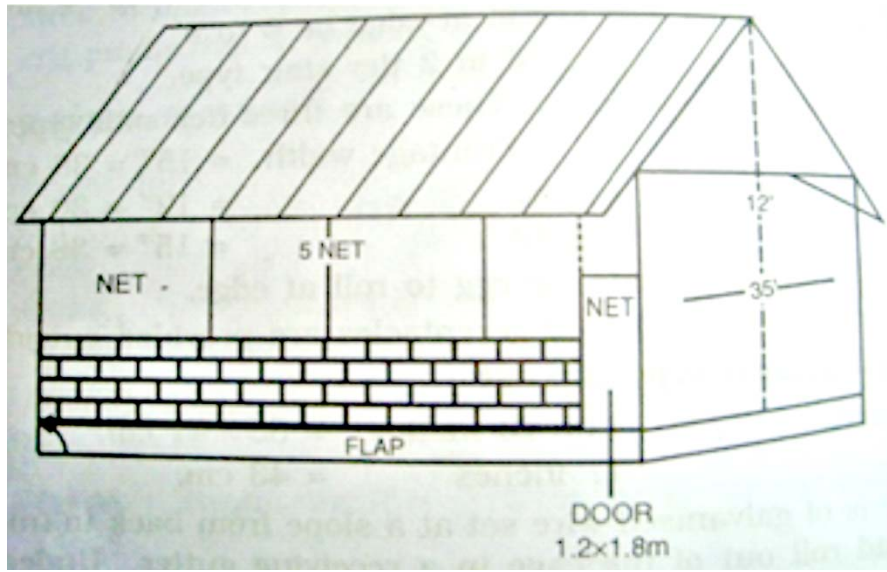
Walls: Length wall should have brick wall of 60 cm. and wire netting of 1.22 m height supported with angle irons. End walls should be solid and made of bricks.

Doors: Two doors 1.22m wide opposite to each other on end walls, covered with wire netting. Height of door should be 1.82m. Arrange foot bath or layer of lime at the entrance.

Roof: 10 ft. high in the centre and 6ft. high on the side with 3-4 ft. hang over (extension) beyond wall to prevent rain water and keep litter dry. Roof should be 'A' type with slope of 1.22 m. from center to sides.

Light: 1 bulb of 40 watts located at 2.1 m height, provided with reflector provides enough light for 9m² floor area. Distance between two bulbs should be 2-2.5 m. and bulbs should be cleaned periodically.

Nests: 60 cm. depth, 1.5 m wide divided into three portions of 50 cm each is enough for 50 birds.



ADVANTAGES OF DEEP LITTER:

1. Source of feed ingredients like vit. B₁₂ (cynocobalamin) and vit₂(riboflavin) synthesized by bacterial action.
2. Temperature control
 - Provides warmth in cold weather
 - Evaporation of moisture in hot season
 - Litter is bad conductor of heat
3. Control of humidity in the house
 - By releasing moisture by evaporation in hot season
 - By absorbing excess moisture in wet season
4. Protection from parasites as they are killed by heat produced by bacterial action.
5. Control of disease germs like *Salmonella* are killed by heat produced by fermentative action.
6. Labor saving as droppings are not removed from the house.
7. Protection from inclement weather – hot and cold.

8. Source of excellent manure.

ROUTINE ATTENTION

1. Stirring of litter regularly each day
2. Keep litter dry to avoid caking
3. Avoid over crowding

PRECAUTIONS AND CARE

1. Damp litter gives rise to ammonia smell which causes coughing, water discharge from eyes and respiratory diseases in birds. Mix 0.5 kg superphosphate per 15 sq. ft. of floor area to control production of ammonia.
2. To control dampness in litter mix 1 kg hydrated lime per 15 ft² floor area. Never mix quick lime in the presence of bird.
3. Stir the litter daily to mix dropping in the litter and to keep it dry
4. Damp litter may provide shelter for internal parasites and *coccidia* thus use anti-coccidia (Amprolium/Bifuran) in feed and also carry out periodical deworming.
5. Maintain proper ventilation to keep litter dry.

BATTERY/CAGE SYSTEM

It is a most intensive type of poultry production and useful to those who have small space at their disposal. People in large cities have found it very useful because they cannot spare open lands for rearing birds.

ADVANTAGES:

1. Economy in space.
2. Better disease prevention and control of infection.
3. Less mortality rate
4. Less expenses on medication
5. Feed saving upto 10gm/day/bird, which means Rs. 30,000 on 2,000 birds

flock per month.

6. Increased laying efficiency and more number of clean eggs.
7. Labor saving of 5 times than deep litter.
8. Birds vices (cannibalism, feather picking, egg eating) are controlled.
9. Easy maintenance.
10. Fowls remains more clean and healthy.

TYPES OF CAGES *

(Brooder cage, layers cage, conventional cages, reverse type cages, Californian type cages)

*Consult yourself for further information

DIFFERENCE BETWEEN CAGE SYSTEM AND DEEP LITTER SYSTEM

Parameters	Cage system	Deep litter system
1. Floor economy	More	Less
2. Disease prevention	More	Less
3. Mortality rate	Less	More
4. Expenses on medication	Less	More
5. Loss of feed	Less	More
6. Saving of feed	More	Less
7. Labour—one for Supervision	5,000 hens	1,000 hens
8. Supervision	Better	Good
9. Vice (pecking/domineering)	No	Yes
10. Maintenance	Easier	Easy

Source: J. Prasad, 2010

Feeding management of Poultry:

Feed cost about 70 percent of total cost of commercial poultry production. Feeding therefore is one of the key factors for successful poultry production. More than 42 nutrients are required by the poultry. They can be arranged into six classes according to their chemical nature, functions they perform and the case with which they are chemically determined. These groups of nutrients are:

- Water

- Protein
- Carbohydrates
- Fats
- Minerals and
- Vitamins

Conventional poultry rations usually include many cereals like soybean, maize, rice, wheat, oat, barley and a few cereal by-products such as wheat bran, rice polish, animal and vegetable protein sources like fish meal, , soybean oil meal, groundnut cake, etc. according to their availability. The whole ration is fortified with adequate minerals and vitamins either in chemically pure or through ingredients known to be rich in these nutrients.

The Principle points for consideration of poultry feed formulation:

- Their digestive tract of poultry is having a simple stomach is comparatively short, digestion is quite rapid. It takes about 2 and half hours for feed to go from mouth to cloaca in the laying hen, 10 hours in a non-laying hen. Poultry birds have no lips or teeth, hence require a more concentrate ration.
- Chickens of different ages require different level of nutrients, hence only the accepted standards as per age should be followed accordingly.
- Poultry birds are fed collectively rather than individually.
- Due to higher rate of metabolism, poultry require a more exact ration.
- Feed must contain all essential nutrients in right amount and proportion required for the purpose for which it fed.
- Ingredients chosen for preparation of poultry mashes must be palatable.
- Fungal infested ingredients should always be avoided.
- While selecting ingredients for poultry mashes, nutritional value of each ingredient should be evaluated vis-à-vis cost.
- Chickens have no teeth to grind grains or oil cakes; hence these ingredients

should be crushed into proper sizes in keeping with age of the chicken.

- Macronutrients and non-nutrient feed additives should be carefully chosen and mixed up meticulously for effective results.
- Include agro-industrial by-products to minimize cost and select a variety of ingredients to make good deficiency of one by other.
- While selecting an ingredient care should be exercised to judge its optimum level of inclusion as many of the ingredients are likely to be deleterious at higher level.
- Care should be taken to select optimum C/P ration for the purpose for which feeds are compounded.

METHODS OF FEEDINGS:

A well-balanced ration improperly fed will not give the most satisfactory results unless a satisfactory method is followed. Some of the popular methods of feeding are as follows:

1) Whole grain feeding system:

By this method birds are allowed to have their required ingredients kept before them in separate containers. The system through permit birds to balance their ration according to individual needs, however, it appears doubtful. This old and abandoned system offers no particular advantages. While it entails the use of several feed hoppers and a considerable amount of time to keep them filled.

2) Grain and mash method:

This method is slightly better than the previous one. It involves feeding of grain mixture along with balanced mash. By this, one can increase or decrease the protein level as desired. Unless the poultry man is exceptionally skilled, the method will lead to bad performances.

3) All mash method:

In this method of feeding, all the feed ingredients are ground, mixed in

required proportion and fed as a single balanced mixture. This method is desirable for all types of poultry grown under litter and cage system. By this, birds can't have the opportunity to have selective eating and moreover the qualities of eggs produced are of uniform quality. However, retain their nutritive value so well as ungrounded feeds.

4) Pellets methods:

Pellets are made of dry mash under high pressure. These are quite hard and cylindrical shape and are being extensively used in western countries. The greatest advantages in using pellets are that there is little waste in feeding. The disadvantages is that pellets are expensive (about 10% more expensive than that of feeds not pellated)

5) Restricted or controlled feeding:

The method involves restrictions of feeding pallets during 6 - 20 weeks of age instead of adlibitum feeding as is practiced at present in most poultry farm. Reduction in feed cost, delayed sexual maturity but improved egg production curve, and along with a reduction in the number of small eggs laid is some of the advantages of this system.

Feed restriction to birds can be made by number of ways:

- Skips a day programme.
- Alternate day feeding.
- Restriction of feeding time.

NUTRIENTS REQUIREMENT OF POULTRY:

Chickens of different ages require different levels of nutrients, according to NRC, C.P and metabolic energy requirements of chickens are as follows:

Group	Age	C.P.	ME (Kcal/Kg.)	Remarks
Starting chicks	Up to 8 wks.	20	2675	Starting poultry feed

Growing chicks	8 to 20 wks.	16	2410	Growing poultry feed
Laying hens	20 to onwards	15	2830	Laying poultry feed
Breeding hens	20 to onwards	15	2830	Laying poultry feed

A protein percentage between 22 to 24 is fed to broilers for the first 5 - 6 weeks to obtain rapid early growth. These ration are called “**Broiler starter ration**”. After this period, broilers are fed with a different type of ration having relatively less protein and more energy for fattening, such a feed is known as finisher ration, which contain 20 % protein and 3200 K cal ME / Kg.

Formulation of poultry ration

Feed formulation involves the judicious use of feed ingredients to supply in adequate amounts and proportions the nutrients required by poultry. While choosing the feed ingredients a consideration is also given to their current price to formulate least cost diets. Following information needed for feed formulation

1. Nutrient requirements for chicken feeds
2. Information on feed ingredients

Nutrient requirements of chicken depend upon the species; breed and its genetic make up, age, production statue and environmental conditions. The available feeding standards are "poultry nutrients requirements by Bureau of Indian standards (1992) Nutrients requirements of poultry (194) by the NRC of the National Academy of Sciences (USA) and similar requirement proposed by the ARC (UK). The accurate way to express the nutrients is in amount per day per animal. Poultry are fed in groups. It is, therefore, not practicable to express the requirements in amounts per day per animal. For optimum growth of young chickens, they should be fed diets containing all the necessary nutrients in the right amounts.

Requirements for chicken feeds

S.N	Characteristic	Requirements for					
		Broiler starter	Broiler finisher	Chick feed	Growing chicken feed	Laying chicken feed	Breeder layer feed
1	Moisture percent by mass, Max.	11	11	11	11	11	11
2	Crude protein (Nx6.25), percent by mass, Min.	23	20	20	16	18	18
3	Crude fibre, present by mass, Max.	6	6	7	8	8	8
4	Acid insoluble ash, percent by mass, Max.	3.0	3.0	4.0	4.0	4.0	4.0
5	Salt (as NaCl), percent by mass, Max.	0.6	0.6	0.6	0.6	0.6	0.6
6	Calcium percent by mass, Min.	1.2	1.2	1.0	1.0	3.0	3.0
7	Available phosphorus by mass, Min.	0.5	0.5	0.5	0.5	0.5	0.5
8	Lysine, percent by mass, Min.	1.2	1.0	0.9	0.6	0.65	0.65
9	Methionine, percent by mass, Min.	0.50	0.35	0.3	0.25	0.30	0.30

10	Metabolizable energy (Kcal/kg), Min.	2800	2900	2600	2500	2600	2600
11	Manganese, mg/kg	90	90	90	50	55	90
12	Iodine, mg/kg	1	1	1	1	1	1
13	Iron, mg/kg	120	120	120	90	75	90
14	Zinc, mg/kg	60	60	60	50	75	100
15	Copper, mg/kg	12	12	12	9	9	12
16	VitaminA, IU/kg	6000	6000	6000	6000	8000	8000
17	VitaminD, IU/kg	600	600	600	600	1200	1200
18	Thiamin, mg/kg	5	5	5	3	3	3
19	Riboflavin, mg/kg	6	6	6	5	5	8
20	Pantothenic acid, mg/kg	15	15	15	15	15	15
21	Nicotinic acid, mg/kg	40	40	40	15	15	15
22	Biotin, mg/kg	0.2	0.2	0.2	0.15	0.15	0.2
23	VitaminB ₁₂ , mg/kg	0.015	0.015	0.015	0.01	0.01	0.01
24	Folic acid, mg/kg	1.0	1.0	1.0	0.5	0.5	0.5
25	Choline, mg/kg	1400	1000	1300	900	900	800
26	VitaminE, mg/kg	15	15	15	10	10	15
27	VitaminK, mg/kg	1.0	1.0	1.0	1.0	1.0	1.0
28	Pyridoxine, mg/kg	5	5	5	5	5	8
29	Linoleic acid, g/100g	1	1	1	1	1	1

30	Methionin+cystine, g/100g	0.9	0.7	0.6	0.5	0.55	0.55
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Broiler: The Bureau of Indian standards (1992) recognizes only two phases in the broilers from day old to marketable age of 8 weeks, that is broiler starter phase (0-5 weeks) and broiler finisher phase (5-8 weeks) while NRC (1994) divided the period into 0-3 weeks, 3-6 weeks and 6-8 weeks since the requirements for nutrients of growing chickens depend upon their rate of growth.

Layers: the BIS (1992) recognize only two phases during the growing period of the chickens, 1. Chick phase (0-8 weeks), 2. Grower phase (8-20 weeks). On the basis of their growth rate and the accompanying nutrient requirements, the growing period of chickens has been divided into 0-6 weeks (starter phase), 6-12 weeks (grower phase), 12-18 weeks (puller developer phase) and 18 weeks to first egg (NRC, 1994).

Essential amino acids for poultry certain amino acids can be produced from others by process of transamination, but a number cannot be effectively synthesized in the animal body and these are referred to as essential amino acid. Arginine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phynylalanine, Threonine, Tryptophan and Valine are essential amino acid for poultry. Methionine and lysine are limiting amino acid.

Calorie/protein ratio: It is defined as the metabolizable energy (Kcal) per kilogram divided by the percentage of crude protein in the ration. The ratio varies with the age of the bird. Calorie protein ratios are:

Type	Calorie –protein ratio
Broiler starter feed	122
Broiler finisher feed	145
Chick feed	130
Grower feed	156
Laying chicken feed	144

Information on feed ingredient

Chemical composition and nutritive value of common poultry feed ingredient

Ingredient	DM%	ME (Kcal/kg)	CP	CF	EE	Ca	P	Lysine	Methionine
Maize	89	3340	9	2.2	3.8	0.02	0.28	0.22	0.18
Broken rice	89	2900	8.5	10.6	1.9	0.08	0.39	0.24	0.16
Wheat	89	3000	10	2.4	1.8	0.05	0.31	0.30	0.16
DORB	91	200	13.5	14.0	0.6	0.07	1.5	0.6	0.25
Rice polish	90	3300	12	8	15.1	0.08	1.30	0.50	0.22
Wheat bran	90	1300	15.7	11	3	0.14	1.15	0.59	0.23
Molasses	74	2300	3.0	-	-	1.10	0.12	-	-
Sunflower cake	93	1900	27	28	1.1	0.37	1.0	1.13	0.58
SBM	89	2300	45	6.6	0.8	0.29	0.65	2.7	0.65
GNC-SE	92	2400	42	13	1.0	0.2	0.63	1.6	0.45
GNC-Exp	90	2600	40	13	7.3	0.16	0.56	1.5	0.42
Rapeseed cake	92	2300	35	11	1.4	0.72	1.12	1.70	0.65
Fish meal	91	2400	42	1.0	5.0	3.73	2.43	3.2	1.1
Meat meal	92	2400	45	8.7	7.1	8.27	4.1	2.5	0.65
Oil or fat	-	8000	-	-	-	-	-	-	-

Maximum level of inclusion of feed ingredients: Each ingredient has its maximum level of inclusion in the diet to obtain optimum performance. This is dictated by the presence of antinutritional/toxic factors, cost of the ingredient, difficulty in

feed formulation, proper storage and shelf life of the feed, its capacity to induce imbalance of nutrients and reduce the performance of birds.

Level of inclusion of some common poultry feed ingredients

Feed Ingredient	Chicks	Grower/layers
Maize	60	60
Rice bran	10	20
Wheat	50	50
DORB	20	20
Rice polish	40	40
Wheat bran	10	15
Molasses	5	10
Sunflower cake	15	20
SBM	40	40
GNC-SE	40	40
GNC-Exp	20	20
Rapeseed cake	10	10
Fish meal	15	10
Meat meal	5	10
Oil or fat	10	5

Brooding management of Chicks:

In nature, chicks hatch at 20 to 21 days of incubation by the hen. The hatched chicks provide the stimulus to the hen to change her work from incubating eggs to brooding young. This form of brooding chicks is the easiest if only a few chicks are raised because the mother hen does all the work. Hens that are “good mothers” include Rhode Island Red, New Hampshire, Plymouth Rock, Cochins, and Silkies. Under natural brooding, chicks can easily be fostered under a broody hen at night,

and she will raise them as her own even if they are pheasants, turkeys, quail, or waterfowl. When broody hens are not available, or large numbers of chicks are to be raised, artificial brooding is necessary. Chicks will perform equally well under artificial or natural brooding, providing they are precocial; that is, able to walk and feed themselves within hours of hatching, as baby chickens are. Novice growers are not advised to try artificial brooding for altricial chicks; that is, chicks such as pigeons, doves, finches, and parrots that remain in the nest to be cared for and fed by the parents. Many of these chicks are naked, blind, and unable to walk for several weeks after hatching and require around-the clock care and feeding.

Housing

Chick brooders can be elaborate pieces of equipment such as tiered battery brooders (Figure 1) or as simple as a cardboard box (Figure 2) in the house or garage. In both cases, the most important aspect is to maintain conditions that allow the birds to thrive.

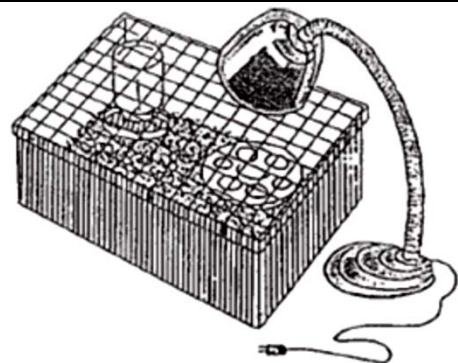
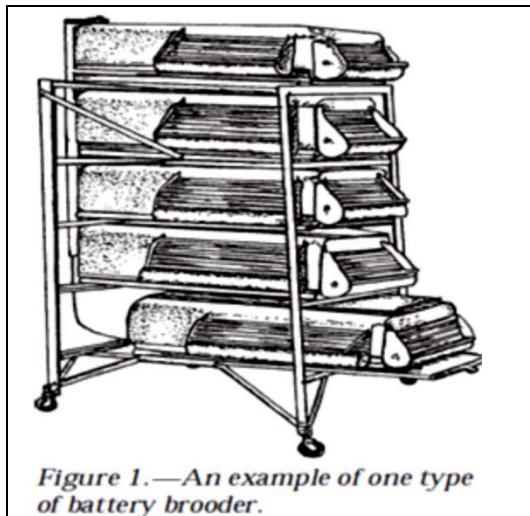


Figure 2.—Setup to brood a few chicks in a cardboard box or wire cage.

Battery brooding

Birds in battery brooders are kept in multiple layers, so many chicks can be brooded in a relatively small amount of floor space. There are many designs. Most include an electric heat source at one end, usually in an area that is somewhat enclosed; another area, about two to three times the size of the heated area, is not

heated.

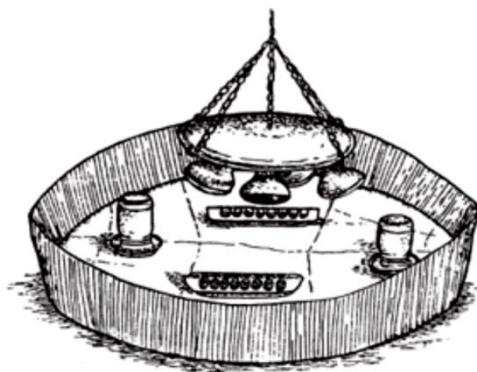
The walls and floor of each brooding area most often are wire. A droppings pan under the wire floor requires regular cleaning. In many cases, feed and water are provided outside the brooding space, making management easier. Battery brooders are an excellent way to brood chicks in a small space. However, chicks can remain in these brooders only a few weeks before they outgrow them. In addition, the cost to purchase one of these units is high.

Floor brooding

Most growers choose to brood chicks on the floor (Figure 3). Material requirements are minimal, but the environment is comparable to battery brooding.

Flooring.

Some type of bedding material or litter is required. Litter must be absorbent and must insulate the chicks from the ground. Most important, litter must not be slippery. A slippery floor, such as newspaper, cardboard, or a glass-bottom aquarium, is disastrous for baby chicks. Many chicks will develop “spraddles,” a condition in which their hip joints become dislocated, which is nearly always fatal. Ideal litter is sawdust or wood shavings; straw can be used if it is chopped into short lengths and is not moldy. Litter must be changed or top dressed (clean litter added over the dirty) if it becomes wet, and that must be done more often as the birds age.



Heat.

For small numbers of birds, heat usually is provided by heat lamps or light bulbs. When large numbers (200 or more) are brooded together, it may be more economical to use propane hovers. Many types of hovers are available if desired.

Proper temperature must be maintained if the chicks are to thrive. During the first few weeks, chicks are cold blooded; that is, unable to maintain their body temperature. As they age, they become warm blooded; that is, able to maintain constant body temperature under normal environmental conditions. Two methods of monitoring chicks' environmental temperature are used successfully. First, start chicks at about 95°F (measured near the heat source at chick height), dropping the temperature about 5°F each week until the birds are feathered or ambient temperature is reached.

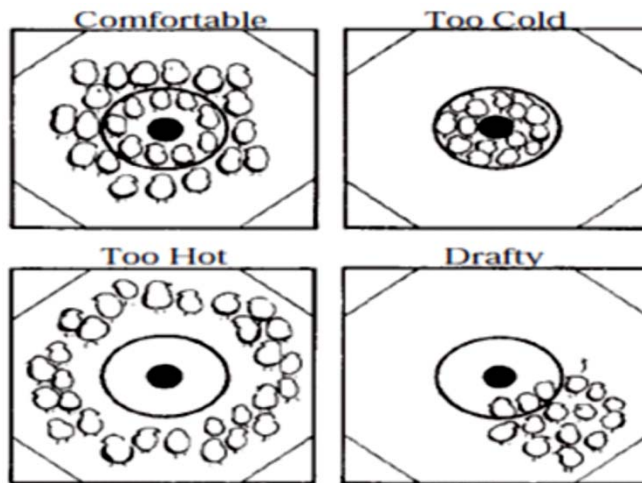
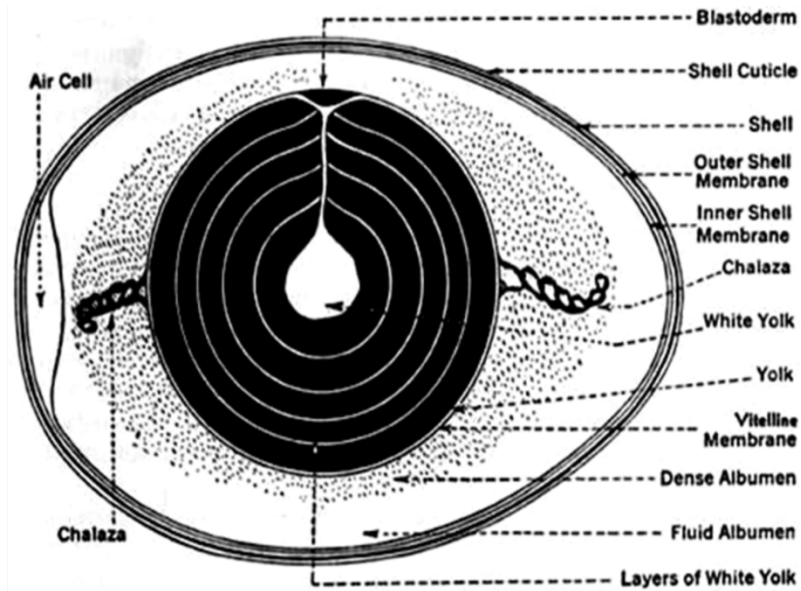


Figure 4.—Chick behavior can indicate their comfort level.

The second method relies on observing the chicks (Figure 4). If the chicks are all under the heat source, it is too cold; if they are all far away from the heat, it's too hot; if they are clumped away from the heat, it is drafty; if they are milling about in all areas of the pen, the temperature is correct.

Formation, structure and Nutritive value of Egg:

Structure of an egg:



Cuticle:

- Acts as a lubricant during the laying process
- Plugs pores
- Reduces moisture and gas loss
- Breaks down over time
- Can be damaged during washing

Shell:

- Color determined by breed or strain of bird
- Composed almost entirely of calcium carbonate with small amounts of sodium, potassium and magnesium
- Serves as a package for contents
- Contains thousands of pores

Shell membrane:

- Two protein fiber membranes

- Separate to form air cell
- Air cell increases as moisture and carbon dioxide is lost from the egg.

Albumen:

- White/clear portion of egg contents
- Four distinct layers (outer thin, inner firm, Chalaziferous, Chalaza)
- Water is primary component
- Egg quality determination

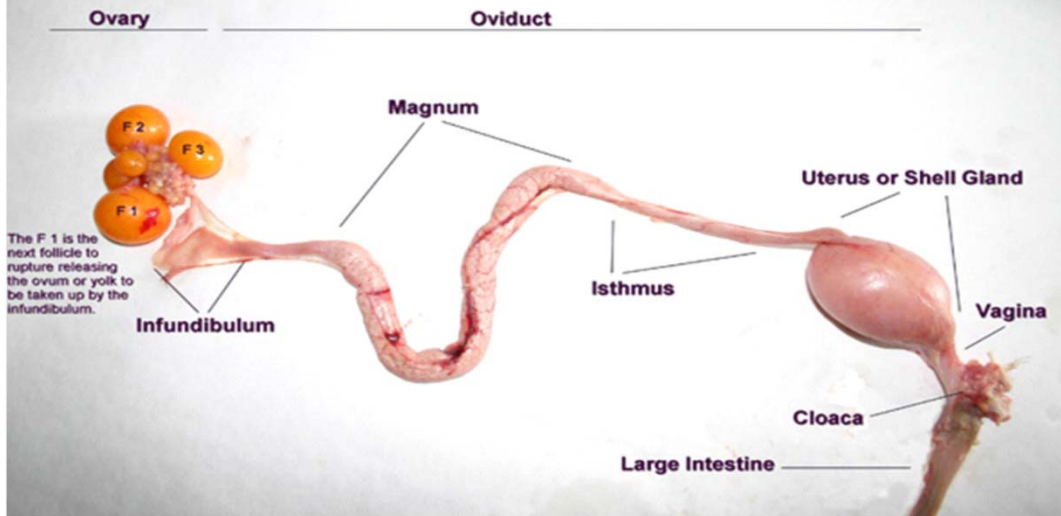
Yolk:

- Vitelline membrane surrounds yolk
- Good source of nutrients
- The composition of yolk lipid is about 65.5% triglyceride, 28.3% phospholipid, and 5.2% cholesterol.
- Fatty acid composition in the yolk is influenced by the type of fat in the hen's diet

Egg Component	% Protein	% Lipid	% Carbohydrate	% Ash
Albumen	9.7-10.6	0.03	0.4-0.9	0.5-0.6
Yolk	15.7-16.6	31.8-35.5	0.2-1.0	1.1
Whole Egg	12.8-13.4	10.5-11.8	0.3-1.0	0.8-1.0

EGG FORMATION:

Reproductive Tract of the Laying Hen



Section of oviduct	Time spend	Functions
Funnel (infundibulum)	15 min	Receives yolk from ovary. If live sperm present, fertilization occurs here (commercially produced table eggs are not fertilized)
Magnum	3 hrs	Albumen (white) is secreted and layered around
Isthmus	1 hr	Inner and outer shell membranes are added, as are some water and mineral salts
Shell gland (uterus)	20-21 hrs	Initially some water is added, making the outer white thinner. Then the shell material (mainly calcium carbonate) is added. Pigments may also be added to make the shell brown
Vagina/cloaca	less than 1	The egg passes through this section

	min	before laying. It has no other known function in the egg's formation.
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Nutritional Composition of an Egg

Nutrient (unit)	Whole Egg
Weight	60g
Water (percentage)	65-58.5
Calories (kcal)	70
Protein (g)	6.43
Carbohydrate (g)	0.36
Total fat (g)	4.8
Polyunsaturated fat (g)	1
Monounsaturated fat (g)	1.8
Saturated fat (g)	1.6
Cholesterol (mg)	185
Choline (mg)	126
Vitamin A (IU)	270
Vitamin D (IU)	41
Vitamin E (mg)	0.5

Selection of hatching eggs and incubator management:

CARE OF EGGS PRIOR TO INCUBATION

The hatchability of eggs can be severely reduced by improper care prior to incubation. Since it may not be practical for you to put the eggs in an incubator as soon as you get them, protect them from extreme variations in temperature. Ideally, eggs should not be more than 7 days old when they are set (placed in incubator). Beyond that point, hatchability declines.

If it is necessary to hold the eggs before you set them, turn them daily and keep them in a room where the temperature is around 50° F (10 C) and the relative humidity is 70 to 80 percent. The vegetable section of your refrigerator could be used for holding the egg until it is time to place them in the incubator. Temperatures below 40° F (4 C) reduce hatchability. Under no circumstances should the eggs be held at room temperature, because temperatures of this level are detrimental to hatchability. Embryos will begin develop at subnormal rates when the temperature reaches about 80° F (27° C)

READYING THE INCUBATOR FOR OPERATION

Before you set the eggs, be sure that the incubator is in good working order. Put some warm water in the water pan, place each thermometer so that the bulb of the thermometer is 1 inch (2.5 cm) above the screen, cover the incubator with the pane of glass, and then operate the incubator until the temperature inside it holds at 99° to 103°F (37 to 39 C).

PREPARING THE EGGS FOR INCUBATION

Eggs must be turned while in the incubator, so before you put in the eggs mark them with a pencil so you can tell when they have been properly turned. An excellent method is to put an "X" on one side of the egg and an "0" on the opposite side. Then you can always tell when the eggs have been turned, because either all "0" 's or all "X"'s are turned up at the same time.

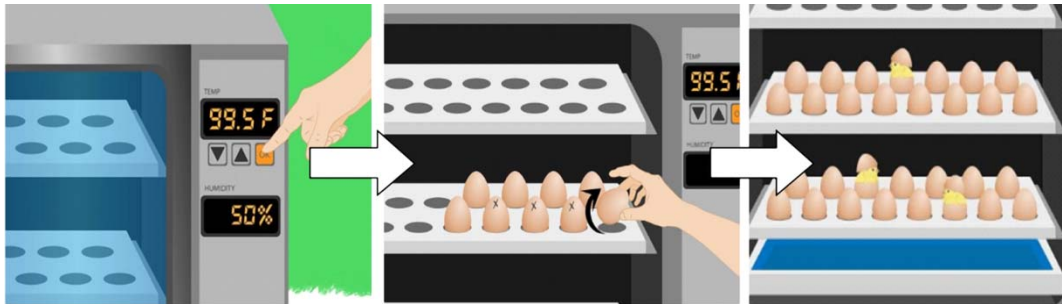
HUMIDITY

The ideal moisture level is about 50 to 55 percent relative humidity (83° - 87 ° F (28 - 31 ° C) on a wet bulb thermometer) for the first 18 days and about 65 percent (89° - 90° F (31 - 32 ° C) wet bulb) for the last 3 days. When you refill the water pan, use warm water. Hot or cold water will affect the temperature of the incubator too much. To increase the humidity level the last three days, set an extra pan of water in the incubator. Or you can put a wet sponge in the incubator to raise the humidity. A word of caution: Do not let the eggs come into direct contact with the water at any time.

TEMPERATURE

Temperature in the still-air incubator can vary from 99° to 103° F. (37 - 39 ° C) with no harmful effects if the temperature varies between these limits rather than staying at either extreme. If it stays at either extreme for several days, the hatch may be reduced somewhat. Overheating is much more critical than underheating. Overheating will result in abnormal embryos, speed up development, and lower hatchability. A thermometer should be in the center of the incubator if possible, and the bulb of the thermometer should be level with, but not touching, the tops of

the eggs. If light bulbs are used to supply the heat they should be distributed as evenly as possible in the incubator.



VENTILATION

Proper ventilation is very important during the incubation process. While the embryo is developing, oxygen enters the egg through the shell, and carbon dioxide escapes in the same manner. As the chicks begin to hatch, it is essential that they receive an increasing supply of oxygen. This means that the air openings need to be opened gradually to increase the flow of air.

LENGTH OF INCUBATION

Chicken eggs require 21 days to hatch, but the incubation period for the eggs of other species of poultry varies. The approximate periods of incubation required for various species of poultry and game birds are:

	Days
Chicken	21
Turkey	28
Duck	28

TURNING THE EGGS

When the eggs are put in the incubator, lay them on their sides and turn them at least three times a day. Turning prevents the embryo from sticking to the shell membranes as it will do if it is left in one position too long. Good results can be obtained by turning the eggs the first thing in the morning, again at noon, and the last thing at night. But it is better to turn the eggs more than three times a day. In

any case they should be turned an odd number of times so that the side that is up longest will be staggered from day to day. Otherwise the egg will be in the same position every night, which is the longest stretch of time between turns.

When you turn the eggs, move them to a different part of the tray to offset variations in temperature in the different parts of the incubator. Continue to turn the eggs from the first through the 17th days but do not turn them after the 17th day.

TESTING THE EGGS

Although it is not necessary to test eggs for fertility, you can eliminate the eggs which are not going to hatch by doing so. It is also an interesting phase of the project, since it is possible to see clearly the developing embryo.

Get a shoe box or a box of similar dimension made from wood or tin and cut a hole in one end about one inch in diameter. Use an extension cord and mount a 60-watt bulb in the box. Darken the room and hold the large end of the egg to the light. What you will see depends mostly on the age of the embryo. It is difficult to see much development until the 4th or 5th day of incubation.

The first parts of the embryo which you will be able to see by candling will be the head and eye, and they will appear as a dark object. If the embryo is alive and circulation is established, the contents of the egg will have a pinkish color or cast. But if the embryo is dead the contents will appear muddy or brownish.

FINAL STAGES OF INCUBATION

After the 17th day, eggs should not be turned, and the incubator should not be opened unless it becomes necessary to add water, replace a light bulb, or make some other necessary adjustment. Chicks will start to pip the shell around the 19th day. All chicks which are going to hatch should be out of their shells by the 21st day. If the eggs were chilled or you ran into operational difficulties during the incubation period, the hatch may be delayed. Chicks that hatch beyond the 22nd day are usually not healthy, vigorous ones.

Poultry Diseases:

Avian influenza (AI) is a highly contagious viral infection which may cause up to 100% mortality in domestic chickens or turkeys. The disease is caused by a virus that belongs to the family Orthomyxoviridae. Influenza viruses have two surface proteins, haemagglutinin and neuraminidase, that determine their subtype and the animal species they infect; there are 16 haemagglutinin and nine neuraminidase types. When AI viruses of two haemagglutinin types, H5 and H7, infect domestic poultry (chickens or turkeys) they often mutate and virulent disease arises in these birds which is called highly pathogenic avian influenza (HPAI). The initial infection that does not cause or causes minimal disease is called low pathogenic avian influenza (LPAI). Wild water birds act as reservoir hosts of influenza viruses, however these viruses generally do not cause disease in these birds.

Egg drop syndrome (EDS) is caused by a viral infection in laying hens. It is characterised by production of soft-shelled and shell-less eggs in apparently healthy birds, and leads to a sudden drop (10-40%) in recorded egg production or a failure to achieve a normal peak in production. It can be difficult to identify the early stages of the disease as hens will eat the shell-less eggs, and the only evidence that may remain is the membranes, which is a sign that is easy to miss. In flocks where some birds have acquired immunity due to the spread of the virus, a failure to reach expected production targets is observed. Clinical signs include diarrhoea and brief loss of shell colour and egg yolk pigment prior to the production of soft-shelled eggs and mortality is usually negligible. Ducks and geese are the natural hosts for the EDS virus and are asymptomatic carriers. Chickens of all ages and breeds are susceptible but the disease is most severe in broiler breeders and brown-egg layer strains. EDS was first introduced into chickens through contaminated vaccine and spread through breeder flocks.

Coccidiosis is one of the most common and economically important diseases of chickens worldwide. It is caused by a parasitic organism that damages the host's intestinal system, causing loss of production, morbidity and death. This disease has a major economic impact on the global poultry industry. It is caused by various species of *Eimeria* in chickens. *Eimeria* are present world-wide, and are

ubiquitous under intensive farming methods. Up to six species have been shown to occur simultaneously on one farm. The omni-present nature of *Eimeria* precludes eradication as a practical option for control. Since species-specific immunity develops rapidly, the management of coccidiosis aims to achieve a balance between allowing natural immunity to build up and preventing high oocyst exposure to naïve birds. Hygiene, anticoccidial drugs and vaccines all play major roles.

Newcastle Disease is a highly contagious viral infection that affects many species of domestic and wild birds to varying degrees. Domestic fowl, turkeys, pigeons and parrots are most susceptible while a mild form of the disease affects ducks, geese, pheasants, quail and guinea fowl. The disease can result in digestive, respiratory and/or nervous clinical signs, which range from a mild, almost inapparent respiratory disease to very severe depression, drop in egg production, increased respiration, profuse diarrhoea followed by collapse, or long-term nervous signs (such as twisted necks), if the birds survive. Severe forms of the disease are highly fatal.

Infectious bursal disease (IBD), also known as Gumboro, is a highly contagious viral infection that is found in chicken flocks in most countries. The severity of the disease will depend on the age and breed of chicken (White Leghorns are more susceptible than broilers and brown-egg layers) and the virulence of the virus. Signs of the disease can include a rapid drop in feed and water consumption, mucoid (slimy) diarrhoea with soiled vent feathers, ruffled feathers, listless chicks with unsteady gait or sitting in hunched position, picking at own vent and sleeping with beak touching the floor.

Infections before 3 weeks of age are usually subclinical (no detectable symptoms). Chickens are most susceptible to clinical disease at 3-6 weeks and severe infections have occurred in Leghorn chickens up to 18 weeks old.

Early subclinical infections are the most economically important as the disease can cause severe, long-lasting suppression of the immune system. Chickens that are immunosuppressed by early IBD infections do not respond well to vaccination

and are more susceptible to other diseases, including those that don't normally affect healthy chickens.

In clinical infections, onset of the disease is sudden after an incubation of 3-4 days. Mortality is usually low but has been reported to be as high as 20%. Recovery from the disease usually occurs in less than a week, however broiler weight gain is delayed by 3-5 days. The presence of maternal antibody (antibody passed to the chick from the mother) will modify the way the disease progresses.

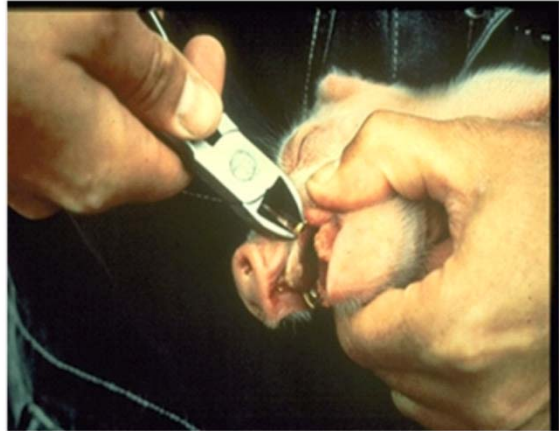
Necrotic Enteritis (NE) is the most common and financially devastating bacterial disease in modern broiler flocks. Early signs of an NE outbreak are often wet litter and diarrhoea, and an increase in mortality, that may not be significant. However, the depression of growth rate and feed efficiency of birds become noticeable by day 35 due to intestinal damage and the subsequent reduction in digestion and absorption of food. Subclinical infections are more economically damaging due to these factors. Furthermore, increased condemnations at processing due to liver lesions associated with subclinical NE can occur. The severity of clinical signs varies with the age of the birds.

Fowl cholera is a contagious bacterial infection. The disease can range from acute septicaemia (blood poisoning) to chronic and localised infections. Domestic fowl, game birds and small feral birds are susceptible. Turkeys are more susceptible than chickens, older chickens are more susceptible than younger ones, and some breeds of chickens are more susceptible than others. The disease is rare in broiler-aged chickens.

Clinical findings vary greatly depending on the course of the disease. In acute cases, increased mortality is usually the first indication. Affected birds have swelling of the face or wattles, discharge from the nostrils, mouth and eyes which may become "cheesy", laboured breathing and, in some cases, lack of coordination. The face, combs and wattles may become cyanotic (turn a bluish colour). Other symptoms include depression, loss of appetite, lameness, diarrhoea and ruffled feathers.

6. Non-ruminants Farm operation:

Teeth clipping in young piglets



Teeth Trimming

- It is usually necessary to trim the piglets' teeth to prevent them biting the udder.
- 4 canine teeth only
- When trimming the teeth the tongue of the piglets should be rolled back to avoid injuring it.

Iron administration

- This is an important problem, especially for young piglets kept indoors and in the cemented floors.
- At birth the piglets have about 50mg of iron in their body. They receive additional 1-2 mg/day from milk while they need 7mg (5-10mg) during the first week. So deficit of 5 to 6 mg /day =150 to 180 mg in 30 days
- The piglets become very pale a few weeks after birth and their growth slows down. (Anaemia)



Anaemia can be prevented by:

- Giving the piglet (3 and 10 days after birth) iron injection IM preferably at neck muscles.
- Oral paste containing iron is put in the mouth within 24 hours of birth or rub the liquid iron containing paste onto the udder of sow.
- When the piglets move from teat to teat they will slowly absorb the iron thus reducing the chances of any toxic reaction due to excessive amounts of iron.
- No injections are required when using Oral Iron Supplement

Tail Cutting(Docking)

- The undocked tail is a very convenient target for tail biting or cannibalism.
- This leads to injury and possibly infection. To reduce tail biting, dock (or cut off) the tail of newborn piglets within about 24 hours after birth.

Culling Debeaking and light management in fowl

Debeaking

The most important management function of poultry bird next to vaccination is debeaking. Chicken should be debeaked at the hatchery to prevent feed wastage, feather picking and cannibalism, 6th to 10th day of old is ideal age for debeaking. A combined hot blade debeaker or electrical debeaker should be used to perform this job. About one, half of the upper and lower beak is removed, keeping the lower beak slightly longer than the upper.

Lighting

Light affects growth and reproduction of poultry birds by different physiological sections. Correct lighting boosts up egg production by 5 to 10 per cent. The duration of the light period should not be decreased during laying period. Lighting encourages the chicks to feed more which will lead to better growth. Even distribution of poultry house is important for proper utilization of all space available in the shed. Irregular lighting results in drop in egg production. One foot

candle should be provided at birds eye level. This is equivalent to one watt for each four square feet of the floor space with lamps well distribution. Lighting should be increased gradually from 21 weeks till it reaches 16-17 hours per day and maintained at that level thereafter. Light should be 8 feet above the floor and good reflectors should be used to direct all light to the birds areas. The light bulbs should be cleaned and checked regularly. The defective bulbs should be replaced immediately.