Small Scale Livestock Production

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2015
Educationist Press
A Division of


Write & Print Publications

New Delhi-110 015

ISBN: 978-81-929705-6-1 (HB)
ISBN: 978-93-84649-03-6 (PB)

Published by : Hitesh Mittal
For Write & Print Publications
H-13, Bali Nagar
New Delhi-110 015
Phone: 011-45635684
E-mail: info@writeandprint.com
Website: www.writeandprint.com

Laser Typesetting : Rajender Vashist
Delhi - 110 059

Printed at : Salasar Imaging Systems
Delhi - 110 035
Phone: 011-27185653

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Dr. P.V. Sreenivasaiah, born 28th Feb, 1955, currently working as Professor

and Head, Department of Livestock Production Management, Rajiv Gandhi Institute of Veterinary Education and Research, Pondicherry, graduated from Veterinary College, UAS, Bangalore, during 1975. He obtained his Master's (at IVRI, during 1977) and Ph.D (From APAU, Hyderabad during 1985) with I Rank in both with ICAR fellowships specializing in Poultry Science. Dr. P.V. Sreenivasaiah has been one of the earlier workers on basic Physiology and Management of Japanese quails when the species was introduced to our country during 1974. He established a Japanese quail breeding unit and was associated in the development of "Giriraja" while working in the All India Coordinated Research Project on Poultry for meat at UAS, Bangalore. Establishment of Department of Poultry Science at Veterinary College, Bidar (Karnataka) and Department of Avian Production and Management at his current work-place are also notable contributions of the author. He is involved in the field of Poultry Science for the past 37 years contributing about 50 research papers in various accredited journals. His books include (a) Scientific Poultry Production (2 Editions, 1987 and 1998) (b) Scientific Poultry Production - a unique Encyclopedia (2006), (c) Veterinary Biostatistics (2007) (d) Small-scale Broiler Production (2008) and (e) Small-scale Layer Production (2008). All the books have been received well by the readers. He has also published 50 research papers, 15 popular articles and a farmer's bulletin.

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Preface

Livestock production is taken up as means of livelihood by a large number of farmers as it brings with it more employment opportunities and income. More and more educated farmers are now venturing into cattle and buffalo production and they find it to be considerably successful. This has prompted the need for publications on various aspects of livestock production especially to cater to the needs of these farmers.

There are many publications available by accredited authors describing to varying depth the rearing of livestock production. However, most of these publications are in full text form and / or describe cattle and buffalo production to such a depth that the farmer may find it difficult to understand. Hence, a question and answer method of presentation is adopted in this publication, wherever appropriate, with maximum emphasis on practical aspects so that the farmer can easily locate for his question and find a solution quickly; scientific reasons are made as simple as possible so that the literate farmer will be able to understand them.

It is hoped that this publication would be useful to the farmers, who want to start a small scale livestock production unit, as a handy ready – reckoner on various aspects of production activity. Veterinary students and field Veterinarians can also get useful information on various practical aspects of livestock production from this publication. Species included in this publication are Cattle, Buffaloes, Sheep, Goats, Pigs and Rabbits.

We thank the Dean and all colleagues at Rajiv Gandhi Institute of Veterinary Education and Research for their support. We acknowledge the extensive use of references listed under "References". We thank Mr. Arvind Mittal, Manager, Write & Print Publications, New Delhi for having imploring us into preparing this publication.

Puducherry
August, 2014

Abbreviations

A/c	Account
AI	Artificial insemination
»	Approximately
Cm	Centimeter
cft	Cubic feet
D	day/days
°	Degrees
°C	Degrees Celsius
°F	Degrees Farenheit
Eg.	Example
FCR	Feed Conversion Ratio
Ft	Feet
FYM	Farm Yard Manure
GI	Galvanized Iron
G	Girth
G	gram/grams
>	Greater than
>	Greater than or equal to

HCHO	Formaldehyde
HF	Holstein Friesian
Ha	Hectare
H_2O_2	Hydrogen Peroxide
Hr	hour/hours
In	Inches
i.e	That is
Kg	Kilogram / kilograms
$KMnO_4$	Potassium Permanganate
In	Inches
<	Less than
<	Less than or equal to
L	Length
Lb	Pounds
Lit	Liter
M	Million/millions, meter/meters
mg	Milligram
Ml	Milliliter
mm	Millimeter
min	Minutes
NH_4OH	Ammonium hydroxide
ppm	parts per million, mg/kg
/	Per

p.a	Per annum
PVC	Poly vinyl chloride
%	Percent
PI	Persistency index
q.s	Quantum sufficient
RCC	Reinforced Cement Concrete
RH	Relative humidity
Re	Rupee
Rs	Rupees
seer	An old unit of measurement; equivalent of 0.93 kg
Sq ft	Square feet
T	Tonne
t/ha	Tones/hectare
Vs	Versus
w/v	Weight by volume
Yr	Year

SECTION–I
CATTLE AND BUFFALO PRODUCTION

1

Herd Selection

It is assumed that water and power supply are available for the farm and the water quality has been certified by a suitable laboratory as fit for dairy animals. It is also presumed that heifers, concentrates, vaccines and pharmaceuticals along with marketing facility are available nearby. Veterinary and / or dairy specialists must be available in proximity to the proposed farm for any exigencies.

1. What is "Small – scale" dairy production?

It is indeed difficult to give a universal definition of "Small – scale dairy producer". The number of dairy animals and quantity of milk production to qualify a dairy farm as a small – scale unit is highly variable depending, among many factors, mainly on the actual location, region and the country in question. However, it appears reasonable to state that the minimum size of a dairy farm that can meet the minimum needs for the sustenance of the farmer and his family is a small – scale dairy unit.

Assuming that, on an average, a dairy animal produces 10 lit per day and minimum net profit is Re 1 per lit, each animal can fetch Rs 300 per month. Further, if Rs 12,000 is the minimum annual income (Rs 1,000 per month) required, at least 4 animals must be in milk production throughout the year. Since it is necessary to have equal number of replacement animals, a herd size of at least 8 animals appears necessary to anticipate a minimum monthly income of Rs 1,000. Therefore, in this publication, a herd size of 10 cows / buffaloes will be considered as a "Small – scale" dairy unit.

2. What are the factors that determine profitability?

1. Breeding stock – should be purchased from a healthy, disease – free herd
2. Care during transportation to keep them healthy during transit
3. Care and management of the breeding stock – this includes:
   a) Proper housing
   b) Management during extreme weather condition(s)
   c) Control of external and internal parasites
   d) Sanitation
   e) Feeding practices
   f) Milking practices
   g) Breeding – detection of estrus, AI, care during gestation and management of dam (mother) and new – born calf
   h) Proper marketing including handling during marketing
   i) Labor management
   j) Waste management
4. Record keeping

3. Which breed of dairy cattle / buffalo to be purchased?

It is the capacity and ability of the farmer and not the breed that determines the success with cattle and buffaloes. Notwithstanding this, selection of a breed needs to be considered.

Each breed has some desirable features and some shortcomings. The aim should be to choose a breed or type of animal that is very well adapted to the local agro – climatic conditions and produce milk at least cost. For this purpose, the following factors have to be considered:

1. Availability of good breeding stock
2. Cost of the animal
3. Acclimatization to the local conditions

4. Cost of maintenance per unit size
5. Quantity and quality of milk production expected
6. Cost of production
7. Disease resistance
8. Previous experience of the farmer

3.1. How to select individual animals in a breed?

Special characteristics of a dairy animal include:

1. A typical extreme angular form (with triple wedges) without any surplus flesh, at the same time should show evidence of good feeding. (Note: The body of a good dairy cow should appear angular when viewed from the front, sides and also from the top. This angularity of form is referred to as triple wedges)
2. Cost of the animal
3. A good dairy animal, in lactation, will never show a rounded appearance (much flesh). However, care has to be exercised to differentiate an animal thin in flesh on account of insufficient food
4. Development of barrel in proportion to the size of the animal
5. Very good development of the udder with squarely placed, long teats and tortuous milk veins
6. The animal should show all other normal signs of health

3.1.1. What are the foreign (exotic) breeds of cattle and how to identify them?

Although certain foreign (exotic) breeds are available, for a small dairy unit they may not be suitable. Besides, the agro – climatic conditions of the location of the farm also determine the breed to be preferred. In any case, for tropical climate, Jersey cross breed followed by Holstein – Friesian, Ayrshire and Brown Swiss, in that order, appears to be suitable.

3.1.1.1. What are the characteristics of Jersey breed?

Small sized animal, fawn in color with or without white markings, has a straight top line (hump absent), double-dished face, prominent eyes, small, semi-circle horns, large udder, with well spaced teats and long tail. It can yield up to 4000 lit per lactation with milk containing 4.5 to 5.3 % fat.

3.1.1.2. What are the characteristics of Holstein - Friesian breed?

Typical black and white - colored large sized animals, long head, straight top line (hump absent); large, pendulous udder with long sized teats and long tail with white switch. They produce 6000 – 8000 lit of milk per lactation with 3.0 – 3.5 % fat.

3.1.1.3. What are the characteristics of Ayrshire breed?

Large breed colored red or brown with a combination of white patches, top straight line, horns are long and carried upwards and neck is short and thick (when compared to other breeds). They yield around 5000 lit of milk per lactation with 4.0% fat.

3.1.1.4. What are the characteristics of Brown - Swiss breed?

Large and powerful (but docile animals), brown in color, have medium – sized horns, thick but loose skin and well developed udder. They yield around 5000 lit of milk per lactation with 4.0% fat. They are more suitable than Jersey to tropical climate.

3.1.2 Common Breeds of Indian dairy cattle and buffaloes

The description of the common Indian breeds of dairy cattle and buffaloes are given below. The description is not exhaustive as only a few common breeds of cattle and buffaloes are discussed here with specific reference to their very important characteristics and the way by which they differ from each other.

3.1.2.1. Cattle

1. Gir

Gir is a good milk breed of cattle. The head is broad with a convex forehead. The eyes are large with thick upper eyelids, which gives a sleepy-appearance to the animal. The ears are long, pendulous and having a curled leaf-like appearance with a notch at the tip. Horns are short having a half-moon appearance. Hump is well developed and the dewlap is moderate in size. Tail is long. Udder is well-developed with long teats.

Animals are deep red in color. Animals with white and dark red patches are also found.

Milk Production comes to 1200 – 1800 kg / lactation. Males of this breed are very slow workers.

This breed is exported to Brazil for crossbreeding to evolve different beef breeds.

2. Red Sindhi

Red Sindhi is a good milk cattle having its native tract in Sind province in Pakistan. Head is moderate in size and forehead is slightly bulged with a broad face. Ears are slightly drooping. Horns are short and thick. Hump is very well developed in males. Tail is long and thin. Udder is large and pendulous with medium-sized teats Color: is red, varying from light to dark.

Milk production comes to around 1200 – 2600 kg / lactation (average: 1800 kg) with a fat percentage of 4.0 – 5.2. Cows are considered to be the most economic milk producers among the Indian breeds of cattle. Males are average workers.

3. Sahiwal

Sahiwal is very good for milk production. Montgomery district of Pakistan is its native tract. Animals are heavy with loose skin. Head is long with a massive forehead. Eyes are large and ears are medium sized. Horns are short and stumpy. Some female animals have loose horns. Tail is long with a black switch. The udder is large with large cylindrical teats.

Color is pale red, sometimes with white spots.

Milk production comes to about 1600 – 2750 kg / lactation with a fat

content of 4.8 – 5.1 %. Males are lethargic and are used for slow work.

4. Deoni

Deoni cattle resemble Gir to a certain extent. The native tract includes Latur district of Maharashtra and adjoining areas of Andhra Pradesh and Karnataka. Animals are medium-sized with a prominent and slightly bulged forehead. Eyes are prominent with black eyelashes. Ears are large and drooping. Horns are thick. Hump is massive in males. Tail is long with a black and white switch. Udder is moderately developed in cows with cylindrical teats.

Color is spotted black and white with black hooves.

Milk production ranges from 600 – 1200 kg per lactation with a fat content of 4.3 %. Bullocks are good for heavy work.

3.1.2.2. Buffalo breeds

1. Murrah

Place of origin of Murrah buffalo is Haryana state. Animals are massive. This breed is considered as the best milk-cum-meat breed of buffalo. The forehead is slightly prominent with bright and prominent eyes in females and shrunken eyes in males. Ears are short and thin. Horns are short, flat and tightly curled in the form of a spiral. Body is long, massive, deep and wedge shaped with a broad hip. Tail is long, almost reaching the fetlock joint with a white switch. Udder is well-developed with long teats.

Animals are jet black in color with white markings on the face and tail.

Milk production ranges from 1400 – 1800 kg / lactation with a fat content of 7.0 to 8.3 %.

2. Surti

Surti buffalo is medium-sized having Kaira and adjoining Vadodara district of Gujarat state as the place of origin. Forehead is slightly broad and round. Eyes are bright and bulging and ears are medium-sized. Horns are flat and sickle-shaped. Body is medium-sized with a wide hip. Tail is long and thin with a white switch. Udder is well-developed with squarely placed medium-

sized teats.

Animals are black or brown in color with white markings below the knee and hock joints and forehead.

Milk production ranges from 1500 -- 1700 kg / lactation with an average fat content of 7.9 %.

3. Mehsana

Mehsana breed of buffalo is a cross between Murrah and Surti breeds. Animals are in general medium-sized. Mehsana town of Gujarat state is the place of origin.

Head is heavy with a long face. Forehead is broad with a slight depression in the middle. Eyes are bright, prominent and bulging and ears are medium-sized and pointed. Horns are black with a loose curl and appears in between coiled to sickle-shaped. Body is long, massive and wedge shaped. Tail is long and thick with a black, brown or white switch. Udder is well-developed, large and bowl-shaped with long, thick teats.

Animals are black in color with white markings on the face, legs and the switch of tail.

Milk production ranges from 1800 – 2200 kg / lactation with an average fat content of 7.0 %.

4. Jaffarabadi

Jaffarabadi buffaloes are massive with a long barrel. This breed is the largest breed of buffalo in India. Place of origin is Gir forest area in Kathiawar, Gujarat state. Head is massive and forehead is very prominent and bulging. Eyes are bright and prominent and ears are long and mostly horizontal. Horns are flat, broad and heavy with a heavy base. They droop on either side of the neck and turn up at the tip (in an incomplete coil). The base of the horn is very thick and broad and sometimes covers the eyes. Body is long, massive, deep and not so compact. Tail is long and almost reaches the fetlock joint. Udder is well-developed, large and capacious with funnel-shaped teats.

Animals are black in color.

3.1.3. What are the signs of normal health?

1. Normal behavior / habits, stance / posture and sound
2. Should respond to external stimuli
3. Eyes bright with pink mucous membrane in cattle and brick red in buffaloes, without any abnormal discharge
4. Ears should be mobile without any discharge
5. Muzzle should be smooth, shiny and moist
6. Absence of abnormal nasal discharge
7. Should take normal quantity of feed and water
8. Should ruminate while at rest
9. Urine should be of light straw color and without any abnormal odor and should be clear (not cloudy)
10. Dung should be of normal color and consistency and of normal quantity
11. Milk should be of normal color and consistency and of normal quantity
12. Skin / coat should be smooth and shiny without any injuries or parasites

3.1.3.1. How to know that an animal is sick?

1. Animal standing with the head down with dull appearance; sunken eyes, lacrimation
2. Tendency to get separated from the group
3. Loss of appetite and consequently, absence of rumination
4. Coarse skin, loss of hairs
5. Dry muzzle
6. Nasal discharge
7. Dark or pale or yellowish mucous membrane
8. Excessive salivation
9. Changes in the color and consistency of dung and urine

10. Reduction in quantity and changes in the quality of milk
11. Abnormal discharge from the genitalia

3.1.3.2. How to examine dung and relate it to health of the animal?

The gross appearance of the fresh dung can give an indication of the problems of the digestive tract and also act as an indicator of the nutritional status of the animal. This is because the consistency of fresh dung depends up on the moisture and fibre content of the feed and fodder and the rate of passage of feed consumed (ingesta) through the digestive tract. Even though this is of major importance to the clinicians, experienced farmers can also get an idea of the above parameters by noting the consistency of the freshly voided dung.

For ease of examination, the consistency of the dung can be scored on a 1 – 5 score scale as follows:

Score	Characteristics
1	Very liquid consistency. This indicates the presence of more of degradable starch or protein in the ration and less of fibre. The digestion of excess protein leads to the formation of more urea, which draws water into the digestive tract leading to more watery dung.
2	Dung is not in the form of a pile, it is somewhat loose. This indicates that the diet is in low fibre, which results in faster rate of passage in the gut.
3	Dung has porridge – like consistency. This indicates that water and protein balance are good.
4	Dung is moderately thick. This indicates a high fibre diet leading to slow passage of ingesta in the gut.
5	Dung is in the form of firm balls. This indicates a very high fibre diet (only of straw) or extreme dehydration.

Interpretation of the score: It is better to have a score of '3' for the freshly passed dung in the case of lactating and dry cows. Cows fed

a low quality diet will have a score of either 4 or 5 (indicating a high fibre diet).

3.1.3.3. How to know whether the animal for sale is pregnant?

If the selected animal is informed to be pregnant, it is better to check the records of estrous and insemination. Although a veterinarian is required to confirm pregnancy, there are certain general signs which can be useful under practical situations; they are:

1. Tendency to accumulate fat
2. More docile nature
3. Enlargement of the abdomen
4. Movements becoming slow
5. Segregating from other animals
6. Enlargement of udder / teats
7. Hollowness of the flank region
8. Preferring to rest most of the time
9. Frequent lying down

3.1.4. After selection of animals, how to transport them?

Any means of transport should protect animals against heat, cold and shock.

3.1.4.1. General guidelines

Regardless of method of transport, the following are the general guidelines:

1. Animals should be kept separated from each other
2. Sick or injured animals and early or advanced pregnant animals should not be transported unless under technical supervision;

generally, pregnant animals are not transported

3. Adequate space has to be provided to stand and lie down
4. Water and feed have to be provided at suitable intervals; under no circumstance, any animal must be deprived of feed and / or water for more than 24 hrs
5. The ropes used for tying the animals should be strong enough not to break and long enough to allow the animal to eat, drink and lie down; no animal should be tied by its horns
6. Animals should be grouped according to their age if such age difference does exist in the selected animals except female animals traveling with sucking young ones.
7. The compartment should be exclusive for transport of animals only and it should have suitable ramps for loading and unloading
8. Animals shall not be lifted by the head, horns or legs during loading or unloading
9. The floor of the transport vehicle should be sufficiently strong to bear the weight of the animals and is covered with adequate amount of bedding / litter; sand is a good bedding material
10. At least one attendant should accompany the animals with a first aid kit
11. Cows or buffaloes, if in milk, shall be milked at 12 hr intervals
12. If animal(s) become sick during transport, they must be attended by a qualified veterinarian as soon as possible
13. Dung should be removed as soon as possible
14. Transport should be by the shortest possible route with extreme care while taking sharp turns; the speed of the vehicle should cause least disturbance to the animals both while in motion as well as when the vehicle may have to be stopped abruptly
15. If the journey needs of more than three days, the animals should be unloaded and given exercise

3.1.4.2. Transport by walk (Road)

If the animals are purchased at a nearby locality, they can as well be walked to the proposed farm. This is the most economical means of transporting animals. In a day cattle can be walked for 30 – 35 km but care has to be taken to walk the animals during cooler parts of the day on soft ground (not regular roads) and allow them to drink water at least after every 20 km. However, animals do loose body weight which can be minimized by providing proper feed and water at regular intervals.

In any case, this mode is neither easy for animals nor for the owners; hence, is not in much practice.

3.1.4.3. Transport by trucks

This is by far the most popular mode of transport mainly because the animals can be transported from the point of selection to the proposed farm directly.

3.1.4.4. Transport by rail

This mode of transport is resorted to when long distance is involved

1. A thick layer (10-15 cm) of sand is put as bedding. This helps to avoid slipping, soaks urine and makes lying down comfortable
2. Eight adult cows can be loaded comfortably in a wagon (broad gauge)
3. Watering should be done every 12 hours
4. Adequate feed should be provided at appropriate intervals

3.2. How to care for the animals that have arrived?

The farmer might have purchased pregnant animals, animals in early lactation with calf or, sometimes, heifers or animals in late lactation. Special precautions are required for each of these categories.

3.2.1. If animal(s) is (are) sick, what to do?

1. Identify and isolate the sick animal in a separate shed
2. Follow strict sanitary conditions

3. Provide fresh, clean drinking water
4. Provide well balanced, easily digestible and palatable feed in divided doses
5. Provide adequate bedding material
6. Avoid exposure to extreme weather conditions
7. Attendants looking after sick animals should never be allowed to handle healthy animals
8. In case of emergency, prompt first aid measures should be followed
   a) In case of hemorrhage, apply tourniquet and apply ice packs to stop bleeding
   b) Assist in respiration in case of difficult breathing
   c) Apply tourniquet and use anti venom in case of snake bite
9. Get Veterinary help as quick as possible

2

Feeding Dairy Animals

Feeding is one of the most important factors in the management of any livestock enterprise. It is also the costliest component in the care of animals. The main objective of any farmer should be to attain the maximum benefit in terms of animal health and production at the least cost.

The twenty-four hour feed allowance of an animal is called a "ration". The ration which provides all the essential nutrients in the correct proportions to the animal for proper nourishment is called a "balanced ration".

1. What are the requirements in a Balanced Ration?

A balanced ration should be

1. Correctly balanced
2. Highly palatable
3. Inclusive of as many ingredients as possible
4. Made of good quality materials
5. Fairly bulky and laxative
6. Prepared properly
7. Economic
8. Devoid of toxic principles
9. Stable over a reasonable storage time

1.1. How are the dairy animals fed?

Daily feed of a dairy animal consists of:

1. Roughage and
2. Concentrates

1.1.1. What are roughages?

Roughages are bulky feedstuffs containing relatively more of less digestible substances with high fibre content. As a general rule it could be said that roughages contain more than 18 % of crude fibre.

Roughages used for feeding cattle and buffaloes could be broadly classified into succulent roughages and dry roughages. Succulent roughages like fodder crops, tree leaves, pasture grass etc. contain more of moisture (60 – 90 %), whereas, dry roughages like straw and hay contain less moisture (10 – 15 %).

Succulent roughages can in turn be sub-divided into leguminous and non – leguminous types. The former are nutritionally very good in that they have high protein content.

Note: Leguminous plants also fix atmospheric nitrogen in the soil with the help of their root nodules. This particular feature helps in reducing the cost of manuring and improves soil fertility. Another advantage with this type of fodder is that it is possible to intercrop these among other grasses, thus saving space and improving the quality of the forage.

1.1.1.1. What is the meaning of "Dry matter"?

All the feed ingredients an animal consumes consists mainly of two components namely 1) Water and 2) that which is not water; i.e., dry matter. Since water, although extremely essential for normal health of the animal, doesn't supply any nutrients (like carbohydrates, proteins, fats, minerals and vitamins), for computation of nutrient intake by the animal, dry matter is the criterion.

This is particularly true in case of grass – eating animals (ruminants) because there is a wide range in dry matter content of the feed ingredients they consume; for example, straw contains very low water content and the fresh grass has a conspicuously high water content.

It is the dry matter which is converted into various nutrients by the microorganisms in the digestive system (especially rumen). Hence, feed intake is considered on dry matter basis for assessing nutrient sufficiency of the feed / ration.

1.1.2. What are concentrates?

Concentrates, are feedstuffs containing high nutritive value with highly digestible materials and less of fibre. These are available commercially in different brand names.

1.2. If I have sufficient land, can I grow fodder?

Yes. In addition to convenience in feeding and availability of fresh fodder, one can save cost on transportation and realize higher profits.

Note: Farmer can consult the nearby Department of Agriculture and/or Animal Husbandry for rooted slips/seedlings/seeds/sets of the fodder crops which are made available at subsidized rates at many centers.

1.2.1. What are the leguminous crops that can be cultivated?

1. Stylosanthes: mostly perennial (yields for many years) and highly suitable for intercropping with other grasses and also as a pasture grass. It is drought – tolerant, rich in crude protein content (16 – 17 %), tolerates a wide range of soil conditions (like laterite, acid and alkaline soils). The average yield of this crop is 40 – 50 t/ha/annum. Different varieties of Stylosanthes are available (like Stylosanthes scabra, Stylosanthes hemata).

2. Centro: a very good drought – resistant, shade – tolerant, mild acid – tolerant, perennial crop. It is suitable for hot – humid climate, but not for cool climate. Crude protein content averages 18-21 % and yields about 30 – 35 t/ ha/annum.

3. Cowpea: an annual crop (yield for one year only) highly suitable for intercropping with other perennial grasses. Important features include tolerance to arid (hot – dry) and semi – arid climate, drought and water – logging. Crude protein content is very high (19 – 20 %) and the yield is around 40 – 45 t/ha/annum.

4. Lucerne: Annual as well as perennial cultivation is possible. Important features include tolerance to frost and drought conditions and suitable to cultivate in hot – humid regions. Major disadvantage is that this crop cannot tolerate water – logged conditions. Crude protein content is very high (20 – 22 %) and the yield is around 70 – 80 t/ha/annum.

5. Siratro: a perennial crop highly suitable for arid and semi – arid regions. Important features include tolerance to shade, tolerance to acid soils, good for intercropping with other fodder crops. It has crude protein content of 16 – 18 % and the yields about 30 – 40 t/ha/annum.

6. Hedge lucerne (Desmanthes): a perennial shrub growing to an average height of about 1.2 to 1.5 m (4 – 5 feet). It is highly palatable and can be grown as inter – crop along with fodder grass. Crude protein content is about 19 – 21% and the average yield, 125 t/ha/annum, as a sole crop (i.e., not as an intercrop)

7. Agathi: a fast growing perennial tree, highly suitable for tropical conditions. The crude protein content averages 36 % and the yield around 60 t/ha/annum.

8. Subabul (Lucaenea): a drought – resistant, highly nutritious, perennial fodder tree. It can grow under different conditions like dry and wastelands, acidic, alkaline and saline soils. Crude protein content is about 26 % and the yield, 40 – 50 t/ha/annum. Feeding of this fodder is to be limited (10 – 30 %of the fodder allowance) as the leaves have a toxic factor called mimosine.

1.2.2. What are the major non – leguminous fodder crops?

1. Hybrid Napier grass: a highly palatable, nutritious, high yielding, fast growing green fodder crop, suitable for tropical conditions. Different varieties of planting material (called Sets) are available (like CO2, CO3, CO4, NB 21 etc.). Crude protein content is 8 – 10 % and the yield, 200 – 250 t/ha/annum.

2. Guinea grass: A highly suitable grass for tropical conditions with different varieties (like Hamil, Mackuenii etc.) as rooted slips. Crude protein content is 7 % on an average and the yield is 100 - 150 t/ha/annum.

3. Anjan grass: a drought - resistant, tropical grass. Black Anjan and

White Anjan are two varieties. The crude protein is 5 - 6 % and the yield is about 30 - 45 t/ha/annum.

4. Para grass: a grass variety that can tolerate water - logged conditions very well. It has crude protein around 7 % and the yield is 100 - 150 t/ha/annum.

5. Fodder maize: a fodder variety of maize. Good for arid and semi-arid zones. Crude protein content varies from 7 - 8 % and the yield comes to about 40 - 50 t/ha/annum.

6. Jowar: is an annual crop with 6-7 % crude protein content. Yield is about 40 - 50 t/ha/annum

2. How to formulate a ration at the farm?

All animals require feed for mainly two purposes: 1) Maintenance of normal physiological functions of the body and 2) Growth, production and reproduction. Both these requirements are considered on dry matter intake of the animal (See Section 1.1.1.1 above). It is assumed that the body weight of a crossbred cow and buffalo is 400 and 500 kg, respectively.

2.1. How to weigh the animals?

It is neither economical nor practical to install a weigh bridge by a small - scale dairy farmer. But, all calculations for formulating any ration require body weight. There is an approximate method to assess body weight of a dairy animal by Shaeffer's formula, which is as follows:

Shaeffer's formula: this is the most commonly used formula for estimating the body weight of adult cattle and buffaloes. This formula cannot be used for very heavy and very young animals as it gives erroneous results. Live $= \left\{\frac{L \times G^2}{300}\right\}$, where L is the length of the body of the animal and G girth at the chest region of the animal both in Inches (In). The formula can be modified to metric system as follows:

1 lb = 0.454 kg, 1 In = 2.54 cm and 1m = 100 cm.

If L is x In and G is y In, converting into m, they will be 0.0254x and 10.0254, respectively. That means, L and G are reduced to of the original $\frac{1}{0.0254}$ value; in other words, L and G have to be multiplied by 39.37 to equate them to

original formula. This follows that, L and G^2 or the numerator has to be multiplied by $39.37^3 = 61023.38$ to make it equivalent of original equation. To convert to kg, numerator needs to be multiplied by 0.454; hence, the factor 61023.38 reduces to 27704.61. Dividing by 300 as per the original equation, a factor 92.35 is obtained and therefore, the final formula to convert Shaeffer's formula to metric units will be:

Live weight (kg) $=92.35(LxG^2)$ where L is the length of the body of the animal and G girth at the chest region of the animal both in m.

2.2. What is the maintenance requirement of a dairy animal?

		Dry matter (DM) requirement		
		Body weight, kg	% of body weight	kg
Crossbred Buffalo	cow	400 500	2.5 3.0	10 15

2.2.1. How to partition the DM requirement into roughages and concentrates?

Rule of thumb: **S!** from concentrates and **T!** from roughages with a condition that the total roughage should be at least 1% of the body weight but not exceed 2% of the body weight (1% of body weight d" Total roughage d" 2% of body weight).

That means, the roughage requirement is,

All in kg	Body weight	DM from roughage			DM concentr
		Recommended	Minimum	Maximum	
Crossbred cow	400	6.7	4.0	8.0	3.3

Buffalo	500	10.0	5.0	10.0	5.0

2.2.2. How much of dry and green roughage to be given?

All in kg	Roughage partitioning		
	Total required	Dry roughage	Green roughage
Crossbred cow	6.7	2.2(⅓)	4.5 (⅔)
Buffalo	10.0	3.3(⅓)	6.7 (⅔)

Note: Value in the parentheses indicates proportion of total roughage

Note: Value in the parentheses indicates proportion of total roughage

2.2.3. How to convert DM requirement from concentrate, dry and green fodders to their corresponding actual weights?

General formula:

$\left(\frac{\text{DM Requirement}}{\text{DM Content}}\right) \times 100$ Utilizing this, the actual weight of concentrate, dry and green fodder can be calculated as follows:

Calculation of actual quantities of concentrate, dry and green fodder requirements

Calculation of actual quantities of concentrate, dry and green fodder requirements

Species	Item	Dry matter		
		Requirement,	Content,	Actual weight

	Concentrate	kg	%	required, kg
Crossbred cow	Concertrate	3.3	90	3.67
	Dry fodder	2.2	90	2.44
	Green fodder	4.5	25	18.0
Buffalo	Concentrate	5.0	90	5.56
	Dry fodder	3.3	90	3.67
	Green fodder	6.7	25	26.80

Note: 1. As a general rule, 1.0 (crossbred cow) to 1.10 (buffaloes) kg of concentrate per day for every 100 kg body weight is given for maintenance 2. For supporting milk production, 1 kg concentrate for every 2.5 lit milk (400 g per lit) in case of crossbred cows and 1 kg concentrate for every 2 lit milk (500 g per lit) in case of buffaloes has to be provided

2.3. What are the requirements for milk production?

For supporting milk production, 1 kg concentrate for every 2.5 lit milk (400 g per lit) in case of crossbred cows and 1 kg concentrate for every 2 lit milk (500 g per lit) in case of buffaloes has to be provided. This allowance is in addition to the requirement of green and dry fodder.

3

Dairy Management

Management in a dairy farm includes

1. Management of herd purchased
2. Management of pregnant animals
3. Management of animal at calving
4. Management of newborn calf
5. Management of growing calves
6. Management of heifers
7. Detection of animals in heat and insemination
8. Management of pregnant animals
9. Management of animals in lactation
10. Management of dry animals
11. Maintenance of herd size, judging and culling
12. Management during adverse climate
13. Waste management

1. Management of herd purchased

See chapter "Herd Selection" for details

2. Management of pregnant animals

2.1. How to take care of pregnant animals?

1. During early pregnancy, animals should not be walked or allowed to run long distances
2. Avoid fighting with other animals
3. Isolate them from other animals, especially sick and aborted ones, if any
4. Floor of the house should be non-slippery
5. They should not be exposed to extreme cold and hot climate
6. Provide adequate amount of clean, fresh drinking water
7. Provide easily digestible, well balanced feed
8. Give sufficient clean bedding material
3. Management of animals at calving (parturition)

3.1. What are the management steps during parturition?

Giving birth to young one (parturition) in cattle and buffalo is termed "calving". The following are the precautions during calving:

1. Do not disturb the animal during normal delivery
2. Assistance is required only when there is any difficulty
3. Watch the animal from a distance
4. Wash the udder, teats and region between hind limbs with antiseptic solution
5. Watch for the expulsion of the calf and the placenta
6. Provide palatable laxative feed for the first few days and later change to normal feed

4. Management of newborn calf

4.1. How to take care of the new – born calf?

1. Proper care should be taken to avoid any infection: Immediately after birth, clean the nostrils and see whether the new born is breathing. If there is any difficulty in breathing, give artificial respiration.

4.1.1. How to give artificial respiration?

(a) Clear the mucous from the respiratory tract. Artificial respiration can be given by alternatively pressing and releasing the chest region

(b). If there is no result, then insert a twig of straw or dried grass in to the nostrils. This will initiate sneezing and will result in clearing the tract

(c). If this also fails, hold the new born animal by the hock and swing it to and fro (upside down) so that the mucous flows out

(d). If this does not work, then mouth – to – mouth respiration should be resorted to by closing the nostrils and blowing in expired air into the mouth of the new born

2. Tie a knot around the navel cord about 2 to 3 cm from the body by using a sterile thread. Cut the navel cord 1 cm below the knot (toward the calf). Apply antiseptic solution (like Betadine) to the cut end still attached to the calf. Attending to the navel cord of the new born calf is very important as infection gaining entry through the navel can cause serious conditions (like navel ill).

Note: The stalk hanging at the navel of the calf dries and falls off by itself within two days.

3. Dry the new born by scrubbing with a clean and dry cloth
4. Allow the dam to lick the new born; this helps to form an in-separable bond / social attachment between the dam and the new – born (imprinting)
5. If there is any difficulty in standing, assist the new born to stand
6. Allow the new born to suck colostrum (the first milk that is secreted by the udder) at the earliest (i.e. within half an hour). This is very important

4.1.2. What is colostrum and why its feeding is

important?

Colostrum is the secretion produced by the udder immediately after calving (up to 5 days). It contains a large amount of nutrients (proteins, vitamins and minerals) and disease – resisting factors in an easily absorbable form. Hence, it protects the calf passive against many infections during early life; this is particularly important in buffaloes.

Soon after birth, the intestines will be able to absorb nutrients and disease – resisting factors far better; after about 5 to 7 days of age, the capacity to absorb such factors reduces significantly. If those factors are not absorbed, they serve no purpose of disease – resistance, but act as any other protein source.

4.1.3. How does the colostrum differ from milk?

Colostrum, being the first milk after calving, is rich in proteins (mainly globulins which offer disease resistance to newborn calf) and minerals as shown in the following table:

Composition of colostrum *Vs* milk (cow) %

Item	Colostrum		Milk	
Total solids		28.3		12.86
Ash		1.58		0.72
Fat		0.15-1.20		4.00
Lactose		2.50		4.80
Casein	4.76		2.80	
Albumin	1.50		0.54	
Globulin	15.06		Nil	
Total protein		21.32		3.34

Note:

1. Giving vaccinations to cows during the dry period helps to increase the quantity

and quality of γ-globulins in colostrum

2. Colostrum of mature cows will be of higher quality than that produced by heifers. Older cows have a greater chance to be exposed to many infections, that too repeatedly. This in turn, stimulates them to produce greater quantities of antibodies (γ -globulins) effective against larger number of diseases
3. Colostrum can be collected under hygienic conditions and stored under freezing conditions (refrigerator chest) for later use (long time storage, even up to one year without decline in quality)
4. Frozen colostrum should be placed in warm water for thawing.
5. Colostrum can be refrigerated for only about one week without decline in quality

4.1.4. How much colostrum should be offered to a calf?

The quantity of colostrum to be fed to calves is $1/10^{th}$ (or 10%) of the body weight of the calf for five days. If weaning is not practiced, the calves should be allowed to suck for 5 minutes 4 – 5 times a day.

In case of buffalo calves, it is a general practice to allow the calf to suck as much as it wants.

Excess colostrum, if any, should be removed from the udder. This can be milked out and mixed with normal milk and fed to other calves. It can also be stored under refrigeration conditions.

7. Give proper identification mark to the calf
8. Observe for any congenital / genetic defects
9. Ensure all natural openings are present
10. Get veterinary help in case of any difficulty

4.1.5. Feeding milk to young calves

After feeding colostrum for the first 5 days, from 6 days to 90 days of age, milk is given to the young calves @ $1/10^{th}$ of the body weight (twice daily).

Simultaneously, at 1 month of age, the calf should get good quality calf starter whatever the quantity it can consume (ad libitum). In general, a calf consumes around 125 g and 250 g of calf starter per day when it is 31 to 60 days and 61 to 90 days in age, respectively. When the calf starts consuming 250 g calf – starter per day, milk feeding can be completely stopped.

From 3 months of age calves can be fed on fresh, tender green fodder; this stimulates growth and functioning of the stomach (rumen) by 6 months of age after which most of the nutritive requirements could be met from good quality fodder.

Note: Fresh clean water should be available always to the calves.

4.2. Weaning

Weaning is the practice of removing the calf from the dam. Most dairy calves are weaned from their dam / mother either immediately after calving or 3-5 days after calving.

Most dairy calves are weaned from cows immediately after calving or within 3 or 5 days. After weaning, the calf should be housed in a clean, dry, well – ventilated calf pen and trained to drink milk immediately.

4.2.1. Why should calf be weaned from its dam?

Many do feel that it is not proper to separate calf from its mother and some do attach religious sentiments too. But, scientific knowledge on this issue indicates the following advantages of weaning:

1. Ensures clean milk production
2. The milk produced by the cow can be accurately quantified
3. Calves can be fed milk – replacers, thus saving milk for human consumption
4. Adequate measured quantity of milk can be given to the calf, thus preventing under – feeding and over – feeding
5. Helps prevent injury to the teat
6. Helps control mastitis

Note: There are drawbacks as well of weaning; for instance, in buffaloes and zebu breeds of cattle, weaning of calves poses certain problems because of the strong maternal instinct in these animals. In such cases, weaning may cause reduction in milk yield, early drying off and temperamental problems.

4.2.2. Training a calf to drink milk

Training a calf to drink from a bucket is simple. Wait for the calf to be hungry. That is, wait for at least 8 – 12 hours after the calf has been removed from its mother (dam). It is more difficult to get the calf to drink from an open top bucket. In such cases, finger should be put into the mouth. If the calf starts sucking, lower its head into the milk while the calf is still sucking. This procedure must be repeated for 2-3 feedings.

Precautions:

1. Take care to use no excessive force in pushing the calf's head into the milk
2. Be gentle with the animal
3. Use one bottle / bucket for one calf

4.2.3. What is "Milk – replacer"?

Milk replacer consists of skim – milk powder and lard or vegetable fat. It is also called "milk substitute". Sometimes, butter milk powder or whey powder is also added. Glucose, soybean flour or cereal flour are added together with vitamins and minerals. If good quality milk replacer is available, there is no need of feeding any whole milk to the calf after the colostrum feeding stage.

4.2.4. What is a good milk – replacer for calves?

A good milk – replacer should contain 10 to 15% fat, 50% spray dried skim milk powder supplemented with Vitamins A, E and B_{12}. It should also contain antibiotic feed additives and 22 – 25 % highly digestive protein. It should be readily dispersible in warm water and should not contain any starch or fibre.

4.2.5. How to offer milk – replacer to the calf?

One part of milk – replacer is mixed in 8 parts of water; correct proportion is important because, too weak or too strong solution tends to create digestive problems.

4.2.6. What to do if milk – replacer is not available?

Under such circumstances, one can go for partial milk – replacers: for example, commercially available "Calf starter" with limited quantity of whole milk feeding.

4.2.7. What is "Calf starter" and how to feed it to the calf?

Calf Starter is the first dry concentrate mixture fed to calves. Calves can be taught to eat calf starter by the following methods:

1. Rub a small quantity of the concentrate on the tongue and lips of the calf. This will induce them to eat more
2. When the calves complete drinking milk from the pail, put some starter at the bottom of the pail. The calves will start licking it. Gradually, the quantity can be increased

Note: Calf starter should be highly palatable. Once, the calf starts consuming about 0.4 – 0.5 kg of starter daily, milk feeding can be discontinued.

Example of a Calf starter:

Maize	- 35 parts
GNC	- 32 parts
Gram	- 10 parts
Wheat bran	- 20 parts
Min Mix	- 3 parts
Rovimix	- 150 g per 100 kg

5. Management of calves

5.1. General considerations:

Cattle and buffaloes can't digest grass at birth and therefore require high quality proteins and Vitamins A, D and B complex are dietary essentials. Birth weight should be recorded immediately after birth. Along with that body length, height and chest girth also should be recorded. Well-fed crossbred calves on an average should gain 400 g a day or 2.5 to 3.0 kg per week.

5.2. Dehorning or Disbudding

Removal of the horn is called "Dehorning", whereas, suppressing the growth of horn at an early age when the horn is in the form of a bud or button is called "Disbudding". Disbudding should be carried out at an early age (i.e. within 3 to 10 days of birth). Disbudding is a common practice.

5.2.1. How to perform disbudding?

The hair around the horn bud is clipped and Vaseline applied. Caustic stick is dipped in water and then rubbed with a rotary motion on the horn bud to deactivate its growth. Scab formation occurs over the horn bud within a few days and drops off in about a fortnight.

Note: This can also be done by means of a hot iron or an electric dehorner. The use of an electric dehorner is ideal.

5.3. Removal of extra (supernumerary) teats

Supernumerary teats can be removed immediately after birth at the same time the navel is treated or at one month of age.

5.4. Identification

This is essential for proper management especially under farm conditions and a compulsory requirement for insurance. Even though farmers put a neck chain with a number and / or paint the horns as a mark of identification, these are not permanent and do not last long. The best method of permanent identification is by tattooing the inside of the ear with ink. Metal or polyurethane ear tags could also be used as a means of identification. Freeze branding (cryogenic branding) is more humane and can be read more easily. The application of extreme cold selectively destroys color producing cells (melanocytes), thereby the hair of the branded area would appear white or discolored. The white hair will begin to appear on the branded site within 50 to 70 days.

Whatever be the method of identification chosen, it is better to get help from a Veterinarian.

5.5. Care of calves – 3 to 6 months of age

At 3 months, milk feeding would have completely stopped. Most often, during this stage, the calf is fed roughages. However, the calf is still very young and hence, is not able to utilize large quantities of roughage.

Once, the calf has reached 3 months of age, the most expensive feeding stage has passed. Now, the objective should be to attain required growth rate with maximum economy. During this stage, the calf – starter can be replaced with concentrate mixture.

5.5.1. Calf Mortality

Calf mortality is very high in the tropics. It can be as high as 50 % especially in case of buffalo calves. In some areas, a high mortality is due to stock (breed / crossbred) unsuitable for the climatic conditions. The best way to reduce calf mortality is to practice good husbandry.

5.5.2. What are the common causes of calf mortality?

5.5.3. Scouring

The most common disease of calves is scouring / calf scours. The general symptoms are a dull appearance of the eyes, listlessness, diarrhea and sometimes an abnormal rise in temperature and respiratory rate. Scouring may be due to purely mechanical causes, nutritive causes or due to infection. Calves that drink too rapidly or are fed cold milk or have hair balls in their stomach often have scours.

Calves having infection will have chalky – white colored faeces with a very offensive smell. Infection usually gains entry through the mouth; but sometimes, through the navel cord (**Navel ill**). The use of antibiotics in feed will definitely reduce the incidence of scours caused by infection.

Giving milk immediately after milking has resulted in reducing mortality due to scours to a great extent. (Usually, in organized farms, feeding of milk to the calves is done 1 – 2 hours after milking).

5.5.4. Hairballs

Hairballs (trichobezoars) form due to licking (immediately after milk feeding) of ears, navel and also other parts of the body. The general signs include grinding of teeth, loss of condition and in some cases an un – natural

gait (movement). Up to 3 to 4 months, rearing calves in individual pens / hutches has been found to greatly reduce the problem of licking. If this is not possible, house calves individually immediately after milk feeding, because tendency to suck/lick hairs will be more at that time. Smearing the tongue and lips of the calf with common salt has found to greatly reduce the problem of hair licking. This problem actually arises as a result of the natural tendency of young calves to suck. Calves suffering from this type of scour usually recover if starved for 24 hours followed by feeding small quantities of milk diluted with water heated to body temperature.

5.5.5. Pneumonia

Pneumonia is inflammation of the lungs. When a calf is suffering from scour, it can contract **pneumonia**. Symptoms include – high temperature, increased respiratory rate leading to gasping. Affected animals should be immediately isolated and prompt treatment should be followed.

5.5.6. Parasites

Parasitism is another problem affecting calves – round worms, threadworms, hookworms, lung worms, tape worms, coccidia etc. General symptoms include running down condition, a dry rough coat, pot-bellied appearance, sometimes diarrhea and a swelling under the jaw. Periodic deworming and a good calf – house hygiene could help in controlling infection.

6. Management of heifers

The aim in rearing heifers should be to achieve the maximum growth and development and the earliest sexual maturity with least cost.

There is always some check to growth at weaning. If the calf that is raised indoors is weaned and suddenly placed outdoors on different quality pasture or roughage, the growth check will be very severe. This will decrease the growth rate and delay sexual maturity. This in turn, increases rearing cost and decreases profitability. Heifers fed 0.25 kg protein rich concentrates and maintained on only medium quality roughage will improve their live weight gain and shorten the time taken to attain sexual maturity.

Under small scale farming conditions, heifers are generally a neglected stock, as they do not give immediate returns. A common problem in heifer

management is underfeeding, mainly arising out of the above problem. That is because of diverting feed and fodder to milk stock, parasitic infections / infestations, over stocking etc. This will lead to reduction in the rate of growth, which may further have adverse effects on the reproductive performance of the animal. Net result will be higher rearing cost. It should be borne in mind that these heifers are important to replace the cows culled; otherwise, expenditure on purchase and transport of new cows will only weigh on profits from the business.

In organized farms, the main purpose of rearing heifers is for replacement of the herd. The replacement rate depends up on several management factors like culling and disposal rate and mortality rate. This generally varies from 20 – 25 %. Only those heifers that would eventually grow to become good cows should be reared for replacement.

Though heifers could be fed individually or in groups, individual feeding is found to be superior. As grazing is practically difficult in our area, the heifers should be provided cut – grass along with 1 – 1.5 kg of concentrates especially during summer months.

6.1. Summer management of heifers

Generally in the tropics, there is poor growth rate among calves as well as heifers. This is mainly due to the poor status of feeding and also, due to thermal stress. Along with better feeding, heifers should be adequately protected from thermal stress by showering or splashing cold water especially during the hot parts of the day. Loose housing of heifers is found to be superior in all seasons (except monsoon). This is the case with buffalo heifers as well.

Next common practice that should be followed is deworming and spraying insecticides against ticks. Regular deworming and spraying against ticks result in 10 % higher growth rate.

6.2. Breeding of Heifers

The aim of rearing heifers should be replacement of the herd and hence, breeding should be planned in such a way that the heifer calves early. The time of breeding has to be decided on the basis of their body size rather than age. It is generally considered that heifers could be bred when they attain around 60 % of their mature body weight. Exotic and crossbred heifers can attain the

above weight by about 20 months, if proper care is given from the calf hood stage itself. Anyway, the aim should be to see that heifers (crossbred and buffaloes) attain their body weight by at least two years of age so that their age at first calving is below three years.

The feeding of heifer before pregnancy (gestation) should be in such a way that the animal is lean (and not hefty). This is achieved by feeding mostly on roughages. During the second half of pregnancy, it can be fed at a higher plane to achieve mature weight. It is found that gestation does not cause a severe drain of nutrients from the heifer's system to cause a retardation of growth.

The ensuing lactation will have a major effect on the condition of the heifer. Therefore, the animal has to be fed suitably for sustaining milk production in addition to growth demands. That is, the animal should have enough body reserves to tide over the period of early lactation.

During the last fortnight of gestation, the heifers should receive larger amounts of concentrates. This will help build up body reserves and also gives time for a gradual change in the microbial population in stomach to suit heavy concentrate feeding. This type of feeding is called "**challenge feeding**".

7. Detection of animals in heat and insemination

Estrus or heat is the period of intense sexual urge experienced by an animal during which time the animals exhibit specific signs or symptoms. In general terms, it can be said to be the state of sexual receptivity that recurs at definite intervals in female animals. It is usually synonymous with the occurrence of ovulation and refers to a state of sexual receptivity accompanied with behavioral as well as physical changes / signs.

7.1. What is the duration of estrous cycle and heat?

In case of cattle, the heat / estrus cycle ranges from 16 – 24 days with an average of 21 days. That is, a cow will show signs of heat / estrus once in 21 days under normal conditions. During each cycle, it is observed that the actual duration of heat / estrus varies from 12 – 24 hours (16 hours, on an average) when the cow shows specific signs of heat. The actual time of ovulation is 12 hours after the onset of heat.

By observing the signs of heat the farmer can come to a conclusion that the particular cow/buffalo is ready for breeding. However, some cows do not

exhibit the specific signs of heat during that period. These are called silent breeders. It is normally very difficult to detect heat in these animals.

Note: In case of buffaloes, estrus period averages 21 days (19 to 23 days) with a heat period averaging 14 hrs. Ovulation occurs 7 hrs after the start of heat symptoms. Detection of heat in case of buffaloes requires careful observation of the animals by the farmer.

7.1.1. How to know that a heifer/cow is in heat?

Cattle exhibit specific physical and behavioral symptoms which can help identifying them to be in heat by a farmer.

7.1.2. What are physical signs of heat in cattle?

1. Swollen, relaxed and reddened external genitalia
2. Clear mucous discharge from the genitalia which is clear and watery during the early period of heat and viscous and ropy during mid – heat
3. Rise in body temperature during early heat, further rise during mid – heat and returning to normal during late heat
4. Swelling of the vulva will be slight during early heat, more during mid – heat and normal during late heat
5. Frequent urination during early heat, more frequent during mid – heat and returning to normal during late heat

7.1.3. What are the behavioral signs of heat in cattle?

The behavioral signs during different stages of heat can be tabulated thus:

Behavior	Early heat	Mid – heat	Late heat
Excitement	More	Less	Very less
Appetite	Slightly less	Conspicuously less	Normal
Bellowing	Less	More	Less
Tail raising and	Less	More	Less

twitching			
Time spent on eating and resting	Reduced	Severely reduced	Reduced
Licking other cows	Pronounced	More pronounced	Pronounced
Mounting on other cows*	Less	More	Less

Note:

1. The cow in heat stands still when mounted by other cows i.e., the ridden cow is more likely in heat than the rider. Hence, this period of heat is called "standing heat" and it is a very definitive sign of estrus
2. Though the above are the important signs of estrus in cows, there are considerable differences in individual animals

7.1.4. What are the signs of heat in buffaloes?

In the case of buffaloes, the signs / symptoms of heat are same (physical as well as behavioral) but less pronounced than in of cattle. Many of the buffaloes exhibit silent heat especially during the summer season. Therefore, it is advised that breeding buffaloes be kept cool during summer months by adopting various summer management measures. High humidity in association with high temperature further complicates detection of estrus. Hence, winter season is conducive for the expression of estrus and is more favorable for breeding buffaloes.

7.2. When to inseminate?

Once the signs of heat are interpreted correctly and the animal is declared

/ found to be in 'proper heat', the next step is to inseminate the cow at the right time. The right time of insemination should always relate to the time of ovulation. Therefore, it would be a better thumb of the rule to inseminate the cow in the evening, if the heat signs are noticed in the morning and to inseminate the cow in the morning, if the heat signs are observed in the previous evening.

Note: After each pregnancy and parturition (calving), recovery of normal heat cycles in cattle and buffaloes occurs by about 30 days. In the case of buffaloes, it takes a longer time (e.g. 60 days or even more). High yielding cows also take a longer time to return to estrus after calving.

In cattle and buffaloes, non-return rate is used as a measure of reproductive efficiency. This is based on the fact that estrus cycles cease during pregnancy and the cows do not return to heat.

The expression that a "75 % conception rate based on 60- 90 days nonreturns" would mean that 75 % of the cows bred had not come to heat after 60 – 90 days and is presumed to be pregnant.

7.3. Package for Improving Reproductive Efficiency

The key factors involved in reproduction management in cattle and buffaloes are:

1. Prompt detection of estrus
2. Breeding at the appropriate time
3. Use of good quality semen
4. Allowing sufficient service period and dry period
5. Regular checking of reproductive disorders
6. Hygiene at the time of calving
7. Quality and quantity of ration during various stages of pregnancy and production
8. Accurate record keeping
9. Feeding time should be avoided for the detection of heat
10. Heat detection should be carried out twice daily

11. Maintenance of heat expectancy chart
12. Standing heat is the best indication of estrus. This behavior will be manifested only if enough open area is provided
13. Cervical mucus during estrus will crystallize in to long crystals in a typical fern like pattern
14. Keep accurate records of dates of heat, service and calving
15. Use records to predict the probable date of heat
16. Look for irregular estrus cycles, abnormal discharges etc.
17. Examine the animal 24-36 hours after service for metoestral bleeding. If this occurs 24 hours after service, the animal was bred too late. If it occurs over 36 hours after service, the cow was bred too early
18. Pregnancy diagnosis at 45 to 60 days after service
19. Balanced feeding
20. Provide suitable shelter management to reduce heat stress

8. Management of pregnant animals

Once an animal is diagnosed to be pregnant, proper care should be bestowed on the animal so that it would give birth to a healthy calf without any difficulty. For this purpose, the period of pregnancy (gestation) can be divided into three stages, early stage, mid stage and late stage.

During the early and mid stages of gestation, it should be borne in mind that the animal will be in lactation (except heifers). Therefore, it needs feed allowance for maintaining the growing fetus as well as milk production. In addition, if the animal happens to be a first calver (heifer), allowance for the growth of the animal should also be taken into consideration.

It is preferable to provide good quality green grass liberally along with the required amount of a good quality concentrate (See Chapter on Feeding). During the late phase of the late gestation, the animal will be in the dry state (as milking would have stopped); hence, extra allowance of feed for the growth of the calf should be provided.

Two weeks prior to the approximate / due date of calving, the pregnant

animal should be provided increasing quantity of concentrate feed to ensure (challenge) maximum milk production. In practice, it is better to increase 0.5 kg of concentrate two weeks prior to the due date of calving and slowly increase this quantity by 300 – 400 g of concentrate daily, so that cow is consuming 0.5 – 1.0 kg of concentrate for every 100 kg body weight. This pattern of feeding is called "challenge feeding". Challenge feeding conditions the digestive tract of the animal for utilizing increased amount of concentrate feed so that it can produce milk at a high rate while maintaining its body condition as well.

9. Management of animals in lactation

At any given time, there should be maximum number of cows in milk in a herd. The proportion of cows in milk to total cows is determined by regularity of reproduction. The higher the calving interval, the lesser will be the cows in milk.

Components of management practice include:

1. Feeding a balanced ration as per requirements
2. Very high yielders should be housed separately
3. Maintain high health standards
4. Housing should be clean and comfortable
5. Avoid slippery floors and sharp bends
6. Avoid over – stocking; in other words provide sufficient floor space (see Chapter "Housing")
7. Provide optimum feeding and watering space
8. Protect against thermal stress (See Section "Management during adverse climate" below)
9. Group cows according to size/production
10. Culling of highly temperamental cows
11. Careful and gentle handling
12. Avoid disturbance due to noise
13. Provide ample exercise

14. Schedule of management operations should be regular

15. Any change in routine should be effected gradually, spread over a period of time. This is mainly because cattle and buffaloes settle down to routines

    Note: Changes in routine could be effected during the dry period during which time cows / buffaloes seem to accept changes in routine.

16. Gentle and correct milking operations

17. Maintenance of high reproductive efficiency

18. Prompt disease control measures

10. Management of dry animals

Though farmers consider dry period as a rest period during which the cow is not in production, it is actually a very active time in the productive life of a cow. In general, under field conditions, it is observed that farmers do not give much attention to the cow during this period. As a result, the body condition of the cow will be affected and the ensuing lactation will be affected. The dry period is actually a preparatory period for the next lactation.

During the first phase of the dry period, the udder stops secretion, during the second phase the udder is in a non-productive state and during the third phase, the udder regenerates for the subsequent lactation. Therefore, dry period should be considered as a transition period (i.e., transition between late pregnancy and early lactation). Monitoring the body condition of the animal and the udder health are of great significance during this period.

The primary objective of dry cow feeding is to optimize milk yield, reproduction and health in the subsequent lactation. Poor nutritional management during the dry period results in lot of associated problems. Feeding during this period should be so adjusted as to maintain the body condition of the animal. As a result, it will be easy to have a normal calving and a good lactation. In order to maintain proper udder health and to control mastitis, it is preferable to treat the cow at dry – off time with antibiotics (dry cow therapy). The help of a Veterinarian should be resorted to for this.

The ideal length of dry period is 60 days. During the close-up period (last 2 weeks), the cow should be on a rising plane of nutrition (see Challenge

feeding). Dry cow should also receive adequate amounts of minerals and vitamins. A good mineral mixture along with good quality green fodder will take of this problem to a great extent.

11. Management of herd size, judging and culling

11.1. Management of replacement stock

Replacement of animals in the herd (in place of producing cows) becomes necessary as a result of death of an animal or culling due to many reasons like old age, disease, low production, sterility/infertility etc. The rate of such replacements can vary from 20 – 25 % depending on the herd management factors.

The farmer has two options for obtaining herd replacements. That is, purchasing or rearing them. The decision has to be taken after carefully considering the costs involved, facilities available in the farm, availability of good stock, health situation outside the farm.

Rearing heifers on the farm reduces chances of bringing in disease and also provides a chance of getting more profits by sale of surplus full-grown heifers. The main disadvantage is that it leads to investments without profits for 2 – 3 years.

Purchasing is beneficial when there are sources of genetically superior stock. This also helps in ready returns from money invested.

In organized herds, the number of replacements to be reared can be assessed from the herd's culling and disposal rates and mortality rate among growing stock. It is difficult to suggest a possible replacement rate under village conditions involving very small herds.

11.2. Judging

11.2.1. Type

Type refers to an ideal or standard of perfection that combines all the body characteristics that contribute to the usefulness of the animal. Eg. Good udder, deep and strong body, good legs etc.

11.2.2. Breed type

This includes the desirable characteristics of conformation mentioned above along with specific characteristics that distinguish one breed from another including color, size, shape, style and other traits.

11.2.3. Breed character

This term used to describe the distinctiveness in conformation.

11.2.4. Comparative judging

This term refers to ranking a number of animals in order of preference according to type. This judging must always emphasize practical considerations. Beauty of conformation is not the only factor.

In comparative judging, each animal must be properly analyzed and evaluated before making comparisons. The correct analysis of an animal is based on the proper evaluation of each part of the cow as compared to an established type standard. The judge cannot evaluate properly unless he has an accurate knowledge of the correct type.

One of the procedures in judging a cow is to check for the presence of defects. If these defects are severe or constitute disqualification, they should be the deciding factor in determining the placing / rank.

A serious defect may be defined as a gross fault that impairs productive performance. Some may be serious enough to constitute a disqualification. Deficiencies and defects may range from slight to serious.

11.2.4.1. Evaluation of defects:

Defect	Evaluation
Total blindness	Disqualification
Blindness in one eye	Slight disqualification
Winged shoulder	Serious discrimination
Temporary lameness	Slight discrimination

Slightly unbalanced quarters	Slight discrimination
Temporary or minor injuries that do not affect the animal's usefulness	Slight discrimination

Note: A slight discrimination may influence the rank, but a serious discrimination usually places the animal in the lower half of the rank class.

11.3. Culling

Culling is permanently removing cows (animals) from the herd. The most common reason for culling is low production. Cows are also culled because of other problems. These include:

1. Reproductive problems
2. Diseases
3. Mastitis
4. Teat of udder injury
5. Poor udder conformation
6. Accidents and injuries
7. Hard to milk condition
8. Poor disposition
9. Temperament
10. Feet and leg problems
12. Management during adverse climate

High temperature and high humidity have the effect of lowering milk production. Cows produce milk comfortably when the temperature ranges from 1.7 to 21.1°C (35 to 70°F). Milk production begins to drop above 21°C (70°F). At 27°C (80°F), there will be a 10% drop and at 32°C (90°F), the drop may be as high as 35%.

12.1. How to manage dairy animals during hot weather?

1. Keeping the cows cool can reduce drop in milk production.
2. Provide adequate shade for cows. Make sure that ventilation is adequate
3. Quality of fodder usually declines in hot weather. Do not feed extremely low quality forages. Low quality – high fibre roughage reduces milk production. Maintain high grain rations to help maintain production
4. Provide liberal quantity of fresh water. The water requirement may increase up to 50 % in hot weather. Feeding dry concentrate increases the need for more water
5. Follow a good fly control program
6. Avoid making cattle stand in un-shaded areas for a long time

13. Waste management

Waste in case of a dairy farm can be in the solid or liquid form; the former consists of primarily dung, waste grass, straw and bedding etc. and liquid form consists mainly of urine, washings etc. These have to be disposed of in order to ensure good health of animals by preventing disease entry and spread. The solid waste from dairy has economic value and hence needs to be handled in a different way than the liquid waste which is mainly eliminated from the farm premises.

13.1. Solid waste

Solid waste, in general, and dung, in particular, has to be removed at frequent intervals and stored in a manure (dung) pit situated away from the shed; the size of the manure pit depends on the number of animals, nature and amount of feed consumed by the animals and the duration for which it has to be stored.

13.1.1. Why dung has to be removed frequently? Frequent removal of dung is warranted to:

1. Avoid contamination of feed, water and milk
2. Avoid infections (especially parasite worm eggs/larvae, oocysts of certain protozoa and some intestinal bacteria which are infective) that can arise out of dung and other excreta. Dung can be a source of infection to other animals, farms and humans via feed, water, fomites, rodents, other birds like crows etc.
3. Minimize production of obnoxious gases which can lead to ventilation problems
4. Minimize fly problems particularly because fresh dung is the preferred material in which flies (like house fly and stable fly) lay their eggs
5. Minimize diseases spread by flies not only to other animals in the farm but also to other farms and humans. Flies are the potential carriers of diseases like cholera, typhoid, anthrax, mastitis, dysentery etc.

4

Milk and Milking

Proper care of dairy animals is cardinal in obtaining optimum amount of clean milk as well as to ensure health of the udder. Many misconceptions, wrong practices etc. do exist as far as milk and milking is concerned. In this chapter, scientific and practical information is provided regarding milk production, milking and handling of milk and the animal during the process.

1. Milk production by a cow/buffalo

1.1. How the milk produced by a cow is retained in udder?

Udder is made up of four quarters. Each quarter has a teat that provides an outlet for milk. A sphincter muscle at the end of the teat controls the flow of milk. Milk letdown occurs when the cow is stimulated.

1.1.1. How a cow is stimulated to letdown milk?

Generally, many believe that sucking by its calf stimulates milk letdown in a cow. But, the stimulation can be even washing of the udder itself.

1.1.1.1. What does the stimulation cause for milk letdown?

The stimulation causes release of milk let down hormone (oxytocin), which causes contraction of muscles around structures that would have stored the milk produced so that the milk comes up to the teats.

1.1.2. What does the milk contain?

Composition of milk, %

Species	Specific gravity	Water	Total solids	Fat	SNF	Total protein	Sugar	A
Cow	1.0313	87.27	12.73	3.68	9.05	3.39	4.94	0.
Buffalo	1.035	82.25	17.75	17.51	10.24	5.05	4.44	0.

Note: 1. pH of cow milk is 6.60 (Lactic acid 0.15%) whereas that buffalo milk is 6.70 (Lactic acid 0.16%)

2. Freezing point of cow milk is (-) 0.53 to 0.57 ° C and that buffalo milk is (-) 0.5443 to 0.545° C

1.2. What are the factors affecting quantity of milk production?

1. Breed of the cow or buffalo: Different breeds have their own capability of production that is genetically determined. Given the requisite environment and inputs, they will be able to produce to their maximum capacity. The average production capacity of different breeds is given in Chapter "Herd selection"
2. Dry matter intake: This is a factor that directly influences the milk yield of cows and buffaloes. This is because all the nutrients needed for the production of milk is supplied by the feed they consume
3. Quality of the feed / ration: A high fibre diet or a low quality diet has a slow digestion and hence, the dry matter intake will be low. In order to sustain high milk production, animals should be provided a well balanced ration in correct quantities (See Chapter "Feeding dairy animals")
4. Quality and type of the forage: The forage provided should be of good quality
5. Climatic conditions (within the barn and outside)

6. Frequency of milking: High yielding cows / buffaloes should be milked at least three times a day so as to keep up their high production. Even the timing of milking should not only be equally spaced but also around the same time on each day

7. Quantity and quality of drinking water: Lactating cows need 2.2 – 2.5 kg (lit) of water per kg of milk produced

8. Space provided per cow in the barn: Over-crowding in the barn will lead to undue stress on the animals, resulting in low production

9. Stress due to physical handling of cows / buffaloes: Unnecessary handling and/or rough handling of the animals results in stress, leading to low milk production

10. Health status of the animal: Many diseases impair the production of cows and buffaloes. Some diseases (e.g. mastitis) have a direct impact on milk production, where as others (e.g. foot problems) have an indirect effect. (See Chapter "Diseases and their control" for additional details)

1.3. Which one is better – cow milk or buffalo milk? Buffalo milk is better than cow milk.

1.3.1. How?

1. Superior for human nutrition – due to – lower concentration of bad (total and free) cholesterol and higher concentration of good (esterified) cholesterol

2. Produces superior curd and yogurt due to a) high concentration of total solids and proteins; particularly, the caseins b) higher concentration of calcium, more so in the colloidal state and c) higher fat content with bigger size of fat globules

3. Yield of butter and ghee is higher – due to higher fat %. Further, texture of ghee from buffalo milk is better – due to bigger size grains. In addition, the keeping quality of buffalo ghee is better than cow ghee as the former is less prone to (hydrolytic) rancidity.

4. Separation of casein is easier due to bigger size of fat globules and

higher proportion of solid fat in milk

5. Due to better emulsifying capacity, buffalo milk fat can form more stable emulsion and its absorption in the human body is better
6. The anti-microbial property of buffalo milk is superior due to higher content of lactoferrin in buffalo milk (320 mg/l) compared to cow milk (150 mg/l)

1.3.2. Is (are) there any drawback(s) of buffalo milk?

Yes; but most of them in the manufacturing industry than in the raw buffalo milk. They are as follows:

1. Table butter from buffalo milk is harder when compared to that from cow milk. Quality is inferior when spread on bread
2. The (oxidative) stability of buffalo ghee is poor due to the lower content of natural antioxidants
3. Buffalo milk is less suitable for the manufacture of hard cheese due to bitter taste, slow acidity development, lower retention of moisture, lower rate of protein and fat degradation
4. Large size of fat globules, high concentration of Calcium and Magnesium and lower stability of buffalo casein result in poor beating (whipping) ability
5. Buffalo milk is less stable. Therefore, gelation (formation of semisolids) of condensed buffalo milk during storage is more

1.4. What factors affect milk fat content (MFC)?

The factors influencing milk fat content (MFC) are:

1. Days in milk: Fat content will be higher at the start of lactation, decreases a few weeks after calving, low at peak lactation (5-7 weeks of lactation), increases after peak yield phase
2. Breed of the cow: Holstein Friesian crosses will have less MFC when compared to the milk of Jersey cross cows
3. Rapid changes in rations will affect the fat content, especially when the ration is deficient in fibre (less fibre in the ration)

4. Change in the rumen pH (optimum pH should be > 6.2)
5. Particle size of forages – fine particle size reduces milk fat
6. High grain – low forage diet, high amount of highly degradable starch and high amount of unsaturated oils reduce the MFC

2. Milking

2.1. How many times a cow has to be milked?

At least twice; very high producing cows should be milked 3 to 4 times a day.

2.1.1. Why?

The udder produces milk all the time. The udder swells and consequent on this, pressure increases; this in turn reduces the rate of milk production. If milking is done, the pressure is released and this helps production of more quantity of milk. High producing cows will stop producing milk in the udder after 8 – 10 hours unless milk produced already is milked out.

It is found that an increase of about 15 – 20 % in milk production is achieved by increasing the frequency of milking from 2 to 3 in the case of high producing crossbred cows (yielding more than15 lit of milk per day).

2.2. Is there any specification for time and timing?

Yes. Since milk letdown is a process controlled by hormones, a farmer had better milk the animals at specific times every day to optimize milk yield. It is analogous to feeding the animals at specific times.

Regarding timing; one has to complete milking within 5 to 7 min for each cow.

2.2.1. Why so?

The effect of the hormone required for letdown of milk (oxytocin) lasts only for about 5 to 7 minutes. Therefore, milking must be completed within this time. Hence, the farmer should get properly trained for milking before venturing into milk production business.

2.3. Should all milk be removed at each milking?

No. It appears logical that it is better to milk out all the milk at each milking; but it is not true.

2.3.1. Why?

Excess milking can cause damage to the milk production system in the udder due to collapse of the tissue that produces milk.

2.3.2. How much to be milked at each time?

About 80% of the milk can be removed from the udder at each milking. Some amount of milk will be retained in the quarter after each milking; this is called "residual milk". It is better to have least amount of residual milk. If too much milk is left in the udder, the pressure builds up faster. This will result in early drying.

2.4. Can the cow be thrashed or threatened to give milk?

Never.

2.4.1. Why?

Frightening or hitting a cow at the time of milking will result in the release of another hormone (adrenaline) which interferes with the milk letdown process. Therefore, frightening or thrashing a cow will only cause more harm than good.

2.5. What are the precautions for milking?

1. As far as possible, maintain the exact time of milking in a day (av. 12 hr interval)
2. Weaned animals should not be milked with the calves nearby
3. Do not feed dusty concentrate during the milking period
4. Prepare and collect all materials required for milking before the start of milking
5. Prepare the cow for 'let down' of milk – usually by washing of the

udder and wiping it dry

6. Hands of the milk man should be thoroughly washed before the start of milking
7. Begin the milking as soon as the 'let down' starts (within 40 – 60 seconds)
8. Use a strip cup. This helps to remove the first milk, which is usually high in bacterial count. This also helps in detecting mastitis
9. Animals suspected of udder infections should be milked at the end
10. Complete the milking within seven minutes
11. The milking process should be carried out continuously, gently, quickly, cleanly and completely. Avoid excitement of the cow prior to milking and during the milking period
12. Use both hands for milking
13. Use the correct procedure and method of milking
14. Dip the teats in antiseptic dipping solution after milking
15. Do not allow milk to come in contact with copper or iron
16. Keep milk away from sunlight

2.6. Is (are) there specific method(s) of milking?

Sure. There are three types of milking, like Stripping, Knuckling and Full hand milking.

Stripping is generally performed in animals with very short teats using the thumb and the tip of the fore finger. This is also done during the initial phase of milking in order to test the quality of milk and during the end of milking in order to eject the residual milk.

Knuckling is done by folded thumb while encircling the teat by the rest of the fingers and applying intermittent pressure. This is a wrong way of milking, as it causes lot of damage to the underlying tissues of the teats. This may even lead to injury of the teats.

Full hand milking is the best method of milking cattle and buffaloes. Here, the base of the teat is encircled by the thumb and forefinger and intermittent

pressure is applied by the fist. This method of milking almost simulates sucking by the calf.

2.7. Can I use a milking machine?

Generally, milking machine is not used when small number of animals is reared as in the case being considered. However, after the establishment of the farm and repayment of the loan, the farmer can afford using the milking machine.

Any way the use of a hand operated milking machine can be thought of in the case of a small herd.

2.7.1. How does a milking machine work?

A milking machine has four parts viz. milking unit, the pulsation unit, vacuum supply system and the milk flow system; of these, it is the milking unit that is attached to the udder.

The milking unit consists of a) teat cup assembly – a steel shell with a liner, which fits over the teat. The liner squeezes and relaxes on the teat as th pulsator operates (similar to hand milking applies pressure and release alternatively). This causes the milk to flow into the system. b) pulsation unit which controls the squeezing frequency and pressure c) connecting air and milk tubes which help create vacuum in the pulsator and flow of milk to the container, respectively and d) milk receiving unit – made of transparent plastic material (to help view the milk flow while milking) to receive milk through milk tubes. The receiver unit can be claw or suspension cup.

The pulsator rate is the number of pulses per min (a pulse refers to application of pressure and its release once). Normal rate ranges from 45 – 70 per minute. Too slow pulsation rate slows milking. Too fast pulsation rate allows air into the system and may slow down the rate of milking. Vacuum supply system creates the desired pulsator rate.

2.7.2. What additional precautions have to be taken?

1. Attach the milking machine gently to the udder
2. Remove the machine gently. First shut off the vacuum and remove all the teat cups together

2.7.3. How to clean milking equipment?

Two types of deposits can be found on milking machines – organic deposit (due to fat, protein and sugar) and mineral deposit – due to inorganic salts. Milk-stone is a combination of the organic and inorganic materials. When the equipment is not properly cleaned, there will be build up of milk-stone. These deposits provide a congenial breeding ground for bacteria.

Alkaline cleaner, chlorinated alkaline cleaner and acid cleaner are used to remove deposits from milk equipments. Alkaline and chlorinated alkaline cleaners remove organic deposits and acid cleaners remove inorganic deposits. Do not mix chlorinated alkaline cleaner with acid cleaners as poisonous chlorine gas is released when these two are mixed.

Do not use household soaps to clean milking machines.

2.7.3.1. Metal parts

Rinse the equipment in luke – warm water as soon as milking is over. Milk solids that are allowed to dry are hard to remove later. Use a hard-bristled brush or sponge to wash the metal parts. Then put the metal parts in an acid rinse. This helps prevent the build up of milk stone. Drain and store the parts upside down.

2.7.3.2. Liners and other rubber parts

First rinse in luke – warm water as soon as milking is over. Put them in a cleaner solution for about two hours. Rinse and wash them and allow to air dry.

2.7.3.3. Milk pipelines

Pipelines are cleaned in place i.e. they are not taken apart for cleaning. The cleaning solution is circulated through the system. There are cleaners exclusively used for pipelines. Use liberal amount clean water to rinse the system.

2.8. How to ensure clean milk production?

Milk has a clean, pleasant and slightly sweet flavor.

2.8.1. How to prevent off-flavours in milk?

Off – flavours in milk include: Feed flavour, Rancidity flavour, Sanitizer flavour, Medicine flavor and Salty flavour. The most common off-flavour is caused by feed. Silage should be fed only after milking. Avoid feeding dusty feed before or at the time of milking. Poor barn ventilation also gives rise to off – flavours in milk.

2.8.2. How to prevent sediments in fresh milk?

1. Keep the cows clean
2. Ensure thorough ventilation in the milking shed
3. Wash the udder thoroughly before each milking
4. Keep the milking area free of dust
5. Do not sweep the barn just before or at the time of milking
6. Keep the milking machine units off the ground
7. Strain or filter milk
8. Remove dung from the shed before milking
9. Do not feed dry concentrate or silage just before or at the time of milking

3. How to prevent infection of the udder?

The infection of the udder is referred to as "Mastitis". It can be caused mainly by bacteria and due to faulty management of milch animals. Bacteria causing mastitis need not necessarily be pathogenic. What is generally observed due to mastitis is reduced milk with or without clots (flakes) in milk, swelling of udder and reduced specific gravity (thickness) of milk.

3.1. What are the forms of mastitis?

3.1.1. Acute mastitis

Udder will be hot, painful and hard. Milk will be watery containing clots, flakes and pus.

3.1.2. Chronic mastitis

Udder will be cold, not painful and uniformly hard. Milk will be occasionally watery, containing many large hard masses.

3.1.3. Indurative mastitis

Udder will be oedematous and congested. Milk will be normal.

3.1.4. Sub-clinical mastitis

As the name indicates, this is mastitis with out clinical signs.

3.2. What are the causes of mastitis?

Mastitis is caused as a result of infection of the udder with pathogenic microorganisms. It can be spread by:

1. Infectious milk from infected quarter through hands, milking machine liners, towels, and wash water
2. Direct contact during milking
3. Unhygienic and inefficient milking
4. Unclean bedding, dirty floor

3.3. How to control mastitis?

A careful planned mastitis control programme is essential for a dairy farm. This involves regular examination of all cows in milk, isolation of problem animals from the herd, prompt and effective treatment of the infected animal. Animals with chronic mastitis infection that does not respond to treatment should be culled from the herd. This will help to eliminate a possible source of infection for other cows.

At the farmer's level, daily examination of the animal at the milking time and examination of the milk with the help of a strip cup will help to identify animals with infection. Any injury to the udder / teats or swelling of the udder / teats (inflammation) should be taken care of immediately. Dipping of the teats with teat dips (iodophore solution) after each milking will help to reduce the incidence of mastitis in the herd considerably. Dry cow therapy – infusion of antibiotics through the teats can be resorted to when a cow becomes dry. This

should preferably be done under Veterinary supervision.

5

Diseases and Their Control

Several diseases / ailments have been reported in cattle and buffaloes; but, it is not in the purview of this publication to give all the details. Since small – scale dairy farmer is not likely to be well versed with treatment of dairy animals, it is compulsory that he should immediately consult qualified Veterinarian to alleviate the condition / disease at the earliest. In any case, most common of the diseases that are likely to affect dairy animals and those that can be easily identified by the farmers are outlined below. For no reason, the details given below be considered complete and exhaustive but, should be treated only as a guideline before Veterinary aid is actually made available at the farm.

1. Diseases affecting calves

See Chapter "Dairy management"

2. Diseases affecting growing and adult animals 2.1. Viral diseases

2.1.1. Foot and Mouth Disease

This is by far the single most important viral disease of dairy animals. It is a highly contagious disease affecting animals with partitioned hooves (cloven footed; like cattle, buffaloes, sheep, goats, pigs etc.) at all ages. Crossbred cattle are more susceptible to this infection.

2.1.1.1. Spread

Animals get infection through direct contact with infected animals, and also through contaminated feed, water and grazing lands, dung, utensils and through contact with animal attendants or milk men. The virus is carried through air and therefore can cause air-borne infection.

2.1.1.2. Symptoms

High fever, anorexia (lack of interest in feed), sluggishness, profuse salivation from the mouth, difficulty in walking (lameness), reduction in the milk yield are the major signs. The affected animals will have fluid – filled swellings (vesicles) in the mouth (especially on the gums and the tongue). In due course, these vesicles rupture forming red, painful wounds (ulcers) in the mouth. There will be the formation of painful ulcers on the foot (in the interdigital space or between the partitions of the hooves) and /or on the udder and teats.

In the case of young calves, these typical symptoms may not be very much evident. There will be sudden death due to involvement of the heart.

In addition to the above signs, there could be secondary infection by pus forming bacteria, which make the situation more complicated. The wound may also be infected by maggots (fly worms) leading to myiasis. The lesions of the foot can cause deformity of the foot or even complete falling (shedding) of the hoof.

On recovery, the animals may become completely sterile, have rough coat, stunted growth and reduced milk production. Recovered animals should not be exposed to direct sun as this causes difficulty in respiration (panting). Recovered animals are totally uneconomical to maintain and they had better be culled and sold for slaughter.

2.1.1.3. Treatment

There is no treatment for the disease but wounds in the mouth can be attended with application of antiseptics (boro – glycerin, a mixture of boric acid and glycerin) after thoroughly washing with potassium permanganate lotion.

2.1.1.4. Prevention

Can be prevented by vaccination. In case of infection, the affected animal/

animals must be separated from the healthy ones. Movement of animals and animal attendants from affected to non – affected areas must be highly restricted and strict quarantine measures must be in place.

Sprinkling 1 to 2 % caustic soda or 4 % solution of washing soda in the shed and paddock helps control of spread of infection.

2.2. Bacterial diseases

2.2.1. Hemorrhagic septicemia (HS)

A highly contagious bacterial disease of cattle and buffaloes occuring especially during monsoon season. Those animals having stress (transportation, exposure to severe rain etc.) during which the resistance goes down are mostly affected.

2.2.1.1. Spread

The causative organism is naturally present in the body of healthy animals and their excretions (like urine and dung). The disease spreads as a result of direct contact with affected animals and by the consumption of contaminated feed and water.

2.2.1.2. Symptoms

The disease takes three different forms as acute form, sub-acute form and chronic form. In the acute form, there will be sudden onset of the disease and death occurs within 24 hours. In the sub-acute form, the disease usually takes a course of 3 days. In chronic form, animals survive for a longer time.

Fever, rapid breathing, anorexia, restlessness, watery discharge from the nostrils and eyes, swelling in the throat and neck region. In chronic form, there will be cough and blood stained discharge from the nostrils. The above signs may be associated with hemorrhagic enteritis (diarrhea with blood) and pneumonia (very common in buffaloes).

2.2.1.3. Diagnosis

Diagnosis can be done by the specific clinical symptoms and examination of blood and nasal discharge.

2.2.1.4. Prevention

Yearly vaccination of all animals (especially one or two months before the monsoon season)

Separation of the affected animals from healthy animals and restricting the movement of animals and animal attendants from affected areas to non – affected areas. Proper disinfection of the shed and premises.

2.2.2. Anthrax

This is a highly contagious bacterial disease affecting all warm – blooded animals characterized by sudden death. It is an important zoonotic disease, which can spread to humans from animals or their products.

2.2.2.1. Spread

The disease spreads by the spores of the organism which are highly resistant and can live in dry state for many years. Sporulation does not occur inside the body of animals (either live or dead animals). Infection occurs through the consumption of feed and water contaminated with the spores of the organism. It should be noted that the spores can also infect pasture / grassland and the animals grazing in these pastureland can get infected. In addition, the infection can be spread by biting flies and also through wounds.

2.2.2.2. Symptoms

Include blood tinged (dark red colored) foamy discharge from the mouth, nostrils and the anus and vagina (all natural openings). There will be high fever. Affected animal dies immediately in per-acute form and may survive for 1-2 days in acute form and then die.

2.2.2.3. Prevention

Controlled by vaccination. Adopting strict hygiene and quarantine measures by restricting movement of animals is very important in prevention of this disease. Controlling vectors and proper disinfection of the shed and premises are equally important.

Cauiton: In case of death due to Anthrax, the carcass should not be subjected to post-mortem examination (i.e. should not be opened) and should

be buried deep or incinerated (completely burnt) along with all the discharges, stained soil, bedding etc. This would help avoid spore formation and further spread of the infection.

2.2.3. Brucellosis

A highly contagious bacterial disease characterized by abortion in cattle and buffaloes. This is mainly a disease of mature animals.

2.2.3.1. Spread

The disease spreads by the consumption of contaminated feed and water and also by direct contact with infected animals.

2.2.3.2. Symptoms

Include severe abortion in pregnant animals usually between the 5^{th} and the 7^{th} month of pregnancy (gestation). Abortion in most cases is accompanied by retention of placenta.

2.2.3.3. Prevention

Testing of animals for Brucellosis and destroying the positive animals.

Vaccination. Segregation of the infected animal, proper disposal of the infected materials like aborted fetus, placenta (after birth), uterine discharge etc. and proper disinfection of the shed and premises.

2.2.4. Mastitis:

Mostly high producing animals are affected. Injury to the udder or teats, incomplete milking etc, can also lead to this condition.

2.2.4.1. Spread

The infection enters through the teat canal and damages the secretary tissue.

2.2.4.2. Prevention

Note: See Chapter Milk and Milking also for additional details.

1. Keep the shed and premises clean
2. Wash the udder and teats with potassium permanganate solution before and after milking
3. Thoroughly wash the hind quarters before milking the animal
4. Thoroughly inspect the first drawn milk from each quarter for the presence of flakes, bad odor, off-color, consistency etc.
5. Segregate the affected animal/animals
6. Destroy the milk drawn from the infected quarter
7. Milk the affected animal only after milking all healthy animals
8. Use of teat dips after each milking
9. Hygiene of the milk man also plays a major role in preventing this problem
10. Adopting dry cow therapy (See Chapter Dairy management for further details)

2.3. Other diseases

2.3.1. Bloat

Bloat is a non – infectious, nutritional disease condition of ruminants characterized by abnormal distension of the abdomen (left side) due to excessive accumulation of gas (in the rumen). Incidence is high in animals consuming more of leguminous fodder along with high grain ration.

2.3.1.1. Symptoms

Two forms include acute and chronic. Acute form is severe and often fatal. The animal feels uneasy, restless, anorectic (lack of interest in feeding), and shows increased swelling of the abdomen. The animal may frequently lie down and get up and also may kick at its belly. Breathing becomes rapid, usually with open mouth and protruded tongue. The animal may eventually die of suffocation.

Chronic form of bloat is usually less severe and generally amenable for treatment.

2.3.1.2. Prevention

Feeding of chopped dry roughage (straw) along with succulent leguminous fodder and inclusion of stem portion of the legume while fodder is offered to the animal. Withdrawal of water for a few hours to the bloated animal has been found to benefit.

2.3.2. Milk fever

This is also a non – infectious, nutritional condition generally seen in recently calved, high producing animals. Acute deficiency of calcium in the blood is attributed as a cause.

2.3.2.1. Symptoms

The affected animal shows restlessness, excitement, muscle twitching and in due course staggers and lies down. The animal usually lies with its neck turned back or with the head kept over the shoulder and is unable to get up. There will be complete loss of appetite, dull appearance, drying of the muzzle, dropping of the body temperature and slow breathing.

2.3.2.2. Prevention

Provision of a well balanced ration and adequate supply of calcium in the ration.

6

Dairy Performance Indices

The following are some of the practical indicators of the performance of a dairy farm which can be calculated only when accurate records are maintained:

Note: Of all the indices, lactation yield (LY), age at first calving (AFC) and calving interval (CI) are by far the most important under commercial conditions.

1. What are the performance indicators in a dairy farm?

The performance of a dairy unit can be measured in terms of various characteristics (traits) like:

1. Milk production
2. Reproduction traits
3. Growth traits
4. Type and conformation traits
5. Traits concerning disease resistance and heat tolerance
6. Draught potential

1.1. How to assess milk production efficiency? Milk production can be assessed in terms of:

1. Lactation yield (LY)

2. Average daily yield (ADY)
3. Peak yield (PY)
4. Persistency

(However, LY is by far the most popular one)

1.1.1. How to measure Lactation Yield (LY)?

There is considerable difference in milk production between breeds, between herds within breeds and between individual animals within herds. Also, there is great variability between species. Milk production is generally referred to as "Lactation yield (LY)".

Lactation yield is generally measured as the total milk yield, in kg, for a period of 305 days from the start of milk yield.

1.1.1.1. Generally milk is measured in litres; why LY in kg?

When measured in lit, the difference due to density (thickness in common term) can't be known. Higher the density higher will be the weight of a lit of milk. For example, one lit of buffalo milk is heavier than that of cow milk. Therefore, for scientific comparison of production efficiency, milk yield is measured in kg.

1.1.1.2. Why LY is measured for 305 days but not 365 days?

It is ideally expected that a dairy animal calves every year; in other words Calving Interval (CI) is 365 days. Of this, 60 days which obviously corresponds to last two months of pregnancy (gestation), the animal is not milked (dry period); hence, LY is measured for 305 days.

1.1.1.3. Why a cow is not milked for last 60 days of gestation?

Milk is rich in calcium; therefore, milking is discontinued during the last 60 days of gestation to help growing calf develop its bones.

1.1.2. What is Average Daily Yield (ADY)?

As the name suggests, it is the ratio of total milk produced, in kg. to the number of days the animal was in milk. Higher the values, better is the efficiency of the dairy animal. The ADY of an exotic breed ranges between 20 to 30 kg, Indian (Zebu) breeds 4 to 5 kg and crossbreds 8 to 10 kg.

The mean lactation yield /day (average daily yield) increases steadily from the date of calving and reaches a maximum (peak yield) by 4 – 6 weeks after calving. Then the level falls gradually till the animal dries off.

1.1.3. What is Peak Yield (PY)?

If the daily milk yield, in kg, is plotted on a graph sheet, a typical lactation curve is obtained because at the beginning milk production increases and later on, starts reducing. During the process, the dairy animal reaches a maximum milk yield which may sustain for some time during the lactation period. This maximum yield is referred to as "Peak yield (PY)". Ideally, it is expected that a dairy animal reaches peak yield as early as possible and sustains it as long as possible; because, in either case LY increases.

1.1.4. What is persistency and how to measure it?

It can be noticed that after peak yield is attained, milk production reduce the rate at which the milk production reduces is the "Persistency"; lower the value of persistency (referred to as "greater" persistency), longer the animal produces at a higher rate and hence, higher will be its LY.

It is generally agreed that Exotic cattle will have lower rate of decline (5.3 – 5.7 %) in milk yield (greater persistency) than Buffaloes and Indian (Zebu) cattle (7.5 – 11%).

It may not be always possible to draw a lactation curve and calculate persistency. Therefore, calculation of Persistency Index (PI) is resorted to. The PI is the ratio of milk produced between 71st to 180th days of lactation to that of total yield till 180th day of lactation. If A is the yield of first 180 days and (A - B)B is the yield during first 70 days, $PI=\frac{(A-B)}{B}$. Obviously, Higher the PI, better is the persistency.

Persistency index of some breeds of cattle and buffalos is Red Sindhi:

3.96, Sahiwal: 3.07, Murrah: 1.23 and Crossbred (Jersey X Hariana): 4.44.

1.2. How to assess reproductive efficiency of a herd?

In small – scale dairy production, the farmer will generally wish to have the calves born at the farm for future years rather than buying animals every time because this reduces not only cost involved but also minimizes disease transmission. Hence, assessment of reproductive efficiency of the herd and/ or each animal is very important.

1.2.1. How to assess reproductive efficiency? Reproductive efficiency of a herd depends on:

1. Age at maturity: age at which the female animal becomes fit for reproduction
2. Age at first calving: age at which the first calf is born
3. Service period: is the time lapse between calving and the first time the animal is inseminated again. In simple terms, how soon the cow conceives after calving
4. Gestation period: is the total duration of pregnancy
5. Lactation period: is the number of days the dairy animal is milked or produces milk
6. Dry period: is the number of days the dairy animal is not milked or does not produce milk
7. Calving period: also called "Calving Interval (CI) or inter – calving period": ideally it should be 1 year (365 days). For the above, it is easy to note that Calving period = Service period + Gestation period or Calving period = Lactation period + Dry period.

1.3. How to assess growth efficiency of a herd?

Rate of growth of calves has a great influence on their productivity in future. Animals showing good growth rate generally tend to become good producers. Growth can be assessed in terms of:

1. Average daily weight gain

2. Average monthly weight gain
3. Body measurements
4. Birth weight
5. Weight at 6 months, 12 months, at maturity
6. Relative growth rate

It is not a commercial practice to weigh large animals on a weighing scale; especially so in case of small – scale dairy farmers. The equipment itself will be expensive. Hence, body measurements are convenient indicators of animal's weight. The indices @ 1 to 5 above are self – explanatory.

Relative growth rate is not a commonly calculated value; however, in simple terms, it is the growth rate relative to the previous time the animal is assessed for growth.

1.4. How to assess conformation of a dairy animal?

Dairy type cattle possess typical body conformation and shape. These physical characters are together referred to as dairy types. These characters are common to all dairy cows (irrespective of the breed). Some important dairy characters (types) are:

1. Long and lean neck
2. Light shoulder and brisket
3. Broad and deep hind quarters
4. Large udder
5. Should have a triangular appearance when viewed from the side Top, side and front wedges (the triple wedges) are looked as a measure of angularity (See Chapter "Herd selection" also).
6. Thickness of skin: High yielders generally possess thin skin than low yielders
7. Shape and size of udder, texture of the udder, type of milk vein (large and tortuous) and rate of flow of milk are some of the other type characters found useful

There are unified score cards for evaluating the dairy type and

conformation in which, different weightages are given for different body parts and features. Such score card traits include general appearance; body capacity, dairy characters and mammary system. These characters are not clearly exhibited by Indian (zebu) cattle. Such assessment is especially important during herd selection (See Chapter "Herd selection").

1.5. How to assess disease resistance and heat tolerance?

There is no numerical way to assess these characteristics of an animal / herd because these are mostly qualitative in nature. But, these are important considerations particularly when the exotic inheritance of the herd increases or when crossbreds are introduced to tropical countries.

The capacity of Indian (zebu) cattle to withstand adverse climate and resist tick – borne infections is well known. Exotic cattle are relatively weak in these respects. Resistance to tick – borne infections is possibly due to their special anatomical and physiological features; for instance, short hair coat, thicker skin, ability to move skin voluntarily (twitching) and peculiar skin secretions etc., which act as fly repellent.

On the same lines, anatomical and physiological features that help in heat tolerance in Indian (zebu) cattle are better ability to dissipate heat by evaporation, more sweat glands and higher sweating rate etc.

1.6. Draught ability

Draught capacity is a trait of economic importance in cattle and buffaloes. But, whenever a male (bull) calf is born, it fetches a higher price if the breed to which it belongs is reasonably good for draught purpose.

7

Economics of Dairy Production

Livestock farming is primarily for livelihood of the farmer and hence, it should be profitable enough for his sustenance. The returns also should encourage him to continue in the business.

For a small-scale dairy operation, a herd with 12 milking animals appears to be optimum. However, there are no set standards to designate a dairy farm as small-scale or otherwise. Hence, the forthcoming Sections will enumerate the method of working out economic returns from a dairy farm with 12 milking crossbred cows.

1. Technical assumptions

It is essential to have a clear cut foresight for finance, building, herd schedule, items of income and expenditure etc. of the dairy farm to be established. The following tables give the details concerning the proposed dairy unit:

1.1. Finance

The monetary requirements for construction of dairy shed and purchase of animals will be obtained from a lending institution (Bank). The banks give 75% of the requirement, the rest being the farmer's contribution. The loan needs to be repaid in five equal annual installments with an interest rate of 12% pa on the outstanding loan.

1.2. Non-recurring expenditure

Table 1: Non-recurring expenditure

	Description		Cost
Building	Calves (up to 6 m)	2.0 m^2/animal	Rs 1000/ m^2
	Animals > 6 m	3.5 m^2/animal	Rs 750/ m^2
Equipment			Rs 500/animal/pa

1.3. Recurring expenditure

This includes cost on purchase of animals, feed, vaccines, medicines, insurance etc. They are tabulate below:

Table 2: Recurring expenditure

Description Animal purchase						Rs 20,000/animal
Allowance, kg/d						
Feeding	For cattle	0-3 m	3-6 m	6-12 m	> 12 m	
	Roughage	-	6	15	25	Re 2/kg
Concentrate	1	1	2	4	Rs 12/kg	
	Vaccines, medicines etc.					Rs 250/animal/pa
	Insurance, 6% of cost of the animals purchased					Rs 1200/animal

1.4. Income

The sources of income, their quantity and value are shown below:

Table 3: Income

Description					Rate
Sale of milk	LL 305 d, LY 3000 l				Rs 20/l
	1 year old				Rs 5,000/animal
Sale of animals	2 year old heifer				Rs 15,000/animal
	After Lactation V				Rs 2,500/animal
		Age, m			
Manure Production, kg/animal/d		0-6	6-12	>12	FYM Rs 500/t
	Dung	5	8	15	
	FYM	3	4	8	

LL: Lactation length, LY: Lactation Yield, FYM: Farmyard Manure

1.5. Other assumptions

The following are assumptions needed for computing profits and cashflow:

1. Single row sheds one each for Calves and Grower / Milking animals
2. Labor: Self
3. Equal number of ? and ? calves, at first purchase and at the farm
4. Calving interval: 1 year
5. Sale of animals: ? after completion of 1 year of age; heifers after 2 years of age
6. Mortality: 10%, to be applied on overall profits; under exigency for replacement, pregnant animals born at the farm will be used

7. Depreciation: Building – 2½% pa, Equipment – 5% pa

2. Economics of a 12-cow dairy farm

2.1. Herd schedule

It is highly essential that the expected number of animals in milk, calves, heifers and bull-calves are known to estimate costs and returns. It requires a schedule as per the purchase of animals at the beginning to facilitate calculation of recurring expenditure and income accurately.

In the current program, it is assumed that:

1. Cows in advanced pregnancy or in first lactation with a newly born calf will be purchased twice in batches of 6 animals each at 6-month's interval during the first year only
2. The animals will be inseminated at the farm and the calves born will be sold; males after 1 year and heifers after 2 years. However, under exigency, heifers may be used to replace the original stock

Table 4: Herd Schedule

		< 6 m		> 6m, < 12 m		For sale		In Milk**	Lactation No
Year	Part	♂*	♀*	♂*	♀*	♂*	♀*		
	0-6 m	C^A_I	C^A_I	-	-	-	-	A_I	
1				G^A_I	G^A_I	-	-	A_I	
	7-12 m	C^B_I	C^B_I			-	-	B_I	I
				G^B_I	G^B_I	-	-	B_I	
2	0-6 m	C^A_{II}	C^A_{II}			G^A_I	-	A_{II}	
				G^A_{II}	G^A_{II}		-	A_{II}	
	7-12	C^B_{II}	C^B_{II}			G^B_I	-	B_{II}	II

	m								
				G^{B}_{II}	G^{B}_{Ii}		-	B_{II}	
3	**0-6 m**	C^{A}_{III}	C^{A}_{III}			G^{A}_{II}	G^{A}_{I}	A_{III}	
				G^{A}_{III}	G^{A}_{III}			A_{III}	
	7-12 m	C^{B}_{III}	C^{B}_{III}			G^{B}_{II}	G^{B}_{I}	B_{III}	III
				G^{B}_{III}	G^{B}_{III}			B_{III}	
4	**0-6 m**	C^{A}_{IV}	C^{A}_{IV}			G^{A}_{III}	G^{A}_{III}	A_{IV}	
				G^{A}_{IV}	G^{A}_{IV}			A_{IV}	
	7-12 m	C^{B}_{IV}	C^{B}_{IV}			G^{B}_{III}	G^{B}_{III}	B_{IV}	IV
				G^{B}_{IV}	G^{B}_{IV}			B_{IV}	
5	**0-6 m**	C^{A}_{V}	C^{A}_{V}			G^{A}_{IV}	G^{A}_{III}	A_{V}	
				G^{A}_{V}	G^{A}_{V}			A_{V}	V
	7-12 m	C^{B}_{V}	C^{B}_{V}			G^{B}_{IV}	G^{B}_{III}	B_{V}	
	Total	30	30	27	27	24	18		

Notes:

1. At the beginning of I year (Batch A) and after 6 m (Batch B), 6 milking animals with calf purchased i.e., 12 in milk and 12 calves
2. m = month, C = Calves, G = Growers
3. Superscript indicates Batch
4. Subscript indicates lactation number of the Batch to which it pertains
5. * 3 animals and ** 6 animals for each cell
6. Movable assets at the end of 5 years:

a) 3 each of G^{a}_{V} and G^{b}_{V} ♂ for sale

b) 3 each of $G^{a}iv$, $G^{b}iv$, $G^{a}v$ and $G^{b}v$, ♀ to be sold after AI and Pregnancy

c) Batch B animals to be sold after completion of V Lactation (6 m).

3. Management including housing, feeding, handling, disease control and sanitation etc. will be as per standards which have been outlined in earlier Chapters in this publication

2.2. Non-recurring expenditure

Table 5 Non-recurring expenditure

Description		n	Allowance	Cost	Total, Rs
Building	Calves (up to 6 m)	12	2.0 m^2/animal	Rs 1000/ m^2	24,000
	Animals > 6 m	24	3.5 m^2/animal	Rs 750/ m^2	63,000
Equipment		36		Rs 500/animal/pa	18,000
					105,000

2.2.1. Calculation

Building requirement of calves = n x allowance x cost = Rs 24, 000; the same way others are also calculated.

2.3. Recurring expenditure

Recurring expenditure differs between I year and the rest primarily because:

1. Animal purchase is done only during I year
2. Number of animals is not the same during first and second half of I year because Batch B animals are purchased after 6 m of Batch A.
3. There are no sales of 1 year old bulls and 2 year old heifers

The following table illustrates calculation of various recurring costs. Note that insurance is done only for the animals purchased for the project.

Table 6 Recurring expenditure (I year)

Description				**Rate**	**n**
Animal purchase				**Rs 20,000/animal**	**12**
Feeding cost	Age	Feed	kg/animal		
	0-3 m	Concentrate	90	Rs 12/kg	12
	3-6 m	Roughage	540	Re 2/kg	12
		Concentrate	90	Rs 12/kg	12
	6-12 m	Roughage	2,700	Re 2/kg	6
		Concentrate	180	Rs 12/kg	6
	> 12 m for 1 year	Roughage	9,125	Re 2/kg	12
		Concentrate	1,460	Rs 12/kg	12
Vaccines, medicines etc.				Rs 250/animal	24*
Insurance				Rs 1,200/animal	12
					TOTAL

2.3.1. Calculation

General rule is multiply n with rate; and in case of fodder and concentrates, multiply the product obtained with quantity. For instance, cost of animal purchase is 12 x Rs 20,000 = Rs 240,000 and cost of concentrates (0-3 m) = 90 x 12 x Rs 12 = Rs 12,960

Table 7: Recurring expenditure (II year and onwards)

Description				Rate	n	Am (Rs
Animal purchase						
Feeding cost	Age	Feed	kg/animal			
	0-3 m	Concentrate	90	Rs 12/kg	12	12,9
	3-6 m	Roughage	540	Re 2/kg	12	12,9
		Concentrate	90	Rs 12/kg	12	12,9
	6-12 m	Roughage	2,700	Re 2/kg	12	64,8
		Concentrate	180	Rs 12/kg	12	25,9
	> 12 m for 1 year	Roughage	9,125	Re 2/kg	12	219
		Concentrate	1,460	Rs 12/kg	12	210
Vaccines, medicines etc.				Rs 250/animal	24	6,00
Insurance				Rs 1,200/animal	12	14,4
					TOTAL	579

2.4. Income

Table 8 Income (I year)

Items sold		n	Production	Total production	Rate, Rs	Total, Rs
Milk	0-6 m	6	1,500 l/animal	9,000 l	20/l	1,80,000
	7-12 m	12	1,500 l/animal	18,000 l		3,60,000
Animals	Males					
	Females					
	After Lactation V					
FYM	0-6 m	12	540 kg/animal	6,480	500/t	3,240
	6-12 m	6	720 kg/animal	4,320	500/t	2,160
	> 12 m for 1 year	6*	2,920 kg/animal	17,520	500/t	8,760
				TOTAL RECEIPTS		554,340

* 6 animals for 12 m and 6 for 6 m

Table 9: Income (II year)

Items sold		n	Production	Total production	Rate, Rs	Total, Rs
Milk	0-6 m	12	1,500 l/animal	18,000 l	20/l	360,0
	7-12 m	12	1,500	18,000 l		360.0

			l/animal			
Animals	Males	6			5,000/animal	30,00
	Females	-				
	After Lactation V					
FYM	0-6 m	12	540 kg/animal	6,480	500/t	3,240
	6-12 m	12	720 kg/animal	8,640	500/t	4,320
	> 12 m for 1 year	12	2,920 kg/animal	35,040	500/t	17,52
					TOTAL RECEIPTS	775,0

Table 10 Income (III and IV year)

Items sold		n	Production	Total production	Rate, Rs	Tot Rs
Milk	0-6 m	12	1,500l/animal	18,000 l	20/1	
	7-12 m	12	1,500 l/animal	18,000 l		360,
Animals	Males	6			5,000/animal	30,0
	Females	6			15,000/animal	90,0
	After Lactation V	6 -				
FYM	0-6 m	12	540	6,480	500/t	3,24

			kg/animal			
	6-12 m	12	720 kg/animal	8,640	500/t	4,32
	= 12 m for 1 year	12	2,920 kg/animal	35,040	500/t	17,5
					TOTAL RECEIPTS	865,

Table 11 Income (V year)

Items sold		n	Production	Total production	Rate, Rs	Tota Rs
Milk	0-6 m	12	1,500 l/animal	18,000 l	20/l	360,
	7-12 m	12	1,500 l/animal	18,000 l		360
Animals	Males	6			5,000/animal	30,0
	Females	6			15,000/animal	90,0
	After Lactation	6			2,500/animal	15,0
FYM	0-6 m	12	540 kg/animal	6,480	500/t	3,24
	6-12 m	12	720 kg/animal	8,640	500/t	4,32
	> 12 m for 1 year	12	2,920 kg/animal	35,040	500/t	17,5
					TOTAL RECEIPTS	880,

Income differs in all the years except years III and IV for obvious reasons of number of animals in production and available for sale. A look at herd schedule will indicate the number of animals at every 6 month's intervals.

1.1. Movable assets on hand at the end of 5 years

The following are the movable assets at the end of 5-year period:

Table 12: Value of movable assets at the end of 5 years

Growing males	6	10,000/animal	60,000
Growing females	12	25,000/animal	150,000
After Lactation V	6	2,500/animal	15,000
		TOTAL VALUE	225,000

1.2. Cash flow

As indicated earlier, Banks stipulate that credit should be returned in five equal annual installments along with interest for the loan outstanding. They also require a cash-flow showing year-wise expenditure-income statement along with gross and net profits. The same are tabulated below:

Table 13: Cash – flow

Description	I year	II year 24,000	III year 24,000	IV year 24,000	V year	T
Non-recurring	105,000	24,000	24,000	24,000	24,000	2(
Recurring	772,380	564,840	564,840	564,840	564,840	3,
TOTAL EXPENDITURE	877,380	588,840	588,840	588,840	588,840	3,
Income	554,340	775,080	865,080	865,080	880,080	3,
Income from loan	260,000	-	-	-	-	2(
TOTAL RECEIPTS	814,340	775,080	865,080	865,080	880,080	4,

Gross profit	(-) 63,040	186,240	276,240	276,240	291,240	9(
Loan installment	52,000	52,000	52,000	52,000	52,000	2(
Interest	31,200	24,960	18,720	12,480	6,240	9:
Depreciation, building	2,175	2,175	2,175	2,175	2,175	1(
Depreciation, equipment	1,800	1,800	1,800	1,800	1,800	9,
NET PROFIT	(-) 150,215	105,305	201,545	207,785	229,025	5(
CUMULATIVE NET PROFIT		(-) 44,910	156,635	364,420	5,93,445	

Notes:

1. Overall profit over 5 years is Rs 593,445 or Rs 118,689 (say 120,000)/pa; in other words Rs 10,000/month or Rs 833/animal/month or Rs 2.78/l of milk

2. Assets available will be of Rs 225,000 or Rs 313/animal/month

3. Total profit + assets is Rs 1,150/animal/month or Rs 3.83/l of milk

2.6.1. Deferred repayment of loan

Net profit during first 2 years is negative; this is obvious because the cash input by the farmer is not accounted for. However, banks do allow deferred payment of loan installment and interest; the farmer can seek repayment of loan in 4 installments starting from 4th year with interest at 12%. The calculations will be as follows (calculations up to calculation of gross profit are same as

shown in Table 13):

Table 14: Cash – flow (deferred repayment)

Description	I year	II year	III year	IV year	V year	Total
Gross profit	(-) 63,040	186,240	276,240	276,240	291,240	966,92
Loan installment	Deferred	35,000	75,000	75,000	75,000	260,00
Interest	Deferred	62,400	27,000	18,000	9,000	116,40
Depreciation, building	2,175	2,175	2,175	2,175	2,175	10,875
Depreciation, equipment	1,800	1,800	1,800	1,800	1,800	9,000
NET PROFIT	(-) 67,015	84,865	170,265	179,265	203,265	570,64
CUMULATIVE NET PROFIT		17,850	188,115	367,380	570,645	

Notes:

1. Overall profit over 5 years is Rs 559,845 or Rs 111,969 (say 112,000)/pa; in other words Rs 9,300/month or Rs 778/animal/month or Rs 2.59/l of milk
2. Assets available will be of Rs 225,000 or Rs 313/animal/month
3. Total profit + assets is Rs 1,091/animal/month or Rs 3.64/l of milk

It can be noticed that, there is increased interest paid and reduced net profit consequent on deferred payment; this can be overcome by:

1. Growing own fodder and having own source of dry fodder to reduce cost on feeding
2. Investing in the business in terms of requisite cash

SECTION–II
SHEEP AND GOAT PRODUCTION

8

Introduction

In our country, sheep and goat are reared on grazing and at the backyard by farmers with small land holdings. Therefore, most of the farmers are not only poor but also illiterate and women mostly take care of the animals. Being illiterate, they tend to resist change and prefer hardships of traditional methods to scientific rearing. It is also common that sheep and goat are a part of mixed (composite) farming involving several crops and/or animals.

Urbanization is limiting the land available for grazing. Over – grazing can result in paucity of natural resources due to over – exploitation on one hand and soil erosion on the other. Some farmers do feed them indoor (stall feeding) on crop residues, forages, agricultural by – products, non – conventional feedstuffs, tree leaves, scarcity fodder etc.

Why should I venture into sheep and goat farming?

The advantages of rearing sheep and/or goats along with the existing farming systems are as follows:

1. Reduced risk – compensates for loss(es) in other farm activities by providing additional income / financial security
2. Efficient use of family labor – because, sheep and goat do not require continuous attention and can be accommodated within the normal farm routine
3. Efficient use of natural resources
4. Increased by-product utilization – especially manure from sheep and goats are extremely beneficial for other farm activities

5. Effective nutrient recycling
6. Efficient use of energy in the system
7. Reduced dependence on external inputs
8. Improved soil fertility
9. Multiple output
10. Increased economic output i.e. profits
11. Biological control of weeds – since sheep and goats do feed on many of the weeds
12. Environment friendly and pollution free environment – since use of weedicide is considerably reduced

1.1. What are the uses of sheep and goat production?

Sheep and Goats are small grass – eating animals (ruminants) which fit well into composite (mixed / diverse) farming systems and play an integral role in these systems. The major products for which sheep and goats are reared include meat, milk, wool (sheep) and fiber (goats). Certain slaughter by – products also have commercial value.

1.1.1. General

1. Easily digestible milk especially in case of goat
2. Fiber, skin, hoof and horns support local handicrafts industries.
3. Valuable by-products are obtained from slaughter house
4. Meat is acceptable to all sections of people (no religious taboo)
5. Small body size enables them to be slaughtered and dressed easily; particularly, goats
6. Goats virtually eat any vegetation and they search for such feedstuffs (Inquisitive feeding habit); they even stand on hind limbs (bi-pedal stance) and eat vegetation (top – feed)
7. High digestive efficiency of grass and leaves (cellulose)
8. Can be profitably reared with low capital investment

9. Does not need elaborate housing
10. High reproductive efficiency (twins / triplets) of goats
11. Quick turnover of capital because they are early maturing which, in turn, results in short generation interval
12. Fits well into mixed farming systems

1.1.2. Milk

Sheep are generally not milked and most of the milk is left for sucking by the lambs. Goat milk is widely consumed by humans as well and is easily digestible. Goat milk is almost similar to cow's milk in its major constituents. Goat milk fat and milk are white in colour. In addition, goat milk fat imparts a peculiar odour (smell) to goat milk. Goat milk is easily digestible and hence, can replace cow's milk for persons allergic to cow's milk. Goat milk is also rich in minerals like sodium, iron, copper and vitamins like vit A. nicotinic acid and choline.

The composition of sheep and goat milk is tabulated below:

Table 1. Composition of sheep and goat milk (%)

Ingredient	Sheep	Goat
Water	81	87
Fat	7.90	4.25
Protein	5.23	3.52
Sugar (Lactose)	4.81	4.27
Minerals (Ash)	0.90	0.86

1.1.2.1. Why no cream layer is formed while boiling goat milk?

The average milk fat (globule) size is small and therefore, fat does not tend to rise to the top on keeping and it is difficult to separate fat for making cream, butter or ghee

1.1.2.2. Why goat milk fat and milk are white in colour?

This is because most of the carotene is already in the form of Vitamin A in goat milk unlike cow's milk.

1.1.3. Meat

Goat meat is referred to as "Chevon" and is the costliest meat in India. Meat from sheep is referred to as "Mutton" and it is also costlier than chicken or beef (meat from cattle).

The differences between Chevon and Mutton (sheep meat) are tabulated:

Table 2. Chevon *Vs* Mutton

Characteristic	Chevon	Mutton
Overall fat content	Less (lean)	More
Subcutaneous fat	Less	More
Fat around kidneys and intestines (omentum, mesentery)	More	Less
Fat covering on meat	Less	More
Texture (from animals aged 2 to 6 years)	Tougher	Less tougher
Flavour	Very less (bland)	Has typical flavor
Odour	Strong especially in males (buck)	Less odor than Chevon
Yield (dressing %)	38%	49 to 54%

Note: Transportation of goats / sheep to slaughter house generally results in the loss of 7-12 % of the body weight. This is found to adversely affect the quality and quantity of meat

The general composition of mutton and chevon is as follows:

Table 3. Composition of Mutton and Chevon (per 100 g)

Ingredient	Mutton	Chevon
Water, g	70.6	74.2
Protein, g	20.2	21.4
Fat, g	8.3	3.6
Energy, kcal/kg	156	110

Ref: Chan et. al., 1995)

1.1.4.Wool

Wool is the natural fibre obtained from sheep. Temperate breeds of sheep (e.g. Merino) generally produce fine wool, whereas tropical breeds of sheep (e.g. Chokla) have coarse wool and some tropical breeds of sheep (e.g. Nellore) have hairs (instead of wool). True wool is non-medulated (hollow) in nature. Wool is more soft and fine when compared to hair. The removal of wool from sheep is technically called "shearing".

Chemically, wool contains Carbon (50 %), Oxygen (22 – 25 %), Nitrogen (16-17 %), Hydrogen (7 %) and Sulphur (3-4 %). The main protein is keratin.

1.1.5. Goat Fibre

There are three different types of goat fibers namely, Common goat hair, Mohair and Pashmina.

1.1.5.1. Common goat hair

Common goat hair consists of fibers that are usually multi-fibered, straight, non-elastic, very coarse and medulated. In many countries, goats are clipped and the hair is used for making ropes. Goat hair is also used for the manufacture of coarse blankets and carpets.

1.1.5.2. Mohair

Mohair is the fine, lustrous hair fiber obtained from Angora breed of goats. This is a textile fiber of exceptional beauty and quality. This differs from

wool in not having the outside layer (cuticular) development. Therefore, clothing made from mohair will have a harder finish and can be dyed to any color with ease. Good quality mohair is soft, fine, bright, wavy, twisted with ringlets throughout its length and should be entirely white. Removal of hair by use of "shearer" is called "Shearing".

Angora goats are shorn once or twice in a year. Some goats shed mohair during the spring season. Some goats are not shorn normally and the fibers are left to grow for about 2 – 3 years. This allows mohair to grow to a length of 30 to 60 cm (1 to 2 feet). This special mohair fetches a very high price.

The finest quality of mohair is obtained from young goats and kids. This is very costly and is mostly used for fashion fabrics. Older goats produce coarse mohair that is generally used for mixing with wool of sheep.

1.1.5.3. Pashmina

Pashmina is the fine undercoat obtained from certain breeds of goats from Central Asia. This is considered to be the finest natural fiber with very high softness and warmth. The fibers are obtained by combing the under coat and also by hand picking. Average yield is about 100 – 120 g/goat /year. Because of its very low yield, it is very costly. Pashmina is used for manufacturing expensive shawls and suiting. These are also blended with wool and other fibers for making a variety of textiles.

1.1.6. Slaughter house by - products

In the process of slaughter of sheep and goats, the following by – products are obtained: Tallow (fat), Intestine, Bone, Blood, Hoof, Horn and Skin. Use(s) of each of these is tabulated below:

Table 4. Slaughter house by – products

By product	Use(s)
Tallow	Manufacture of soap. In animal feeds as a source of energy
Intestine	Manufacture of casings for the preparation of sausages.

Bones	As bone meal and bone grit. Crushed bone is also used for the manufacture of bone glue and gelatin. Collagen from bones is used as a protective coating and binding material. Soluble collagen has the property of absorbing and holding water/moisture. Therefore, it is used extensively for the preparation of cosmetics
Blood	Extraction of hemoglobin which is used in tonics (haematinics)
Skin	Very valuable by – product in leather industry
Other byproducts	Glue and gelatin from horn and hooves, handicrafts from horns, horn and hoof meal (subjecting horn and hoof to very high steam pressure)

What are the major differences between sheep and goat?

Table 5. Differences between sheep and goats

Feature	Sheep	Goats
Body structure	Stocky	Thin and slender
Horns	Stocky, spirally twisted	Thin and slender
Beard and tassels	Generally absent	Generally present
Odor in males	Absent	Present
Scent glands	Present in face and feet*	Absent

* Hence, sheep move in flocks

Dental formula and eruption of teeth

1.1. Dental formula

Sheep Permanent: 2 (I 0/4, C0/0, PM 3/3, M 3/3) = 32

Goat Permanent: 2 (I 0/4, C0/0, PM 3/3, M

3/3) = 32

Eruption of teeth in sheep and goats:

Table 6. Eruption of teeth in sheep and goats (age in months)

Teeth	Sheep	Goats
Central incisor	14	14-20
Centro-lateral incisor	24	21-25
Lateral incisor	36	26-30
Corner incisor	48-60	30-40

9

Flock Selection

1. How to start a sheep / goat farm?

Starting a sheep / goat farm requires breeding males and females so that they produce lambs / kids at regular intervals which, in turn, can be reared and marketed at a desirable age / weight.

1.1. Characteristics in a good breeding stock

1. Availability and adaptability to the local conditions
2. Prolificacy (ability of the females to produce more number of viable young ones)
3. Mothering ability of the females
4. Rapid growth rate of the young ones
5. Docile temperament
6. Optimum feed conversion ability of the lambs / kids
7. Disease resistance
8. Heat tolerance ability

2. Factors affecting health of sheep and goats

1. Faulty management practices
2. Poor housing facility
3. Overcrowding

4. Mixing of different species / age groups
5. Improper ventilation
6. Improper flooring
7. Improper drainage facility
8. Unhygienic conditions inside and outside the animal house
9. Qualitative or quantitative deficiency in feed
10. Excessive feeding or under feeding
11. Contaminated or polluted drinking water
12. Contaminated feed
13. Toxins through feed / improperly stored feed / mouldy feed
14. Extreme climatic conditions
15. Lack of proper exercise
16. Pollution of grazing land – pesticide pollution
17. Chemical pollution
18. Inhibition of normal behavioral pattern

3. What are the signs of normal health?

1. Normal behavior / habits, stance/posture and sound
2. Eyes bright with pink mucous membrane without any abnormal discharges
3. Ears should be mobile without any discharges
4. Muzzle should be smooth and shiny
5. Absence of abnormal nasal discharge
6. Should take normal quantity of feed and water
7. Should ruminate while at rest
8. Urine should be of light straw color and without any abnormal odor and should be clear (not cloudy)

9. Dung should be of normal color and consistency and of normal quantity
10. Milk should be of normal color and consistency and of normal quantity
11. Skin / coat should be smooth and shiny without any injuries or parasites
12. Normal physiological values of pulse, respiration rate and temperature are as follows:

Table 2. Normal physiological values in sheep and goats

	Sheep	Goat
Respiratory rate, per minute	12 – 30	12-15
Pulse rate, per minute	70-80	70-80
Rectal temperature (°C/°F)	39.4 – 40.0 (103 – 104)	38.7 – 40.3 (101.6 – 104.6)

4. What are the signs that the animal is sick?

1. Animal standing with the head down with dull appearance; sunken eyes, lacrimation
2. Tendency to get separated from the group
3. Loss of appetite and consequently, absence of rumination
4. Coarse skin, loss of hairs
5. Nasal discharge
6. Dark or pale or yellowish mucous membrane
7. Excessive salivation
8. Changes in the color and consistency of dung and urine
9. Reduction in quantity and changes in the quality of milk

10. Abnormal discharge from the genitalia

5. After selection, how to transport the animals?

Any means of transport should protect animals against heat, cold and shock.

5.1. General guidelines

Regardless of method of transport, the following are the general guidelines:

1. Animals should be kept separated from each other
2. Sick or injured animals and early or advanced pregnant animals should not be transported unless under technical supervision; generally, pregnant animals are not transported
3. Adequate space has to be provided to stand and lie down
4. Water and feed have to be provided at suitable intervals; under no circumstance, any animal must be deprived of feed and/or water for more than 24 hrs
5. The ropes used for tying the animals should be strong enough not to break and long enough to allow the animal to eat, drink and lie down; no animal should be tied by its horns
6. Animals should also be grouped according to their age if such age difference does exist in the selected animals except female animals traveling with sucking young ones
7. The compartment should be exclusive for transport of animals only and it should have suitable ramps for loading and unloading
8. Animals shall not be lifted by the head, horns or legs during loading or unloading
9. The floor of the transport vehicle should be sufficiently strong to bear the weight of the animals and is covered with adequate amount of bedding / litter; sand is a good bedding material
10. At least one attendant should accompany the animals with a first aid kit

11. If animal(s) become sick during transport, they must be attended by a qualified veterinarian as soon as possible
12. Dung should be removed as soon as possible
13. Transport should be by the shortest possible route with extreme care while taking sharp turns: the speed of the vehicle should cause least disturbance to the animals both while in motion as well as when the vehicle may have to be stopped abruptly
14. If the journey needs of more than three days, the animals should be unloaded and given exercise

5.2. Transport by walk

If the animals are purchased at a nearby locality, they can as well be walked to the proposed farm. This is the most economical means of transporting animals. Care has to be taken to walk the animals during cooler parts of the day on soft ground (not regular roads) and allow them to drink water at least after 15 - 20 km. However, animals do loose body weight which can be minimized by providing proper feed and water at regular intervals.

In any case, this mode is neither easy for animals nor for the owners; hence, is not in much practice.

5.3. Transport by truck

This is by far the most popular mode of transport mainly because the animals can be transported from the point of selection to the proposed farm directly.

5.4. Transport by rail

This mode of transport is resorted to when long distance is involved.

1. A thick layer (10-15 cm) of sand is put as bedding. This helps to avoid slipping, soaks urine and makes lying down comfortable
2. Watering should be done every 12 hours
3. Adequate feed should be provided at appropriate intervals

6. How to care animals on arrival?

The farmer might have purchased pregnant animals or animals in early lactation with young ones. Special precautions are required for each of these categories.

6.1. If animal(s) is (are) sick, what to do?

1. Identify and isolate the sick animal in a separate shed
2. Follow strict sanitary conditions
3. Provide fresh, clean drinking water
4. Provide well balanced, easily digestible and palatable feed in divided doses
5. Provide adequate bedding material
6. Avoid exposure to extreme weather conditions
7. Attendants looking after sick animals should never be allowed to handle healthy animals
8. In case of emergency, prompt first aid measures should be followed
   (a). In case of hemorrhage, apply tourniquet and apply ice packs to stop bleeding
   (b). Assist in respiration in case of difficulty in breathing
9. Get Veterinary help as quick as possible

10

Growing Lambs and Kids

1. How to manage the newborn?

Proper care should be taken to avoid any infection: Immediately after birth, clean the nostrils and see whether the new born is breathing. If there is any difficulty in breathing, give artificial respiration.

1.1. How to give artificial respiration?

Clear the mucous from the respiratory tract. Artificial respiration can be given by alternatively pressing and releasing the chest region

If there is no result, then insert a small twig of straw or dried grass in to the nostrils. This will initiate sneezing and will result in clearing the tract.

If this also fails, hold the new born animal by the hock and swing it to and fro (upside down) so that the mucous flows out.

If this does not work, then mouth – to – mouth respiration should be resorted to by closing the nostrils and blowing in expired air into the mouth of the new born.

1.2. Attending to the navel

Tie a knot around the navel cord about 2 to 3 cm from the body by using a sterile thread. Cut the navel cord 1 cm below the knot (towards the lamb / kid). Apply antiseptic solution (like Betadine) to the cut end of the cord. Attending to the navel cord of the new born lamb / kid is very important as infection gaining entry through the navel can cause serious conditions (like navel ill).

Notes:

1. The stalk hanging at the navel of the newborn dries and falls off by itself within two days
2. Dry the new born by scrubbing with a dry cloth
3. Allow the dam to lick the new born
4. If there is any difficulty in standing, assist the new born to stand
5. Allow the new born to suck colostrum at the earliest (i.e. within half an hour). This is very important.

2. General considerations in the feeding of lambs / kids

Lambs / kids can't digest grass at birth. Hence, they require high quality proteins and Vitamins A, D and B complex as dietary essentials. In any case, lambs / kids should be fed colostrum within half an hour after birth. Colostrum should be fed for at least 3-5 days.

After the colostrum feeding period, lambs / kids may be given whole milk @ $1/6^{th}$ of the body weight for the first 30 days. The total quantity should be distributed equally over 4 feedings.

From the second week onwards, an easily digestible concentrate mixture with high nutritive value (starter) could be given. The starter should be of good quality (at least 70% digestible) with at least 20 % of protein. Simultaneously, good quality, tender green grass can be offered to the lambs / kids after the second week to nibble.

After the first month, the quantity of milk can be reduced to $1/8^{th}$ of the body weight for the next 30 days and to $1/10^{th}$ – $1/15^{th}$ of the body weight in the third month. Milk feeding can be completely stopped at the end of 3 months.

If kept along with their dam, lambs / kids should be allowed restricted sucking 2-3 times a day. In the event of the death of the dam, colostrum of another doe that has lambed / kidded more or less at the same time could be used for feeding or the doe could be used as a foster mother; otherwise, goat milk or diluted cow milk fortified with Vitamin A (10,000 I.U) could be provided

2.1. What is colostrum and why its feeding is important?

Colostrum is the secretion produced by the udder immediately after lambing / kidding (up to 5 days). It contains a large amount nutrients (proteins, vitamins and minerals) and disease – resisting factors in an easily absorbable form. Hence, it protects the lamb / kid against many infections during early life without any vaccination.

Soon after birth, the intestine of the young one will be able to absorb nutrients and disease – resisting factors far better; after about 5 to 7 days of age, the capacity to absorb such factors reduces significantly. If those factors are not absorbed, they serve no purpose of disease – resistance, but act as any other protein source.

2.1.1. How does the colostrum differ from milk?

Colostrum, being the first milk after lambing / kidding is rich in proteins (mainly globulins which offer disease resistance to newborn kid) and minerals.

Notes:

1. Giving vaccinations to sheep / goats during the dry period helps to increase the quantity and quality of γ-globulins in colostrum
2. Colostrum of mature sheep / goats will be of higher quality than that produced by young goats. Older goats have a greater chance to be exposed to many infections, that too repeatedly. This in turn, stimulates them to produce greater quantities of antibodies (γ -globulins) effective against larger number of diseases
3. Colostrum can be collected under hygienic conditions and stored under freezing conditions (refrigerator chest) for later use (long time storage, even up to one year without decline in quality)
4. Frozen colostrum should be placed in warm water for thawing
5. Colostrum can be refrigerated for only about one week without decline in quality
6. Excess colostrum, if any, should be removed from the udder. This can be milked out and mixed with normal milk and fed to other lambs /

kids. It can also be stored under refrigeration conditions

3. Weaning

Weaning is the practice of removing the lamb / kid from the dam (mother). Most lambs / kids are weaned from their dams either immediately after birth or 3-5 days after birth.

After weaning, the lamb / kid should be housed in a clean, dry, well – ventilated pen and trained to drink milk immediately.

3.1. Why should a lamb / kid be weaned from its dam?

Many do feel that it is not proper to separate lamb / kid from its dam and some do attach religious sentiments too. But, scientific knowledge on this issue indicates the following advantages of weaning:

1. Adequate measured quantity of milk can be given to the lamb / kid, thus preventing under – feeding and over – feeding
2. Helps prevent injury to the teat of the dam
3. Helps control mastitis

3.1.1. Training a lamb / kid to drink milk

Training a lamb / kid to drink milk from a bucket is simple. First, wait for the lamb / kid to be hungry. That is, wait for at least 8 – 12 hours after the lamb / kid has been removed from its mother (dam). It is more difficult to get the lamb / kid to drink from an open top bucket. In such cases, a finger should be put into the mouth of the lamb / kid. When the lamb / kid starts sucking, lower its head into the milk while the lamb / kid is still sucking. This procedure must be repeated for 2-3 feedings

Precautions

1. Take care to use no excessive force in pushing the kid's head into the milk
2. Be gentle with the animal
3. Use one bottle / bucket for one lamb / kid

3.1.2. Training a lamb / kid to take feed

Starter is the first dry concentrate mixture fed to lambs / kids. Lambs / kids can be taught to eat the starter by the following methods:

1. Rub a small quantity of the concentrate on the tongue and lips of the kid /lamb. This will induce them to eat more
2. When the kids / lambs complete drinking milk from the pail, put some starter at the bottom of the pail. The animal will start licking it. Gradually, the quantity can be increased

Note: Starter should be highly palatable.

Example of a starter feed:

1. Maize - 35 parts
   GNC - 32 parts
   Gram - 10 parts
   Wheat bran - 20 parts
   Min Mix - 3 parts
   Vit A,B2, D3 - 25 g per 100 kg of feed
2. Maize - 45 parts
   Rice polish - 20 parts
   Wheat bran - 15 parts
   Dried skim milk - 8 parts
   Ground nut cake - 10 parts
   Mineral mix. - 2 parts
   Vit A, B2, D3 - 25 g / 100 kg of feed

4. Dehorning or Disbudding

Removal of the horn is called "Dehorning", whereas, suppressing the growth of horn at an early age when the horn is in the form of a bud or button is called "Disbudding". Disbudding should be carried out at an early age (i.e.

within 3 to 10 days of birth). Disbudding is a common practice.

4.1. How to perform disbudding?

The hair around the horn bud is clipped and Vaseline applied. Caustic stick is dipped in water and then rubbed with a rotary motion on the horn bud to deactivate its growth. Scab formation occurs over the horn bud within a few days and drops off in about a fortnight.

Note: This can also be done by means of a red hot iron or an electric dehorner. The use of an electric dehorner is ideal.

5. Identification

This is essential for proper management especially under farm conditions and a compulsory requirement for insurance. Even though farmers put a neck chain with a number and/or paint the horns as a mark of identification, these are not permanent and do not last long. The best method of permanent identification is by tattooing the inside of the ear with ink. Metal or polyurethane ear tags could also be used as a means of identification. Self-piercing or non-piercing tags are available in the market. The help of a Veterinarian could be sought for this.

11

Feeding Sheep and Goats

1. General aspects of feeding sheep and goats

Under semi-intensive system of rearing, supplementary feeding of concentrates and harvested grass become necessary. About two-thirds of the energy requirements of mature sheep / goats should be met through roughages. Half of the roughages could be of the leguminous type and the rest green grass. Instead of grass, tender tree leaves (jack, erythrina etc.) can also be provided.

Under intensive system of rearing (confinement rearing), all the required roughage and concentrate should be provided to meet the nutritive requirements. The amount of roughage and concentrate to be fed depends up on the body weight, age, physiological condition (like growth, pregnancy or lactation).

A mature goat will consume about 5 kg of green fodder daily. Goats have greater capacity for feed (dry matter) intake per kg body weight than cattle and buffaloes. Dairy goats in the temperate (cold) regions are found to consume dry matter to the tune of 5 – 6 % of their live body weight compared to 4 – 5 % of the body weight by tropical (hot region) goats. Meat type goats of the tropics consume less dry matter (2.5 – 3 % of their body weight).

Almost all the dry matter requirement of adult, dry (non-producing) goats and sheep can be met by feeding forages. When forage supply is limited, some concentrate mixture has to be supplemented. Concentrate mixture that is used for feeding cattle can be fed to sheep/goats. Pellet concentrate mixture is better than dry mash (because it helps to reduce respiratory problems due to dust). Depending up on the quality and quantity of fodder available, the concentrate allowance for different categories of goats can be reduced. Additional

allowance of concentrate feed is to be fed to advanced pregnant sheep/goats (during the last two months of gestation).

2. Feeding behavior

2.1. Sheep

Sheep have cleft upper lip which, helps in close grazing. The lips, the lower incisors and the dental pad in the upper jaw are the main structures employed for grazing. Tongue does not protrude out while grazing in sheep (as in the case of cattle and buffaloes).

Large groups of sheep split into small sub-groups at the time of grazing. After about two hours of grazing, they stop eating, lie down and start chewing (ruminating). Sheep ruminate around eight times at regular intervals throughout the day and night. The total rumination time, in general, comes to approximately 8 hours.

Sheep are found to select forage higher in protein and lower in fibre and are able to reject certain forages because of their structure / physical characteristics. Sheep generally reject forage that is contaminated with urine and dung.

Sheep generally prefer to eat short grass by taking smaller bites and would even starve if left on a pasture with very long grass. Sheep bite the grass / plant and it is broken between the teeth (lower incisors) and the dental pad while jerking the head forwards and backwards. This is different from that of cattle (which use their tongue to collect the vegetation into the mouth before biting).

Sheep do not drink water daily, if they are grazing on lush green pasture. The average daily water intake of sheep managed indoors under semiintensive condition of the tropics is 4 to 5 litres.

Salt should be available for sheep (the requirement of salt is approximately 7 g per day)

2.2. Goats

The ability of goats to feed on a wide variety of herbage (grass, weeds, shrubs, tree leaves, barks of trees etc.) has resulted in their widespread

distribution all over the world. Goats relish variety and therefore, do not thrive well when maintained on a single type of feed.

Goat fed with cut tree leaves under village conditions

Goats have special feeding habits. Goats have a competitive advantage over other farm animals because they can graze standing on their hind – limbs (bipedal stance). By this specialized behavioral pattern, they can browse up on leaves and branches that are high up.

Goats prefer browsing rather than grazing or nibbling. Drier and coarser grass that is usually rejected by sheep is well utilized by goats.

Goats can digest fibre better than cattle and sheep (goats are 4.4 % superior to sheep, 7.9 % superior to buffaloes and 8.6 % superior to cattle in crude fiber digestibility).

It is found that goats are able to distinguish salt, sweet, sour and bitter tastes; goats have a higher threshold for bitter taste. This ability enables goats to choose from a wider range of plant species than sheep or cattle. Goats generally browse on shrubs that are normally bitter. Goats, like sheep, generally refuse any forage that is contaminated with urine or dung.

Time spent browsing by goats depends up on the quantity and quality of feed available; normally 8 hours are spent in eating, which may extend up to 12 hours during the dry season.

12

Breeding Management

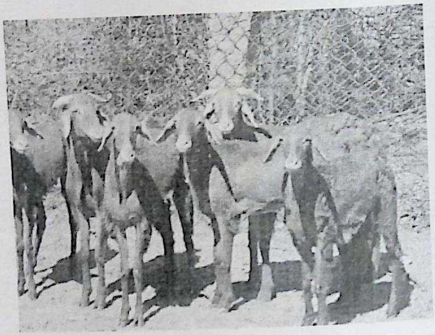
Sheep come to heat (ready for mating) at specific season and each time they show many estrus periods (referred to as seasonally poly-oestrous. This onset of breeding season is triggered by decreasing intensity of light (or shorter days) especially in temperate breeds of sheep. Some exotic (foreign) breeds of sheep are exceptions to this feature (Eg. Rambouillet and Dorset) and are considered as out-of-season breeders. In the case of tropical breeds, as there is not much variation in the day length, sheep can come into oestrus during any time of the year. Still, lambing is found to be seasonal in the tropics. One reason is that, this is influenced by the type of feeding management. Another probable reason could be that the rams may be less fertile during some seasons (summer) than others. Therefore, in the tropics, it should be possible to produce three lamb crops in two years.

Sheep of the temperate breeds attain sexual maturity by 8 – 10 months of age and those of the tropical breeds attain maturity at a later stage. The major reason for this might be the poor level of feeing and management of these animals in the tropics. It may also be due to the direct effect of the climatic environment.

It is found that high ambient temperature has a major effect on the reproductive behavior of ewes and rams. In ewes, high ambient temperature reduces the number of ovulations during a breeding season, decreases the development of embryos, increases embryonic mortality and decreases the birth weight of surviving fetus and survivability of lambs. Embryonic loss was more profound during the time of breeding and one day later.

The average duration of estrus in tropical sheep is similar to those of the

temperate (cold climate) breeds (18 – 24 hours), with ovulation taking place towards the end of heat (i.e., shortly before the end of heat). The length of estrus cycle varies from 14-19 days.



A flock of Nellore sheep; rams are with horns

1. Selection of rams for breeding

1. The ram should show masculine features
2. Should be very active and vigorous in nature
3. The ram should be free from excessive skin wrinkling
4. Rams with excessive skin folding are found to be more susceptible to heat stress and less fertile
5. Should have a rectangular body with straight belly and back
6. Should possess two testes of appropriate size
7. Should not have any genetic problems

2. Selection of ewes for breeding

1. The ewe should show feminine features
2. Should confirm to breed standards
3. Should be free from excessive skin wrinkling

4. Ewes with excessive skin folding are found to be more susceptible to heat stress and less fertile
5. Should have good health and active in nature
6. Should have a smooth, soft and pliable udder
7. Should be docile and have good mothering ability
8. Should not have any infectious disease or genetic problems

3. Preparations before breeding

Adequate preparation is required before the breeding season for effective breeding to take place.

1. Two weeks before the probable start of the breeding season, all the mature ewes in the flock have to be provided with a "flushing ration". Flushing means improving the plane of nutrition of the ewes just before the breeding season so that it helps in the shedding of more ova and increases the probability of multiple births
2. Examine the feet of all the ewes and rams. Trim them if over grown
3. Deworm all ewes and rams with a suitable anthelmintic (See Chapter Health Management)
4. In the case of wool sheep, remove the wool from the perineal regior. (around the base of the tail and the vulval opening; between hind limbs)
5. Shear the ram completely
6. Usually flock mating is practiced. Allow the rams to the ewe flock. It will be a better practice to allow the ram into the ewe flock during the night hours, when it would be comparatively cooler
7. Rams may be put for active breeding only after they attain 18 months of age (even though they are capable of breeding from 9 – 10 months of age)
8. One ram could be placed with 25 – 50 ewes (average 30) for a period of 30 – 35 days
9. Remove rams from breeding ewe flock after two estrus cycles (30 –

35 days). This would help to insure that late-cycling ewes are also bred

10. At the end of the breeding season, ewes can be put on a maintenance ration until 4-6 weeks prior to the expected date of lambing
11. During the last 4 – 6 weeks of gestation, ewes may be provided with a high plane of nutrition. This would help to supply additional energy to the rapidly growing foetus and also help to prevent some metabolic diseases in the dam (Eg. Ketosis and lambing paralysis)
12. Pregnant ewes should get enough exercise

(Note: Use of grass or non-legume pasture during the breeding season is found to be better because some leguminous plants contain plant estrogens that would interfere with fertilization and cause embryonic mortality)

4. Selection of breeding goats

Selection of good breeding stock (both females and males) is very important as they form the basis / foundation of the whole farming enterprise.

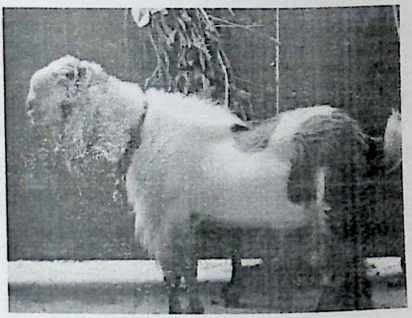
A pair of Black Bengal goats with good features

4.1. Selection of breeding males (bucks)

The following aspects are considered while selecting bucks:

1. The animal should have masculine characteristics
2. Should have a wide chest with large chest girth
3. Straight fore and hind limbs with strong feet

4. Legs should be wide apart and squarely set
5. Should not show any evidence of lameness
6. Back should be strong and straight
7. Bright and wide eyes
8. Should possess two testes of appropriate size
9. Should possess two rudimentary teats of uniform size
10. Should be preferably from twin or triplet births (multiple births)
11. Should confirm to breed standards
12. Should be free from genetic defects like cryptorchidism (testis not found in scrotum), inguinal hernia (intestines being felt in scrotum) etc.
13. Should be free from infectious diseases



A very good buck of Jamnapari breed

4.2. Selection of breeding females (Does)

1. The animal should have feminine characteristics
2. Should have a wide chest
3. Straight fore and hind limbs and strong feet
4. Loose, pliable, soft skin and coat

5. Alert and bright eyes with an questioning (inquisitive) look
6. Broad muzzle (portion containing nostrils) with large open nostrils
7. Udder should be carried forwards
8. Straight top line
9. Should be preferably from twins or triplets (multiple births)
10. Should confirm to breed standards
11. Should be free from genetic defects like inguinal hernia (intestines being felt between hind – limbs)
12. Should be free from infectious diseases

5. Management of breeding goats

5.1. Bucks

Breeding bucks should be housed individually in a buck pen. They must be provided adequate exercise, feed (balanced diet), water and health care. The buck should be kept trim and healthy. The animal should be in good body condition before the start of the breeding season. The animal should be subjected to physical examination and should be screened for infectious diseases at least 6 to 8 weeks before the breeding season.

Proper foot care and hygiene (painful conditions of the feet and joints would interfere with proper mounting). Over grown feet should be trimmed.

Optimum utilization for breeding should be ensured. Never allow bucks to run with does because it can lead to reduction in potency.

Adequate protection from thermal (heat) stress so that males retain interest in mating (libido).

5.1.1. Effects of castration

When extra male kids are available, they can be grown for meat (Chevon); such males can be castrated (by Burdizzo castrator / Closed method). They must be castrated early because late castration (7 to 8 months) results in less dressing percentage.

Early castration of bucks results in carcasses with a higher dressing

percentage than that of entire males. It has been found that as the body weight increases, the rate of bone growth decreases and the rate of lean (low fat) tissue growth remains the same. Castration of males at an early age increases the fat composition of the carcass. With respect to lean meat the fore – limb and the shoulder are found to have the highest lean meat. It is observed that goats deposit lower sub – cutaneous fat (below the skin) and inter – muscular fat (between muscles) than sheep.

6. Signs of estrus in sheep and goats

1. Swelling and reddening of the external genitalia
2. Clear mucous discharge from the external genitalia (this is not as pronounced as that in the case of cattle)
3. Flagging of the tail
4. Bleating continuously
5. Nervousness
6. Frequent urination
7. Irregular appetite (dislikes feed)

(**Note:** the behavioral signs of oestrus are very much less pronounced i sheep than in goats. Therefore, it is very difficult to detect ewes in oestrus i all female flock without the help of a teaser ram. Teaser ram is a ram that has been vasectomised and used for detecting females in oestrus). Likewise a teaser buck can also be used in a band of does for detecting animals in oestrus accurately).

7. Signs of pregnancy in sheep and goats

1. Tendency to accumulate fat
2. More docile nature
3. Enlargement of the abdomen
4. Movements becoming slow
5. Segregating from other animals
6. Enlargement of udder / teats

7. Hollowness of the flank region
8. Preferring to rest most of the time
9. Frequent lying down

8. How to care pregnant animals?

1. During early pregnancy, animals should not be walked or allowed to run long distances
2. Avoid fighting with other animals
3. Isolate them from other animals, especially sick and aborted ones, if any
4. Floor of the house should be non-slippery
5. They should not be exposed to extreme cold and hot climate
6. Provide adequate amount of clean, fresh drinking water
7. Provide easily digestible, well balanced feed
8. Give sufficient clean bedding material
9. Management of young ones at birth

Giving birth to young one in goat and sheep is termed kidding and lambing respectively.

The following are the precautions during kidding / lambing:

1. Do not disturb the animal during normal delivery
2. Assistance is required only when there is any difficulty
3. Watch the animal from a distance
4. Wash the udder, teats and region between hind limbs with antiseptic solution
5. Watch for the expulsion of the kid / lamb and the placenta
6. Provide palatable laxative feed to the dam for the first few days and later change to normal feed.

13

Health Management

Health is defined as the state or condition of the animal in harmony with the environment; in simple terms, absence of disease. Disease is the condition in which the animal shows physiological, anatomical or biochemical changes from the normal which in simple terms the animal is not at ease.

Various factors affect health of all animals and some of the important factors that affect health of sheep and goats are:

1. Extreme climatic conditions without suitable remedial measures
2. Faulty housing facility: this includes overcrowding, slippery , improper flooring, mixing of age groups and improper drainage
3. Faulty health management: improper sanitation and disinfection, and improper vaccination schedule
4. Faulty feeding: suitable quantity of ration of recommended composition not provided leading to nutritional deficiency(ies), contaminants and/ or toxicants in feed and rarely excess feeding
5. Lack of proper exercise and inhibition of normal behavioral pattern

1. What are the general signs of health in sheep / goats?

The general signs of health in sheep and goats have been elaborated in the Chapter "Flock Selection":

2. What are the general signs of a sick animal?

The general signs of a sick animal have been elaborated in the Chapter "Flock Selection":

2.1. How to care a sick animal?

Elaborated in Chapter "Flock Selection"

3. Major health problems of sheep / goats

Diseases (including parasitic problems) are responsible for major losses in sheep / goat enterprise. In majority of the farms, the profit or loss from the enterprise is determined largely based on how well the diseases and parasitic problems are controlled. The use of disease free animals (breeding stock), preventive vaccinations and deworming program, clean and disinfected sties, clean surroundings and a good balanced ration can do a lot in preventing losses due to diseases.

3.1. Parasitic problems

Sheep and goats harbour a variety of internal parasites like round worms (ascarids), hook worms (strongylids), thread worm (strongyloids), lung worm, kidney worm, tape worm etc. There is also a very good chance of infecting the fodder field by these, when dung is used as a manure to fertilize the field.

3.1.1. Transmission

The ingestion of infective stage of the parasite is the common method of transmission of most of the internal parasites. However, hook worms are capable of penetrating the skin of animals. Rarely, newborn animals may be born infected or get infected soon after birth through colostrum.

3.1.2. Symptoms

Symptoms of parasitism vary considerably with respect to the species / type and the number of worms (worm load). In heavier infections, there will be progressive loss of condition, lack of appetite, weakness; finally, the animal becomes skin – bound (emaciated). Those which inhabit cause anemia.

3.1.3. Prevention and control

Proper disposal of dung and other wastes from the farm (See Chapter –

Waste Management)

Adequate feeding of animals on a balanced feed help them tolerate the effects of worm problems. Over crowding, especially of young stock, must be avoided. Similarly, mixing / group housing of different age groups is also strictly not allowed. Pen must be kept well ventilated, warm and dry.

It is a customary practice to deworm all the animals; it is always better to use appropriate anthelmintic drugs in case the animal is found to be infected by a specific parasite. This can be confirmed by faecal examination.

3.2. Nutritional deficiencies

When one or many essential nutrient requirements such as dietary energy, crude protein and mineral and vitamin levels is (are) inadequate, animals become weak and unthrifty. They will ultimately have poor growth and reproductive performance resulting in severe economic losses.

3.2.1. Mineral deficiency

Major deficiencies occur with calcium and iron. Calcium deficiency results in rickets. Here, the animal will have weak forelimbs that cross ove each other and extremely low growth rate.

3.2.2. Vitamin deficiency

Deficiency of Vitamin A is often observed in those animals that are not offered green forages. Affected animals invariably abort. Deficiency of Vitamin D also occurs and this leads to rickets. Deficiency of Vitamin B complex vitamins results in low growth rate and unthrifty condition.

4. Disease control measures

As a golden rule: "Prevention is better than cure"; it is always better to take all steps to control infection than treating one. The basic steps required to control infection are:

1. Resting: Leaving the pens free / empty for around 15 days when all the animals in those pens have been taken to market or slaughter. It is better to wash and disinfect these pens during this period
2. Prohibiting the movement of people from infected animal quarters:

This would result in carrying the infective agent from the infected animals to healthy animals

3. General hygiene: Cleaning the pens, periodic removal of dung, cleaning the manger, water trough etc. will result in reduction in the incidence of infections. These activities act as preventive measures.

4. Disinfection: before disinfection, wash and remove all visible organic matter from the floor and walls. Use the appropriate disinfectant (See Chapter Sanitation and Disinfection).

5. Proper stocking density: There is a tendency to house a large number of animals in a single pen for reasons of economy. This will result in the pen becoming very dirty with dung and urine spread over the floor. Such an environment is ideal for the multiplication of different microbial organisms (pathogenic and non-pathogenic). The situation is more serious in pens with less of ventilation. High ambient temperature aggravates this problem. There is a general saying that "if animal numbers are doubled, infections are tripled". Even though this is not scientific, this should be given due consideration while deciding stocking density

6. A vaccination program in consultation with a Veterinarian

7. Restrict the use of moldy feed. Always, a balanced ration according to the age and requirements should be offered to avoid nutritional deficiency(ies)

8. Culling of weak animals: It is a better practice to cull all the weak animals in the flock. Weak animals have poor growth rate and limited resistance to diseases and hence, are more susceptible to infections than others

9. Control of ticks and other vectors

In spite of all care, if any infection actually occurs, the following steps are equally important:

1. Quarantine: keeping all the animals that are brought into the farm from outside in isolation, away from the farm stock for at least a month. This will help to identify whether the newly brought animals are having any infections and if so, they could be removed from the stock

2. Isolation of infected animals: Once, it is found that a particular animal is showing disease symptoms, it is better to isolate it from the farm stock and house it in the sick animal shed. This would help to contain the infection i.e., not allowing the infection to spread to other healthy animals in the farm

3. Correct diagnosis and prompt treatment of diseased animals: Investigation should be done to diagnose the condition of sick animals and prompt treatment should be adopted. A veterinarian's help is essential in this aspect

4. Proper disposal of dead animals: The best method of disposal in the case of large sized animals is burial and incineration for young animals.

14

Economics of Goat Production

Livestock farming is primarily for livelihood of the farmer and hence, it should be profitable enough for his sustenance. The returns also should encourage him to continue in the business.

For a small – scale goat farm, a band / flock with 30 female animals (does) and 2 males (bucks) appears to be optimum. However, it is very difficult to designate a goat farm as small-scale or otherwise because of lack of specific standards. Hence, the forthcoming section will enumerate the method of working out economic returns from a goat farm with 30 does + 2 bucks.

1. Technical assumptions

It is essential to have a clear cut foresight for finance, building, band / flock schedule, items of income and expenditure etc. of the goat farm to be established. The following tables give the details concerning the proposed unit:

1.1 Finance

The monetary requirements for construction of goat shed and purchase of animals will be obtained from a lending institution (Bank). Banks, in general, give 75% of the expenditure, the rest being the farmer's contribution. The loan needs to be repaid in three equal annual installments with an interest rate of 12% pa on the outstanding loan.

2. Economics of a 30 does + 2 bucks goat farm

2.1. Band/flock schedule

It is highly essential that the expected number of animals at any time are known to estimate costs and returns. It requires a schedule as per the purchase of animals at the beginning to facilitate calculation of recurring expenditure and income accurately.

In the current program, it is assumed that:

1. Does (12 – 18 months) and bucks (18 – 24 months) that are adapted to the agro-ecological conditions of the region will be purchased in one batch (30 does + 2 bucks) at the beginning of the project
2. The animals will be subjected to natural mating at the farm and the kids born will be sold as growers; males and females after 8 months. However, under exigency, female kids may be used to replace the original stock, as per the requirement
3. Management including housing, feeding, handling, disease control and sanitation etc. will be as per standards which have been outlined in earlier Chapters in this publication

2.2. Non-recurring expenditure

Table 1: Non-recurring expenditure

	Description	n	Allowance	Cost	Total, Rs
Building	Kids (up to 3 m)	88	0.4m²/animal	Rs m²	250/ 8800
	Growers	88	1 m²/animal	Rs m²	250/ 22,000
	Does	30	1 m²/animal	Rs m²	250/ 7,5,00
	Bucks	2	3.4 m²/animal	Rs m²	250/ 1,700

Equipment	2,000
Total	42,000

2.3. Calculation

Building requirement of kids = n x allowance x cost = 88 x 0.4 x 250 = Rs.8800/; the same way others are also calculated.

2.4. Recurring expenditure

This includes cost on purchase of animals, feed, vaccines, medicines, insurance etc. They are tabulated below:

Table 2: Recurring expenditure

Description	Animal purchase				Rs 2500/buck Rs 2000/doe
			Allowance, g /d		
Feeding	For goat	0-3 m	3-8 m	>8 m	
	Roughage*	-	1000	2500	Re 1/kg
	Concentrate	50	200	300	Rs 12/kg
	Vaccines, medicines etc.			50/animal/pa	
	Insurance				Rs 100/buck, Rs 80/doe

* Animals are let out for grazing and

also offered lopped tree leaves as and when available; therefore, 50% of the requirement is stall – fed

The following table illustrates the calculation of various recurring costs. Note that insurance is done only for the animals purchased for the project.

Table 3: Number of animals for calculation of Recurring expenditure and income

Description				Rate	Year I	11
Animal purchase				Rs2500/buck Rs 2000/doe	5000 60,000	nil
Feeding cost	Age	Feed	g/animal/d			
	0-3 m	Concentrate	50	Rs 12/kg	2376	47[illegible]
	3-8 m	Roughage	1000	Re 1/kg	3960	79[illegible]
		Concentrate	200	Rs 12/kg	9504	19[illegible]
	Does	Roughage	2500	Re 1/kg	27375	27[illegible]
		Concentrate	300	Rs 12/kg	39420	39[illegible]
	Bucks	Roughage	2500	Re 1/kg	1825	18[illegible]
		Concentrate	300	Rs 12/kg	2628	26[illegible]

Vaccines, medicines etc.			Rs 50/animal	1500	1500	15(
Insurance				Rs100/buck, Rs80/doe	2600	26(
				TOTAL	156188	10

Table 4: Recurring expenditure

Description				Rate	Year I	1
Animal purchase				Rs2500/buck Rs 2000/doe	5000 60,000	ni
Feeding	Age	Feed	g/animal/d			
cost	0-3 m	Concentrate	50	Rs 12/kg	2376	4
	3-8 m	Roughage	1000	Re 1/kg	3960	7
		Concentrate	200	Rs 12/kg	9504	1
	Does	Roughage	2500	Re 1/kg	27375	2
		Concentrate	300	Rs 12/kg	39420	3
	Bucks	Roughage	2500	Re 1/kg	1825	1
		Concentrate	300	Rs 12/kg	2628	2
Vaccines, medicines etc.					Rs 50/animal	1
Insurance				Rs100/buck, Rs80/doe	2600	2

TOTAL	156188	1(

2.5. Income

The sources of income, their quantity and value are shown below:

Table 5: Income

Description		Rate
Sale of animals	8 months old (buck)	Rs2200/animal
	8 months old (doe)	Rs2000/animal
Manure Production, kg/animal/d	Category	
	Grower Adult	FYM Rs 600/t
	Dung 3 5	
	FYM 1.5 3	

2.6. Other assumptions

The following are assumptions needed for computing profits and cashflow:

1. Shed for housing growers, does and bucks
2. Labor: Self
3. Equal number of male and female kids at birth
4. Kidding interval : 8 months (three kiddings in two years)
5. Sale of animals: all male kids, after completion of 8 months of age; female kids (after retaining the required number for replacement under exigency) to be sold at 8 months of age
6. Mortality: 10%, to be applied on overall profits; under exigency for replacement, animals born at the farm will be used
7. Depreciation: Building – 2½% pa, Equipment – 5% pa

Table 6: Income from the enterprise

Items sold		I Year n	I Year Rs	II Year n	II Year Rs	III Year n	III Year Rs	Total (Rs)
Animals	Males	Nil	Nil	44	96800	44	96,800	193,6
	Females	Nil	Nil	44	88000	44	88,000	176,0
	Culled bucks	Nil	Nil	Nil	Nil	2	3,600	3,600
	Culled does	Nil	Nil	Nil	Nil	30	54,000	54,00
FYM	0-8 m, 1.5kg/animal/d	44	14,454	88	28,908	88	28,908	72,27
	Adults, 3 kg/animal/d	32	21,024	32	21,024	32	21,024	63,07
	TOTAL RECEIPTS		35478		234,732		292,332	5625

2.7. Movable assets on hand at the end of 3 years

The following are the movable assets at the end of 3 year period: Breeding bucks (2) and does (30) purchased at the beginning (Value about Rs 60,000).

3. Cash flow

As indicated earlier, Banks stipulate that credit should be returned in five equal annual installments along with interest for the loan outstanding. They also require a cash-flow showing year-wise expenditure-income statement along with gross and net profits. However, in the case of goats repayment is possible in three years by deferring repayment for the first year.

Net profit during first year is negative; this is obvious because no animals are available for sale. However, banks do allow deferred payment of loan installment and interest; the farmer can seek repayment of loan in 2 installments starting from the 2nd year with interest at 12%.

The calculations will be as follows:

Table 7: Cash – flow

Description	I year	II year	III year	Total
Non-recurring	42,000			42,000
Recurring	156,188	107,028	91,188	354,404
TOTAL EXPENDITURE	198,188	107,028	91,188	396,404
Income	35,478	234,732	292,332	562,542
Income from loan	150,000	-	-	150,000
TOTAL RECEIPTS	185478	234,732	292,332	712,542
Gross profit	-12,710	127,704	201,144	316,138
Loan installment	Deferred	75,000	75,000	150,000
Interest	Deferred	18,000	9,000	27,000
Depreciation, building	1,000	1,000	1,000	3,000
Depreciation, equipment	100	100	100	3,00
NET PROFIT	-13,810	33,604	116,044	135,838
CUMULATIVE NET PROFIT		19,794	135,838	

Notes:

1. Overall profit over 3 years is Rs 135,838 or Rs 45,279 (say

	45,280)/pa; in other words Rs3773/month
2.	Assets available will be of Rs 60,000
	Total profit + assets is Rs 195,838

SECTION–III
PIG PRODUCTION

15

Selection of Pigs

In our country, it is rather difficult to set – up a large pig production unit because of religious taboo against pork consumption. Hence, only small – scale production units in areas where rearing and marketing doesn't attract public resistance is possible. Obviously, a farmer venturing into pig production must specifically make it certain that marketing will not be a problem. However, wherever market is good, there will be lesser fluctuations all through the year.

Similar to that of cow dung, pig manure is used for biogas production. In addition, bristles are useful in production of secondary products like brushes.

1. Why should I venture into pig farming?

Venturing into pig farming is primarily on economic grounds. It is well known that investment required for pig farming, in terms of building and equipment, is relatively small and returns come quickly; consequently, it is easy to get in and out of the business in a short time. Pigs can be reared under complete confinement and are highly prolific when compared to other farm animals. Augmenting above facts, labour requirement is less than in dairy / poultry farming. Market for pork (meat of pig) is very stable provided that there is no other stigma against pork consumption.

1.1. Are there any other uses of pigs other than pork?

Yes. Pig bristles (stiff hairs in the skin) are used for manufacture of brushes and pig manure, like other livestock manure, is useful as fertilizer and for the production of biogas.

1.2. What are the traits of economic importance in pigs?

Traits of economic importance or economic traits are those traits or characters that are of major importance with respect to the economics of the enterprise. Some important economic traits in pigs include:

1. Litter size at birth and at weaning: Litter size at birth indicates the total number of young ones born in a litter (at one farrowing) and the litter size at weaning indicates the total number of piglets that are weaned out of the piglets born. These are very important traits that directly influence the profitability of the enterprise. These traits though are genetically based, are also dependant upon management factors. Litter size at birth is an indirect measure of the care and management provided to the mother (dam) during, at and immediately after farrowing whereas, the litter size at weaning indicates the mothering ability of the dam and the care provided to the young ones after birth.

2. Birth weight and total litter weight at weaning: The birth weight of piglets is important because it influences the livability to a great extent. Piglets that are very weak at birth do not grow into good weaners. Weaning is done in piglets (removal from the dam / stoppage of milk feeding) at 56 days of age. The total weight at weaning is important in that it gives an idea of the mothering ability of the dam as well as the growth rate of the piglets.

3. Daily weight gain from weaning to market: This is important because fast growing piglets have to be reared only for a short time before reaching market weight.

4. Feed conversion efficiency: Feed conversion efficiency is the amount of feed required for unit/per kilogram weight gain by the individual animal. This could be calculated only if proper records are kept with regard to the feeding of individual animals. This is very important because the entire profitability of the farming enterprise depends up on this factor.

5. Type and conformation score: These give an idea of the carcass production potential and carcass characteristics of the animal. Nowadays, as the demand of fat (lard) is very less, there is a tendency to produce pigs with minimum fat and maximum primal meat cuts (like bacon, ham, trim loin, shoulder etc.) with qualities such as juiciness,

tenderness and flavor. These changes have been brought about in animals by careful breeding procedures. This is more important as per the present consumer preference scenario.

2. What aspects must be borne in mind before venturing into pig production?

As indicated above, it is obvious that religious taboo exists on the consumption of pork. This is rather unavoidable. Further, consumers prefer to eat only lean meat (without fat) which requires very careful feeding management and slaughter at proper age. Pigs are highly susceptible to heat; hence good care during summer is mandatory.

Unhygienic rearing practices instill an aversion in the minds of people; hence, very good sanitation practice has to be followed and if management is not to the standards, losses due to parasites and mange (infection of skin) can be heavy.

Hence, profitable pig production depends on:

1. Use of good breeding stock from a healthy, disease-free stock
2. Proper transport of the selected stock to the farm
3. Good management of the breeding stock purchased
4. Proper feeding and management of sows during gestation (pregnancy)
5. Proper feeding and management of the sow and litter (young ones) during the suckling period (milk feeding stage)
6. Careful weaning followed by proper care of the weaned ones
7. Provision of adequate housing and maintenance of good sanitary conditions in the farm especially control of parasites and mange along with control of other diseases
8. Keeping proper records of production
9. Marketing at proper age
10. Handling manure and other byproducts efficiently

3. How to start a pig farm?

Starting a pig farm requires breeding males and females so that they produce piglets at regular intervals which, in turn, can be reared and marketed at a desirable age / weight.

3.1. Characteristics in a good breeding stock

1. Availability and adaptability to the local conditions
2. Prolificacy (ability of the females to produce more number of viable young ones)
3. Mothering ability of the females
4. Rapid growth rate of the piglets
5. Docile temperament
6. Optimum feed conversion ability of the piglets
7. Disease resistance
8. High ratio of lean to fat (indicating more meat than fat)

3.2.Breed

There are more than 60 well-defined breeds of pigs. Each one has some desirable features and some weaknesses. The major objective should be the production of large number of young ones that grow rapidly and economically and at the same time be well adapted to the local agro-climatic conditions. Considering the above factors, it is preferable to select Large White Yorkshire breed of pig for starting a small-scale pig farm, even though other breeds like Duroc, Landrace and their crosses are also suitable. Generally, breed or crosses which are available nearby as and when required is preferable.

3.2.1. Selection of a good breeding stock

The following points are worth taken care while selection of foundation stock of breeding pigs:

3.2.1.1. General (Structural soundness)

Structural soundness refers to the skeletal system. This is an important point to be considered for the selection of male as well as female breeding stock. This can affect reproductive efficiency (especially in breeding boars). Soreness, stiffness and pain while moving would greatly affect the mounting ability of boars.

Both the limbs should be squarely placed. Animals with forelegs that are turned out (splayed foot) or turned in (pigeon toed) and hind limbs that are splayed (turned) out (cow hock condition) should be avoided.

While walking, the animal should move with an even, long and easy stride. The impression of the hind foot should be placed on top of the impression of the fore foot in correct structural soundness. Pigs that have short steps (goose-stepping gait) are structurally unsound and should not be selected. Toes of the feet should be of approximately the same size. Toes that are uneven indicate structural unsoundness.

3.2.1.2. Selection of Sow (female)

Breeding sows have to be selected based on the following considerations:

1. Young female pigs (gilts) should be selected at 4-6 months of age
2. Selection should be based on available records of production of their parents
3. They should come from families noted for large litter size (producing more number of young ones) and early sexual maturity or good growth rate
4. They should be healthy, possess sound feet and should be well grown
5. They should not possess any inherited defects (like deafness, blindness etc.)
6. They should have at least 7 pairs of well-spaced, prominent teats. The underline should be well defined with large and easily seen teats. Teats should be evenly placed. If they are placed close together, milk production will be affected (because of less amount of mammary tissue). Animals with very tiny (pin) teats, blind teats (teats that fail to mature and have no opening) and inverted teats (those with a crater in the middle and are not functional) should be avoided
7. Should have a wide, well-muscled loin
8. Should be quiet / docile in temperament. Temperament affects the number of piglets that are weaned
9. The stock should be from a disease free herd

10. Make sure that there are no signs of coughing, diarrhoea or sneezing

3.2.1.3. Selection of Boar (male)

The following are the criteria for selection of a breeding boar:

1. Should show masculinity and breed characters
2. Should have smooth shoulders and strong back
3. Should have uniform width from front to back
4. Should not show any tendency to narrow at the loin
5. Tail should be set high and there should be no fat around the tail
6. Ham should be wide, deep and full
7. Should have a short pastern (region above the hooves)) and should stand squarely on all four legs
8. Should have 12 – 14 rudimentary teats on the abdomen (ventral aspect)
9. Should not be nervous
10. Should be active and friendly. Inactive boars are usually slow breeders.

Note: Teats present in male pigs are called rudimentary teats. Teat on a female that is not connected to the milk gland will not produce milk. Such teats are called blind teats.

3.2.2. What breeds can be considered for purchase?

In case of pigs, one had better prefer purchasing the breed / crossbred that is available nearby from a reliable source because transport over long distance is especially stressful for pigs. The following are the breeds that are popular:

Breed	Color	Special features	Prolificacy
Large White Yorkshire (Origin: USA)	White in color (with occasionally black spots on the skin)	Considered as the best bacon type breed. Ears are erect. Long animals.	Highly prolific. Have very good mothering

			ability
Landrace* (Origin: Denmark)	White skin with white hairs; Small black spots are common	Ears are large and drooping and cover the face. Extremely long animals	Highly prolific
Duroc (Origin: USA)	Red in color (with shades varying from a golden yellow to very dark red); A medium cherry red is preferred; Black spots may appear over the skin	Large animals	Highly prolific with good mothering ability; Produce large quantity of milk
Berkshire (Origin: UK)	Black in color with white markings on the feet, head and tail; Possess a short snout and a wide dished face	Long animal	
Hampshire (Origin: USA)	Black in color with a white belt encircling the body including the forelimbs. Hind limbs are usually black and no white should appear above the hock. Legs are short. Head and tail are black. No white on head	Ears are erect. Smaller than other breeds	Highly prolific with good mothering ability
Poland China (Origin:	Black in color with six white points – feet, face and tip of the tail	Head is trim with drooping ears. Large sized	Not highly prolific

USA)		animal with good length. Typical Poland China has thick, even flesh and is free from wrinkles and flabbiness	
Tamworth (Origin: UK)	Red in color with shades varying from light to dark; head is long and narrow with a long snout	Erect ears. Body is long and narrow	Thin shoulder and strong back
Chester White (Origin: USA)	White hairs and white skin. Small flecks in the skin are allowed, but not black or any other colored hairs	Intermediate / medium in size Rapid growth rate	Highly prolific. Sows produce and raise large litters; good mothering ability

* Many animals have weak pasterns

Note: A number of new breeds have been developed with the aim of producing a pig that is prolific, will make efficient use of feed, have rapid growth rate and produce a carcass high in lean meat and low in fat cuts by crossing different recognized breeds of pigs. Eg. Beltsville No 1 and No.2, Maryland, Lacombe, Minnesota No.1 and No.2

3.2.3. How to assess age of the animals purchased?

To ensure that the animals are of approximately the same age as that which is claimed by the seller, order of eruption of teeth is the most convenient

method. It is however advisable that the animals are purchased from a recognized breeding farm maintaining records so that age can be assessed accurately from their identification and date of birth. If animals have to be purchased from a private party with no records being maintained, eruption of teeth can be used for determining approximate age.

Dental formula of pigs (on one side of each jaw)

	Incisors	Canines	Pre – molars	Molars	Total
Temporary	3	1	3	0	28
Permanent	3	1	4	3	44

The order of eruption of teeth is as follows:

1. Piglets have 8 temporary teeth at birth (4 canines and 4 corner incisor teeth
2. The first pair of temporary incisor teeth to erupt is the corner pair.
3. Then come the temporary Centrals (1^{st} pair) and then the laterals (2^{nd} pair)
4. By about 5 months of age, all the temporary teeth will be present in the mouth
5. At about 6 months of age, the corner temporary incisors are replaced by permanent ones
6. The temporary Centrals are replaced by permanent set at about one year of age
7. The temporary laterals are replaced by permanent ones by about one and a half years and all the permanent teeth would be present (referred to as full – mouth)

3.2.4. After selection, what are the considerations?

1. Proper care during transport to the farm
2. Good management (especially during summer) of the stock procured which includes housing, feeding, day – to – day management, proper sanitation and control of diseases and parasites

3. Keeping proper records of production
4. Following sound marketing practices – marketing at proper time

3.2.4.1. After selection of animals, how to transport them?

Any means of transport should protect animals against heat, cold and shock.

3.2.5. General guidelines of transportation of pigs

Regardless of method of transport, the following are the general guidelines:

1. Animals should be kept separated from each other
2. Sick or injured animals and early or advanced pregnant animals should not be transported unless under technical supervision; generally, pregnant animals are not transported
3. Adequate space has to be provided to stand and lie down
4. Water and feed have to be provided at suitable intervals; under no circumstance, any animal must be deprived of feed and / or water for more than 24 hrs
5. Animals should also be grouped according to their age if such age difference does exist in the selected animals
6. The compartment should be exclusive for transport of animals only and it should have suitable ramps for loading and unloading
7. Animals shall not be lifted by the head /ears or legs during loading or unloading
8. The floor of the transport vehicle should be sufficiently strong to bear the weight of the animals and is covered with adequate amount of bedding / litter; sand is a good bedding material
9. At least one attendant should accompany the animals with a first aid kit
10. If animal(s) become sick during transport, they must be attended by a qualified veterinarian as soon as possible
11. Dung should be removed as soon as possible

12. Transport should be by the shortest possible route with extreme care while taking sharp turns: the speed of the vehicle should cause least disturbance to the animals both while in motion as well as when the vehicle may have to be stopped abruptly.

16

Management of Piglets

Piglets form the foundation for the pig unit. Hence, care and management of the piglets is cardinal for the profitability of the enterprise as a whole; more the number of piglets born and survive, better will be the productivity and profitability of the venture. Hence, details of care and management of piglets is described below with a specific consideration of a small – scale pig production unit.

1. Management of piglets at birth:

Care of piglets naturally begins at once they are born. At birth, the following should be kept in mind by the farmer:

1. Proper care should be taken to avoid any infection
2. Immediately after birth, nostrils are cleaned, mucous from the respiratory tract is cleared and observed whether the new born is breathing or not
3. If there is any difficulty in breathing, artificial respiration has to be provided
4. Artificial respiration can be given by alternatively pressing and releasing the chest region

   Note: If there is no result, then

   (a) Insert a twig of straw or dried grass in to the nostrils. This will initiate sneezing and will result in clearing the tract

   (b) If this also fails, hold the new born animal by the hock and swing

it to and fro (upside down) so that the mucous flows out

(c) If this does not work out then mouth – to – mouth respiration should be resorted to. By closing the nostrils, blow in expired air into the mouth of the new born. The carbon dioxide in the expired air will initiate breathing

5. Tie the navel cord about 2 inches from the body and cut it. Apply antiseptic lotion (like Betadine) to the cut end

6. Dry the new born by scrubbing with a dry cloth because, gilt / sow which has given birth will not lick the new born piglets

7. If there is any difficulty in standing, assist the young ones to stand.

8. Cut the needle teeth by means of sharp scissors or nippers

9. Allow the new born to suck colostrum at the earliest (i.e. within half an hour)

10. Observe for any congenital defects and cull those with severe congenital defects at birth itself

11. Observe all natural openings of each piglet born and those with defects should be separated and examined by a Veterinarian for suitability for further rearing

12. Give proper identification mark by ear notching for all the piglets used for further rearing

1.1. Do piglets need additional heat soon after birth?

Yes. Piglets immediately after birth are not able to protect them from extreme cold weather. At birth they are highly susceptible to extreme cold.

1.1.1. Why?

It is noted that the body temperature of piglets drop by about 1.7 to 7.2° C in the first 30 minutes after birth. This will return back to normal by 48 hours. This drop will be high in smaller piglets because of higher surface area per unit weight than normal piglets. A new born piglet has very poor insulation due to inadequate fat cover below the skin (subcutaneous fat) and therefore, it loses heat to its surroundings very easily. If the piglets are not dried with the help of a towel or dry cloth, they lose heat faster due to wet surface. Reduced ambient

temperature causes increased mortality in piglets during the first two to three days after birth. Therefore, this period can be considered as the critical period in the life of piglets.

1.1.2. How to provide artificial heat?

The warmth provided by the sow and littermates when they huddle together is important in conserving heat. In addition, provision of brooder bulb (infra – red bulb or a thermostatically – controlled electric brooder; similar to the one used in case of day – old chicks) to increase the environmental temperature in the immediate vicinity of the piglets is found to have great effect.

Note: Huddling of gilt / sow with the piglets is likely to predispose, especially some of the weak piglets, to get trampled under the weight of their dam. Extreme care is required to watch and separate all piglets under the cover of guard rails as soon as possible.

1.2. Is it necessary to allot piglets to the teats?

No. Nursing in sows follow a strict pattern naturally. It is always important not to disturb this pattern by human interference.

The sow lies down at the time of nursing and the piglets get themselves arranged alongside the teats. The piglets fight among themselves and settle down at each teat. The strongest piglet gets the best teat. This is called formation of teat order. The formation of teat order gets completed by the fourth day.

The piglets start massaging the teats up and down to initiate milk flow. This massage stops when milk flow begins (normally lasts up to one minute). At this stage, the piglets start to suck at a very fast rate. The milk flow may stop suddenly and the piglets can be found sucking the teat vigorously. Later, the piglets fall asleep at the udder and slowly the sow gets up and walks away.

1.2.1. What are the common problems in piglets?

The most important problem encountered in new – born piglets is the piglet anemia; the brief account of the same is provided below:

1.2.1.1. Piglet anemia

Piglets are born with a small reserve of iron in their body. More over, the

milk of sows does not normally provide sufficient amount of iron for the piglets. Therefore, iron deficiency anemia, called piglet anemia, occurs in piglets.

Piglets having anemia will be generally inactive and show rapid breathing, diarrhea, paleness in the ears and belly.

The condition can be prevented by:

1. Daily administration of 4 ml of 1.8 % ferrous sulfate solution orally to piglets
2. Painting of the mother's (dam's) udder with ferrous sulfate solution and sugar
3. Deep intramuscular administration of Iron dextran injection at 3 days and 3 weeks of age
4. Placing fresh, clean soil in the pen so that the piglets can lick and obtain their requirement of iron
5. Using soil mixed with a solution of ferrous sulfate and copper sulfate (500 g of ferrous sulfate + 75 g copper sulfate in 3 lit of water)

2. What are the other management steps required?

2.1. Weaning

The practice of removing the young ones from the dam / mother can be called as weaning. In other words, weaning can be said to be the stoppage of milk feeding of the young ones.

Peak milk production in sows is attained by about 3 weeks after farrowing after which it decreases. The normal practice is to wean the piglets by 8 weeks of age.

Some farmers also adopt early weaning as this has got certain advantages like:

1. Piglets grow faster (as they are fed other feed stuffs)
2. Sows can be bred earlier (sows come to heat within one week after weaning)

3. Sows do not loose much body weight (as there is less loss of nutrients through milk)
4. Weaning should be done gradually. It is preferable to take the sow away from the piglets (not the piglets away from the dam)
5. It is preferable to deworm the piglets immediately after weaning

2.2. Castration

Male piglets that are not required / selected for future breeding should be castrated. Advantages of this include:

(a) Prevention of indiscriminate breeding

(b) Improvement in growth rate

(c) Reduced boar taint (in pork; characterized by offensive smell related to the testosterone hormone)

(d) Facilitates management

2.2.1. When to castrate?

Castration is done when the male piglets are about 6 weeks old or 10 days before weaning. This involves removal of both the testicles surgically (unlike in the case of other farm animals like cattle, buffaloes, sheep and goats, where castration is done by closed method). For this procedure the help of a qualified Veterinarian is mandatory; hence, the description is not provided in this publication.

17

Feeding Pigs

1. What are the considerations for feeding pigs?

Pigs are similar to humans and dogs in that they can't eat grass as the main food; they are simple – stomached or mono-gastric. But, other than grass, they can eat all types of feed. However, adult animals do have a limited capacity to utilize fibre in grass. In addition, they can't be fed only on feed made of ingredients from vegetable sources; they compulsorily require a part of the feed coming from animal origin, say fish meal, meat meal etc.

Hence, feeding pigs is mostly centered on grains (cereal grains) that can be replaced only to a certain extent with by-products. In this way, pigs are in direct competition with man in terms of feed ingredients. Therefore, computation of a cheap ration for pigs is highly competitive and demanding.

Like any other simple – stomached species, pigs also need to be fed at regular intervals. In fact, they become so accustomed for the timings that they expect feed to be offered at that particular time; otherwise, they feel stress.

Being a very fast growing species, the next consideration is the quality of the feed. Feed must have all the nutrients like proteins, vitamins, minerals, energy etc. to sustain and support such a rapid growth. This is particularly true because they are fed inside their sty (stall feeding). The feed should not be stale and contaminated with fungi or molds.

One more very important factor is the fat deposition; with awareness on fat, cholesterol and human health, preference is for less fat (lean) pork. This has to be always borne in mind while feeding pigs and deciding the slaughter age.

1.1. What are the objectives of feeding pigs?

Therefore, the major objective of a small scale pig farmer should be to use cheaper, lower-grade feed stuffs to the full extent possible and supplement them with more nutritious feed ingredients as per the economy to attain fastest growth without excess fat deposition.

1.1.1. What are the general feed allowances?

Thumb rule for feeding adult pigs:

Breeding boar – 2.5 kg of concentrates per 100 kg body weight

Sow with litter: 2.5 – 3.0 kg per 100 kg body weight + 0.2 kg per piglet (a sow of 100 kg with 8 piglets require 4.6 kg of concentrates per day)

Piglets usually consume around 10 kg of creep feed (high quality concentrate feed) from 2 weeks to 8 weeks of age. Out of this, nearly two-thirds is consumed between 6-8 weeks of age

1.1.2. What is flushing and why it is practiced?

Flushing is a practice of providing extra feed to sows and gilts from 1 – 2 weeks prior to mating and bringing them back to normal feeding after mating. This is found to increase the number of ova released during the heat period and thus results in increase in the litter size. Also, the sow / gilt will be in a better body condition at the time of mating.

2. Are all pigs fed with the same feed?

Obviously not. The different feed / rations are tabulated below:

Feed	Remarks
Creep ration/ feed	Highly nutritious, highly digestible, highly palatable low fiber diet or ration containing 19 – 20 % of crude protein and high amount of minerals and vitamins, fed to piglets up to7 weeks of age. This is usually fed in a creep feeding area in the farrowing pen in which only the piglets are allowed access and not the sow.
Starter ration	Fed to weaned piglets (at 8weeks – of about 8 – 12 kg body weight). Contains at least 18 % crude protein, low

	fiber level and is highly digestible.
Grower / Weaner ration	Fed to piglets that is weaned and is in the growing stage (normally of 12 – 50 kg body weight). Contains at least 18 % crude protein
Fattening / Finisher ration	Fed to pigs that are used for fattening for market (pigs of about 50 – 90 kg body weight). Contains about 14 % crude protein
Pregnant animal ration	Fed to pregnant gilts and sows. Crude protein content is about 16 %
Ration for lactating female	Fed to lactating / nursing sows. Contains about 15 % crude protein

Note: In practice, it is possible to combine two or more of the above rations to suit the local farmer's conditions / situations

2.1. What are the benefits of creep feeding?

Creep feed should be specially formulated to be highly digestible and palatable so that the following benefits are obtained:

Allows better growth in piglets when compared to those that have been on milk feeding alone

Helps the digestive system of the piglet to adapt to a change of diet from milk to a solid food

Helps to keep the sow in good body condition (as less of nutrients only are drained from its body)

2.2. What ingredients can be used to make above feed?

Cost of feeding normally represents 60 – 70 % of the total cost of rearing pigs. The type of ration fed determines the health of the animals, their growth rate, their breeding / reproductive efficiency, their feed efficiency and the type of carcass produced. These factors in turn determine the total profit from the

enterprise.

Requirements of pigs differ depending on their age, sex and reproductive status; accordingly, different rations have to be fed in order to obtain optimum performance. For instance, Creep feed is usually offered to piglets from the second week to 5 weeks of age. Starter ration is given to young piglets etc.

In selecting different ingredients to include in the rations, it is necessary to consider local availability, cost, nutritional value and palatability. The following ingredients are generally used in preparing different rations for pigs:

Maize: Can be very well used for preparing a concentrate feed as it contains very high amount of carbohydrate. Maize grains should be coarsely ground or crushed before feeding

Sorghum: Possesses about 95 % of the energy feeding value of maize grains. Should be crushed before feeding and should not incorporate more than at the rate of 35 % of the ration (because it produces a soft fat)

Wheat bran: Can be incorporated as it has a feeding energy value of about 85 % of that of maize grains. It has high fiber content and so should be used not more than 40 % of the ration

Rice bran: due to fiber content greater than wheat bran, it has a lower feeding value than wheat bran. In addition, it has laxative effect. Hence, it should not be used more than 30 – 50 % of the ration. Rice bran at higher levels leads to the production of soft pork, which is undesirable

Rice polish: This ingredient is rich in B complex vitamins and when used without de-oiling, it is rich in energy also. It is used in most animal feeds. It can be added up to 30% levels. It has fibre content less (3 %) than that in rice bran (11 %)

Cassava / Tapioca: Four parts of cassava/tapioca can replace one part of maize in pig rations. It contains a toxic principle and so, it should be cooked or dried before feeding

Ground nut oil cake: the byproduct obtained after the extraction of ground nut oil and is a good source of protein. However, it should be incorporated cautiously because of the presence of aflatoxin, in case, it is contaminated with fungus. This gets rancid if stored for a long period of time

Dried fish / fish meal: This is a good source of animal protein. The major disadvantage is that it should not be incorporated in rations of finishers during the final stage of fattening as it would give a fishy taste to the pork

3. Pig Rations

As indicated already, different rations have to be fed to pigs depending on age and corresponding requirements. It is generally not possible to give a specific ration formula for any ration mainly because availability, cost and other considerations differ from region to region. Hence, a general range of each ingredient in different rations is provided below. In fact, there could be ingredients other than those listed below which can be used. The farmer had better consult the local Animal Husbandry Department or a Veterinarian or a Veterinary Institute nearby for a final ration formula.

3.1. Creep and Starter rations

Rations for very young pigs must generally have a minimum protein content of 19% to support fast growth rate expected. Hence, in addition to the grains, Creep and Starter rations do contain about 25% of protein sources made up of Ground nut cake (GNC) and fish meal. GNC, being of vegetable origin, is deficient in certain important nutrients (amino acids) and therefore, has to be fortified with fish meal.

The general range of ingredients is given in the following table:

Table 1. Creep and Starter ration formula

Ingredients	Range (%)
Maize	35 to 40
Millets	30 to 35
GNC	15 to 20
Fish meal	6 to 8
Salt	0.5

Note: Other ingredients include mineral supplements like Di Calcium phosphate (DCP), limestone (shell grit) each up to 1%, commercial mineral mixture (containing

Calcium, Cobalt, Copper, Iodine, Iron, Manganese, Phosphorus, Zinc etc.) up to 1%, Vitamin supplements (standard supplements available at market containing Vitamins A, D, B complex, C, E and K) at 25 g per 100 kg ration (0.025%) and an antibiotic supplement at approved levels. Some growth promoters (probiotics) are also added depending on availability. If millets are not available, maize itself can be used in their place.

3.2. Grower and finisher rations

After the initial rapid growth, growth rate in relation to its body weight (relative growth rate) reduces and therefore, grower rations generally have a crude protein content of 18 %. Finisher rations are primarily aimed at giving a proper finish to the carcass (accumulation of fat underneath the skin to the accepted level); therefore, protein levels are reduced further and energy level slightly increased.

The following table gives a general range of different feed ingredients:

Table 2: Grower and finisher ration formula

Ingredients	Grower ration	Finisher ration
Maize	75 to 80	80 to 85
Barley*	15 to 20	15 to 20
Wheat bran*	2 to 4	4 to 8
Rice polish*	10 to 12	10 to 12
GNC	10 to 15	5 to 10
Fish meal	5 to 6	2 to 4
Lucerne (Alfalfa) meal	5 to 10	15 to 20
Salt	0.5	0.5

Note:

* Replacing Maize

Other ingredients include mineral supplements like limestone (shell grit) up to 1%, commercial mineral mixture (containing Calcium, Cobalt, Copper, Iodine, Iron, Manganese, Phosphorus, Zinc etc.) up to 1%, vitamin supplements (standard

supplements available at market containing Vitamins A, D, B complex, C, E and K) at 30 g per 100 kg ration (0.025%), Vitamin B12 supplement 40 g per quintal (0.040%) and an antibiotic supplement at approved levels.

3.3. Breeder rations

Gilts for breeding purposes (after attaining 80 kg body weight) are hand fed (at a rate of 2 kg feed per animal) a separate diet containing 14% protein and are flushed (See Section 1.4 Chapter "Breeding Management") for about 3 weeks with a ration containing 16% protein. After breeding, sows are offered ration with 15 % crude protein at 1.5% of their body weight; in case of gilts, 2% of body weight is allowed to facilitate growth. Feed allowance is further increased for both gilts and sows 3 to 4 weeks prior to expected date of farrowing to obtain higher litter size.

On the day of farrowing, they are off-fed followed by gradual resumption of full feeding.

To support lactating animals, protein content is increased to 15 % and feed allowance is 3% of their body weight.

4. Water requirement of different categories of pigs

Water requirement of pigs (lit / day)

Age (weeks)	Water required
8	3
20	7
28	8
Pregnant sow	
1st 3 months	12
last month	15
Lactating with 5-8 piglets	25
Lactating with 10-12 piglets	30
Breeding boar	

Note: It is found that a loss of water to the extent of 10 % of the body weight of pigs result in disorders and 20 % loss will result in death. When water intake is limited, feed intake is reduced resulting in a reduction of body weight and a net reduction in feed efficiency. The water requirement of pigs varies with the season (environmental factors) and the physiological state of the animal (stage of growth, pregnancy, lactation etc.). It is generally found that more water is consumed during summer months than during winter. More water is consumed by growing pigs and sow with litter.

18

Breeding Management

1. How to manage breeding females?

The breeding females are called "gilts" before they give birth first time; later on, they are referred to as "sows". Pigs are poly-estrus animals (animals that come into heat or estrus many times in a year). In contrast to other farm livestock, pigs produce large number of young ones (litter) at each farrowing (act of giving birth in pigs). The species has an estrus cycle of, on average, for 21 days (range 19-24 days). At the end of each estrus cycle, gilt / sow exhibits symptoms of heat for a duration of 48 hrs (estrus period) which is desirable for mating.

Breeding stock (i.e., animals that are proposed to be used for breeding) should be separated from rest of the litter by about 3 months of age. Young boars and gilts should be separated from each other by 4 months of age. Breeding boars should be housed individually / singly in a boar pen. Pregnant gilts should not be housed with pregnant sows. Pregnant female should be dewormed at least two weeks before and brought to the farrowing pen at least one week before the expected date of farrowing after thoroughly washing the animal with an antiseptic solution. Each pregnant animal should be housed individually. Farrowing pen should be kept always clean and dry.

1.1. How many breeding males need to be maintained?

Generally, one boar (male) per every 25 gilts / sows is commercially acceptable; a breeding ratio of 1: 25. It is necessary that the stock, especially boars, should be changed to avoid problems due to mating among close relatives.

1.2. How to know that a gilt / sow is in heat?

The following signs are exhibited by the gilt in heat which can be observed by the farmer:

1. Grunting (making a peculiar sound)
2. Restlessness
3. Swelling of the external genitalia
4. Reddening of the external genitalia
5. Stands still when pressure is applied on the back / hindquarters. This is called "riding test" and is an accurate means of detecting heat.
6. Females will seek out males during this period

1.3. Gilt / sow is in heat; when to breed?

1. Gilts (young females) should be bred / mated for the first time when they come to the third heat. At this time, they should weigh approximately 80 – 90 kg.
2. Sows can be bred / mated during the first heat after weaning (when the piglets are separated from the dam / mother). At this time they should have good body condition. Post weaning heat is the best and most fertile heat in sows. This normally occurs within a week following weaning.
3. The period of maximum fertility in the female occurs during mid-heat
4. Maximum litter size (maximum number of piglets) can be obtained by mating the female twice during the heat period; first mating 24 hrs after the onset of heat symptoms / signs and the second 8-12 hrs after the first mating.

Note: Boars can be used for breeding for the first time when they are 7 –8 months of age. Young boars should not be used for more than 25 services (mating) per month.

1.4. Care of breeding gilts / sows

Flushing is a practice of providing extra feed to the gilts and sows from 1

– 2 weeks prior to mating and returning to normal feeding after mating. This practice has been found to increase the ovulation rate and thus the litter size. Litter size normally increases up to two and a half to three years of age, remains constant till five years and then declines and mature gilts gain about 40 – 45 kg and sows, 20 – 30 kg body weight during pregnancy.

Two important factors associated with high ovulation rate are the adequacy (plane) of nutrition and growth rate. Excess fat should be avoided in breeding gilts and sows. It has been found that increased back fat thickness increases embryo mortality.

Heat stress on the first day after mating results in a great reduction in the number of live young ones; therefore, it is beneficial to cool the animals for the first five days after mating.

Addition of glucose to feed two weeks prior to the expected date of mating is found to increase the rate of ovulation and hence the number of young ones at birth.

2. How to care the breeding boar?

The breeding boar should be in good health and thrifty condition if managed well. Care should be taken not to fatten the breeding boar. Adequate well balanced ration (14 % crude), sufficient exercise and good and comfortable housing are very essential for achieving this.

A mature boar should not be mated to more than three sows in a day. In the case of young boars, it should be restricted to 2 sows per day. Some boars are very active during the breeding season and as such are difficult to manage, but are excellent breeders. Some boars are inactive (mainly because of inadequate feeding and improper management). The major reasons are being too fatty or not having sufficient exercise. It is very essential to see that breeding boars in the farm are in good breeding condition.

It is always better to have the boar in its own individual quarters, as it will not serve a sow / gilt in new or unfamiliar quarters / surroundings. The individual pens of the boars used for breeding should preferably be near to the quarters of gilts and sows. This practice will also help induce estrus / heat in females.

It is better to have periodic health check up of breeding boars (at least

once in 6 months). Proper deworming should be practiced (See Section 3.10.4 in Chapter "Health Management" for deworming Schedule).

3. How to know that a gilt / sow is pregnant?

Stoppage of signs of estrus (heat) after mating is an obvious sign that a female is pregnant. In addition, the pregnant animal shows a tendency to fatten, a change in the temperament (becomes more docile) and resorts to slow movement preferring to rest most of the times isolating itself from rest of the herd. There will be obvious enlargement of the abdomen and udder.

3.1. How to take care of pregnant animals?

1. During early pregnancy, animals should not be walked or allowed to run long distances and transportation should be avoided
2. Avoid fighting with other animals; hence they are isolated into individual pens
3. Floor of the house should be non-slippery
4. Sick and aborted animals must not be in the proximity of pregnant ones
5. Pregnant animals must be protected from extreme cold and hc climate; wherever extreme cold is expected, room heaters may have be installed in the pen prior to shifting. When the weather is very ho intermittent spray of cold water by installing showers in the pen is advisable
6. Provide adequate amount of clean, fresh drinking water
7. Provide easily digestible, well balanced feed
8. Give sufficient clean bedding material

Note: There are two critical periods during pregnancy – the early part of pregnancy and the latter part of pregnancy. During the early part of pregnancy, the pregnant female should be provided with mild exercise. Inactive and fat sows do not generally produce and raise large litters. Plenty of fresh water should be provided to pregnant females. This is especially important during summer months. In addition, adequate well balanced ration, proper housing, protection from heat stress and adequate exercise can help prevent disease problems and keep the pregnant female healthy. (See Chapter "Health

Management")

3.2. How to know that a gilt/sow is likely to give birth?

A few hours before the actual farrowing, the advanced pregnant animal exhibits typical lack of interest in feed (anorexia) and signs of nest – building. It frequently lies down and gets up again indicating restlessness. There will be swelling of the external genitalia and hardening of the teats. If any or many of these symptoms are seen, the farmer has to make arrangements for farrowing.

3.2.1. Care during farrowing:

1. Keep the animal off-fed
2. Wash the udder, teats and the perineal region with antiseptic solution
3. Do not disturb the animal during normal delivery. Assistance is required only when there is any difficulty (dystocia)
4. Watch the animal from a distance
5. Watch for the expulsion of placenta

Notes:

1. Sows remain in lateral recumbency (lie down) during the process of farrowing. After delivering one or two piglets, sow may change the lying position or may even get up. Piglets are passed out singly. Some piglets may come out head first and some others tail – end first. The whole duration depends up on the litter size, but on an average it takes about 3 hours.
2. Provide palatable laxative feed for the first few days and change to normal feed
3. Piglets weigh 1.0 – 1.2 kg (on an average) at birth
4. **Teat seeking drive** in the new born piglets is very strong at this stage. They may even try to suck any part of the dam's body (like the ears) during this stage
5. The number of piglets born is indeed a genetic character / trait, but, the number of piglets weaned and weight at weaning are definitely determined by management factors

Note: Full feeding is resumed gradually after farrowing day

3.2.2. Can the sow/gilt allowed to consume placenta?

The placenta (after birth) is shed after all the piglets are born. This is usually been consumed by the sow. As far as possible, it is a good practice to remove the placenta as soon as it is shed mainly because of chances of infection if the sow/gilt is allowed access to it.

3.2.3. What are the common problems expected after farrowing?

Generally, no complications are expected in pigs after farrowing; however, the following are the common ones of the complications:

1. Mastitis: Inflammation of the udder caused by a variety of organisms. The animal should be subjected to detailed examination to find out the exact cause and proper treatment should be resorted to immediately by a Veterinarian.

2. Agalactia: Failure to secrete colostrum during the first 24 hours after farrowing. This may be due to insufficient secretion of the hormone oxytocin (responsible for milk let down). This can be corrected by intra venous administration of 5-10 IU of oxytocin by a Veterinarian.

Note: In both the cases, piglets should be hand – reared or placed under the care of a foster mother. Piglets can be successfully reared on diluted cow's milk (50 % dilution) along with antibiotics. If fostering is to be practiced, there should be not more than three days difference in age between the foster sow's own piglets and the orphan piglets.

3.2.4. What to do if gilt/sow dies before weaning?

It is rather not easy to find a foster gilt/sow; gilts/sows will accept foster piglets only up to 1 week after farrowing.

3.2.4.1. How to facilitate accepting piglets by foster mother?

To initiate fostering, the sow's own litter should be removed till they are hungry. Piglets to be fostered should be rubbed with dung from the piglets of the dam at the back region (smell has a major role in offspring recognition by the dam). All the piglets are then put back to the sow and should see that the foster piglets are accepted.

4. Culling

Culling is defined as removal of animals from the farm stock. This should be done periodically to help remove unproductive and less productive animals form the farm, thus improving returns. The following categories of animals need culling from the farm:

1. Excess and surplus boars
2. Debilitated animals
3. Animals with permanent deformity
4. Sows after 6 farrowings
5. Gilts failing to get conceived after three services
6. Sows with very high inter-farrowing interval
7. Sows having a tendency for cannibalism
8. Sows with no mothering ability
9. Cryptorchid boars
10. Boars that are reluctant to breed

19

Health Management

Health is defined as the state or condition of the animal in harmony with the environment; in simple terms, absence of disease. Disease is the condition in which the animal shows physiological, anatomical or biochemical changes from the normal which in simple terms indicates that the animal is not at ease.

Various factors affect health of all animals and some of the important factors that affect health of pigs are:

1. Extreme climatic conditions without suitable remedial measures
2. Faulty housing facility: this includes overcrowding, slippery / improper flooring, mixing of age groups and improper drainage
3. Faulty health management: improper sanitation and disinfection, and improper vaccination schedule
4. Faulty feeding: suitable quantity of ration of recommended composition not provided leading to nutritional deficiency(ies), contaminants and / or toxicants in feed and rarely excess feeding
5. Lack of proper exercise and inhibition of normal behavioral pattern

1. What are the general signs of health in pigs?

The following are the general signs of health in pigs:

1. Normal behavior / habits, stance / posture and sound
2. Skin / coat should be smooth and shiny without any injuries or parasites

3. Eyes bright with pink mucous membrane, without any abnormal discharge
4. Ears should be without any discharge and erect / drooping depending on the breed characteristic
5. Muzzle should be smooth and shiny
6. Absence of abnormal nasal discharge
7. Normal feed and water consumption
8. Urine should be of light straw color and without any abnormal odour and should be clear (not cloudy)
9. Dung should be of normal color and consistency and of normal quantity
10. Should have normal physiological norms

2. What are the general signs of a sick animal?

Contrary to healthy ones, a sick animal shows any / many of the following signs:

1. Animal standing with the head down; dull appearance
2. Tendency to get separated from the group (except while pregnant)
3. Loss of appetite (anorexia), except while in heat or pregnant
4. Coarse skin, loss of hairs
5. Abnormal nasal discharge
6. Sunken appearance of eyes, shedding of tears (lacrimation)
7. Congested, pale or icteric mucous membrane
8. Excessive salivation
9. Variation in the physiological norms
10. Changes in the color and consistency of dung and urine
11. Abnormal discharge from the genitalia

2.1. How to care a sick animal?

Sick animals need extra care and attention when compared to healthy ones. This will help in faster recovery from the illness. A veterinarian has to be requested to visit the animal facility to inspect, diagnose and suggest remedial measure(s).

However, the following general precautions can be undertaken whenever sick animal(s) is (are) identified in the farm:

1. Identify the sick animal and isolate the sick animal – separate the sick animal from the group to a separate shed (sick animal shed)
2. Movement of people to be restricted. Attendants looking after sick animals should never be allowed to handle healthy animals. The sick animal(s) has(have) to be attended as often as possible
3. Provide adequate bedding material
4. Follow strict sanitary conditions
5. Provide fresh, clean drinking water
6. Provide well balanced, easily digestible and palatable feed in divided doses
7. Avoid exposure to extreme climate. Provide adequate warmth during cold weather and vice versa. In either case, Avoid exposure to too much bright light
8. In case of emergency, prompt first aid measures should be followed
9. In case of hemorrhage, tourniquet to be applied and ice packs used to stop bleeding
10. Assist in respiration in case of difficulty in breathing

3. What are the important diseases of pigs?

Diseases (including parasitic problems) are responsible for major losses in pig enterprise. In majority of the farms, the profit or loss from the enterprise is determined largely based on how well the diseases and parasitic problems are controlled. The use of disease free animals (breeding stock), preventive vaccinations and deworming program, clean and disinfected sties, clean surroundings and a good balanced ration can do a lot in preventing losses due to diseases.

Some of the common ailments in pigs are enumerated below:

3.1. African Swine Fever:

3.1.1. Cause and spread

Virus; spreads by contact or by carriers and also by feeding raw swill / garbage.

3.1.2. Symptoms

High fever, loss of appetite, depression, reddening of the skin and finally death; survived ones are carriers and their growth is retarded.

3.1.3. Prevention and control

Vaccination

3.2. Brucellosis

3.2.1. Cause and spread

Bacteria; spreads by contact and through contaminated feed and water.

3.2.2. Symptoms

This disease causes Abortion, sterility or infertility in sows and boars, swelling of the testicles in males and swelling of the joints. This disease can spread from infected animals to humans. Therefore, it is better to test the breeding stock for the presence of the infection periodically.

3.2.3. Prevention and control

Regular screening of breeding flock and culling of the affected ones

3.3. Hog cholera

3.3.1. Cause and spread

Virus; spreads through nose and mouth secretions and through urine and faeces. Young animals are more prone to the infection when compared to adult animals.

3.3.2. Symptoms

Infected animals show high fever, loss of appetite; eyes become sticky

with a thick discharge, loss of weight, cough, difficulty in breathing etc. In severe (acute) cases, animals die within one week.

3.3.3. Prevention and control

Culling of the infected animals

3.4. Enteritis

3.4.1. Cause and spread

Bacteria; fecal contamination

Young piglets are affected one week after birth and they usually die within 10 days.

3.4.2. Symptoms

The major symptoms include watery diarrhoea, sometimes with traces of blood and vomiting.

3.4.3. Prevention and control

General sanitation and disinfection of the sties and surrounding areas can prevent this problem to a great extent.

3.5. Coccidiosis

3.5.1. Cause and spread

- Protozoan parasite
- Fecal contamination
- Affects young piglets from 5 days to 5 weeks of age

3.5.2. Symptoms

Affected animals show yellowish diarrhea (without blood), become weak and may not feed milk. Most of the affected animals die.

3.5.3. Prevention and control

Sanitation of the sty and the premises is the best preventive step.

3.6. Baby-pig scour

3.6.1. Cause and spread

Bacteria; fecal contamination, contaminated water, men and material Affects new-born piglets and adult pigs carry the organism

3.6.2. Symptoms

Infected animals develop diarrhoea within 2 - 8 days of age. They become weak, do not eat (anorectic) and may get infected by other organisms and eventually die out.

3.6.3. Prevention and control

Provision of adequate ventilation in the farrowing house, proper sanitation and disinfection of the sty (especially farrowing pens) and the surroundings are found to prevent this problem.

3.7. Metritis – Mastitis – Agalactia Syndrome

3.7.1. Cause and spread

Infection by many types of organisms (bacteria) and usually doesn't spread to other animals

3.7.2. Symptoms

Inflammation of the uterus (metritis), udder (mastitis) and lack of milk secretion (agalactia)

This usually appears within a day or two after farrowing. The affected sow lies on the belly, udder becomes hard, swollen and hot to touch, and yellowish discharge may appear at the genitalia. There may be constipation also.

The piglets die due to lack of milk.

3.7.3. Prevention and control

The affected sow should be treated with antibiotics and the piglets should be fed milk substitutes.

3.8. Porcine Stress Syndrome

3.8.1. Cause and spread

Environmental factors and genetic factors; overcrowding can complicate

the condition.

3.8.2. Symptoms

The affected animals show reddening of the skin, anxiety, muscle tremors and will have pale, soft and fluid – oozing carcass when slaughtered.

3.8.3. Prevention and control

Avoid overcrowding in pens, protection from extremes of weather (hot and cold), provision of clean, dry housing, avoiding distraction from loud noise etc.

3.9. SMEDI syndrome

3.9.1. Cause and spread

Group of viruses

3.9.2. Symptoms

Still born piglets, Mummified piglets, Embryonic Death and Infertility of sows

3.9.3. Prevention and control

Strict sanitation and disinfection routine

3.10. Parasitic problems

Pigs harbor a variety of internal parasites like round worms (ascarids), hook worms (strongylids), thread worm (strongyloids), lung worm, kidney worm, tape worm etc. There is also a very good chance of infecting the fodder field by these, when dung is used as a manure to fertilize the field.

3.10.1. Transmission

The ingestion of infective stage of the parasite is the common method of transmission of most of the internal parasites. However, hook worms are capable of penetrating the skin of animals. Rarely, newborn piglets may be born infected or get infected soon after birth through colostrum.

3.10.2. Symptoms

Symptoms of parasitism vary considerably with respect to the species / type and the number of worms (worm load). In heavier infections, there will be

progressive loss of condition, lack of appetite, weakness; finally, the animal becomes skin – bound (emaciated). Those which inhabit cause anemia.

3.10.3. What is the most important parasite of pigs known to infecthumans and how to prevent it?

Of several parasites, the tape worm Taenia solium is of much greater public health importance because the intermediate stage of this worm is capable of developing in man and in pig. Pigs get infected by ingesting ova passed by mature tape worm segments in the faecal matter of humans which develop into cysts and remain in the muscles and cause extensive damage to the organ(s) they invade.

The best method of prevention is not to allow pigs to wander around and get access to human faeces, proper and routine examination of pork to detect infection (presence of cysts in muscles) and refraining from eating improperly cooked pork.

Prevention and control

Proper disposal of dung and other wastes from the farm (See Chapter – Waste Management)

Adequate feeding of animals on a balanced feed help them tolerate the effects of worm problems. Over crowding, especially of young stock, must be avoided. Similarly, mixing / group housing of different age groups is also strictly not allowed. Sty must be kept well ventilated, warm and dry.

It is a customary practice to deworm all the animals; it is always better to use appropriate anthelmintic drugs in case the animal is found to be infected by a specific parasite. This can be confirmed by fecal examination. Even without a fecal examination, the following routine deworming schedule can be adhered to:

1. All piglets before weaning
2. Growers at about 4 months of age
3. Adult boars (twice yearly)
4. Sows (15 days before farrowing and after weaning of piglets)
5. All animals in quarantine before entering the stock

3.11. Nutritional deficiencies

When one or many essential nutrient requirements such as dietary energy, crude protein and mineral and vitamin levels is (are) inadequate, animals become weak and unthrifty. They will ultimately have poor growth and reproductive performance resulting in severe economic losses.

3.11.1. Mineral deficiency

Major deficiencies occur with calcium and iron. Calcium deficiency results in rickets. Here, the animal will have weak forelimbs that cross over each other and extremely low growth rate. Iron deficiency is generally found in sucking piglets (See Piglet anaemia)

3.11.2. Vitamin deficiency

Deficiency of Vitamin A is often observed in those animals that are not offered green forages. Affected animals invariably abort. Deficiency of Vitamin D also occurs and this leads to rickets. Deficiency of Vitamin B complex vitamins results in low growth rate and unthrifty condition.

3.12. Miscellaneous conditions

3.12.1. Porcine Stress Syndrome (PSS)

This is a hereditary condition usually seen in heavily muscled pigs. The affected animals have very little tolerance to stress (especially associated with hot weather). When subjected to hot weather, animals exhibit muscle tremors and twitching along with red spots on the underline. These animals die suddenly.

3.12.2. Pale, Soft, Exudative pork (PSE pork)

This is another condition seen in heavily muscled pigs characterized by the production of low quality pork with no inter – muscular fat (marbling). The pork will be very pale in color and is soft and watery (exudative) in nature. When this pork is cooked, the meat lacks taste.

4. Disease control measures

As a golden rule: "Prevention is better than cure"; it is always better to take all steps to control infection than treating one.

The basic steps required to control infection are: l

1. Resting: Leaving the pens free / empty for around 15 days when all the animals in those pens have been taken to market or slaughter. It is better to wash and disinfect these pens during this period
2. Prohibiting the movement of people from infected animal quarters: This would result in carrying the infective agent from the infected animals to healthy animals
3. General hygiene: Cleaning the pens, periodic removal of dung, cleaning the manger, water trough, wallowing tank etc. will result in reduction in the incidence of infections. These activities act as preventive measures
4. Disinfection: before disinfection, wash and remove all visible organic matter from the floor and walls. Use the appropriate disinfectant (See Chapter Sanitation)
5. Proper stocking density: There is a tendency to house a large number of animals in a single pen for reasons of economy. This will result in the pen becoming very dirty with dung and urine spread over the floor. Such an environment is ideal for the multiplication of different microbial organisms (pathogenic and non-pathogenic). The situation is more serious in piggeries with less of ventilation. High ambient temperature aggravates this problem. There is a general saying that "if pig numbers are doubled, infections are tripled". Even though this is not scientific, this should be given due consideration while deciding stocking density
6. A vaccination program in consultation with a Veterinarian
7. Restrict the use of kitchen waste and uncooked slaughter wastes for feeding. Always, balanced ration according to the age and requirements should be offered to avoid nutritional deficiency(ies)
8. Culling of weak animals (runts): It is a better practice to cull all the runts in different litters. Runts have a poor growth rate and limited resistance to diseases and hence, are more susceptible to infections than other piglets
9. Control of ticks and other vectors

In spite of all care, if any infection actually occurs, the following steps are equally important:

1. **Quarantine:** keeping all the animals that are brought into the farm from outside in isolation, away from the farm stock for at least a month. This will help to identify whether the newly brought animals are having any infection and if so, they could be removed from the stock

2. **Isolation of infected animals:** Once, it is found that a particular animal is showing disease symptoms, it is better to isolate it from the farm stock and house it in the sick animal shed. This would help to contain the infection i.e., not allowing the infection to spread to other healthy animals in the farm

3. **Correct diagnosis and prompt treatment of diseased animals:** Investigation should be done to diagnose the condition of sick animals and prompt treatment should be adopted. A veterinarian's help is essential in this aspect

4. **Proper disposal of dead animals:** The best method of disposal in the case of large sized pigs is burial and for piglets, incineration

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Behavior and Vices

1. Thermoregulatory behavior in pigs

Young animals cannot tolerate very cold climatic conditions. Immediately after birth they are highly susceptible to cold.

1.1. Why are piglets most sensitive to cold?

See Chapter Management of piglets for details.

1.1.1. Cold climate

As the piglet grows, the sensitivity to cold decreases and it will be able to conserve heat by increased thermal insulation by the formation of subcutaneous fat. Further, it increases its feed intake to compensate heat loss.

1.1.2. Hot climate

Under hot conditions, adult pig has to adopt behavioral means of thermoregulation (eg. Wallowing) as the sweat glands are very much limited. In this case, its subcutaneous fat is a severe disadvantage because it curtails heat loss.

Hence, in addition to wallowing, they may also adopt different postures like lying flat on the ground, changing sides and locations on the floor, getting closer to metallic objects (to dissipate heat by conduction), increase water intake many fold, reduce feed intake (affects growth).

In hot environments, pigs have difficulty in eliminating metabolic heat and therefore, they voluntarily reduce feed intake. This will result in deterioration of daily live weight gain and feed conversion. It is found that heavier animals

are more prone to this problem (especially lactating sows with litter and breeding boars). High temperature also has got a detrimental effect on the reproductive performance of pigs. For example, the number of ova shed, number of ova fertilized and the number of live piglets born are found to be very low. Also, there will be a reduction in the number of sows expressing heat signs resulting in a reduction of the number of piglets born in a year. These problems are pronounced when the ambient temperature is above 35° C.

When exposed to hot sun, especially in poorly ventilated pens, the pigs are liable for heat stroke. The body temperature increases quickly from 39 to 41° C. This is accompanied by drastic increase in respiration rate and pulse rate. Skin becomes hot and conjunctiva becomes congested. Froth appears on the mouth and the animal lies on its side (lateral recumbence) with the mouth half open. Death occurs within 1 to 2 hours.

Heat is lost through conduction (directly from the skin to the objects in contact like floor, walls, equipment etc.) and by convection (heat loss aided through air movement / wind). The loss of heat through the skin is high when temperature is low and air movement is high. At about 35° C, heat loss to the atmosphere is negligible. Therefore, it is necessary to ensure very good ventilation in the sty for effecting thermoregulation.

Pigs show a variety of adaptive responses to heat. When it is hot, pigs normally lie down on their sides on the floor so as to disseminate heat through conduction. The thermal conductivity of the floor is very important here (concrete has a conductivity of 1.0, whereas, wood has a conductivity of 0.05 only).

Another major source of heat loss is by evaporation of water (through loss of water vapor from the lungs during respiration). Pigs do not sweat as they do not have sweat glands distributed over the body surface (sweat glands in pigs are present only on their snout). They adjust with the behavioral thermoregulatory mechanism of wallowing. Wallowing in hot environment has the advantage of smearing the whole body surface with a wet layer of water which dries slowly and on evaporation, takes away heat from the skin, thus relieving the animal of heat stress.

Behavioural anomalies or vices are those behavioral patterns that are not normal to the species of animal and those that cause certain problems to the same animal or to others. They may even lead to injuries and reduction in the

growth and other performance factors, thus leading to disruption of the profitability of the whole enterprise. These are mostly caused by faulty management practices. Therefore, pig farmers should have a general understanding of these so that they would be in a position to prevent these at the budding stage itself.

2. Vices in pigs

The following are the major vices exhibited by pigs:

1. Tail biting

Tail biting is a common behavioral problem in pigs. It starts as a simple (passive) chewing of the tail and slowly leads to inflicting a wound with bleeding. At this stage, other animals in the pen also show interest in biting the tail of the affected animal and this becomes a vicious circle. The tail of the affected animal is bitten off piece by piece until only a small stock remains at the base.

The affected animal becomes restless (listless), doesn't eat (anorectic), inactive and suffers loss of blood. The wound may also get contaminated by bacteria.

1.1. Causes

The common causes of tail biting in pigs include the following:

1. High stocking density
2. Lack of adequate feeding space
3. Parasitic infection
4. Boredom
5. Stress and
6. Too high temperature and humidity

Tail biting is exhibited more by pigs of the age group 3 – 5 months. This is because at this age exploratory activity will be more pronounced.

1.2. Remedy

In order to prevent this problem, preventive measures have to be taken immediately after it is observed. It is preferable to segregate (separate) the biting and the bitten animal. The bitten animal should be treated for wounds and resulting infection. The active biters should be isolated from the group. A very effective preventive measure is amputation of the tail of all piglets when they are a few days old. This has to be done by a Veterinarian.

2. Anal massage and coprophagia

One of the pigs in a pen massage the anus of other pigs with it's snout. Normally, this results in defecation by the affected animal. The faeces that are voided will be eaten by the pig that massaged. Obviously, it eating faeces (coprophagia) is associated with this problem.

2.1. Causes

The major causes include boredom, overstocking in pens, lack of adequate balanced diet etc.

2.2. Remedy

In order to prevent these problems, it is preferable to reduce the stocking rate in pens and to place chewable objects such as hay, leaves, twigs etc. in the pens to divert the mouthing activity of susceptible pigs. Feeding of a well balanced diet to pigs also would help control these problems to a great extent.

3. Bar biting

This problem is exhibited by those pigs that are kept in crates such as a farrowing sow. Due to boredom and stress the pigs start biting the bars of the crate in order to engage themselves in some activity. This behavioral problem can be reduced to a great extent by improving management conditions (especially housing). It can also be reduced by providing chewable objects like straw, grass leaves or twigs.

4. Vacuum eating

This is another mouth based anomalous syndrome in which the animal exhibits chewing motion without anything in the mouth (eating vacuum). This chewing motion causes excessive froth/foam in the mouth and froth/ foam

drops down. This activity occurs more when the sow is in a sitting position or when it sits in a dog sitting posture. It is found that the animals engaged in this activity are thin and take too much time to exhibit estrus after weaning.

The main reason for this is frustration due to boredom. This can be prevented by giving straw; grass leaves or twigs for chewing and also by providing a well-balanced ration.

5. Chronism

This problem involves killing and eating of viable young ones (piglets). This problem occurs mostly in sows that give birth for the first time. Hyper-excitability in the sow could be a cause for this. This leads to aggression and ends up with piglet killing and eating. Pigs having this problem are usually administered sedatives. Administration of oxytocin is also found to give relief to this problem.

21

Economics of Pig Production

For a small-scale pig production unit, a drove with 5 sows and 1 boar is taken into consideration.

Technical assumptions

It is essential to have a clear cut foresight for finance, building, drove schedule, items of income and expenditure etc. of the pig farm to be established. It is assumed that the farmer is having adequate land and capital.

The following tables give the details concerning the proposed small scale piggery unit:

Non-recurring expenditure

Table 1: Non-recurring expenditure

Description		Covered area m²/animal	Open area	Cost Rs. / m²
Building	Breeding boar	7.0	12	500
	Breeding sows	2.7	12	400
	Farrowing pen	8.0	1.5	500
	Grower sty	1.5	1.5	300
Equipment			Rs per annum	2000

Recurring expenditure

This includes cost on purchase of animals, feed, vaccines, medicines, insurance etc. They are tabulated below:

Table 2: Recurring expenditure

Description						
	Animal purchase: Sow (Rs /Animal) Boar					2500 3500
				Allowance, kg/d		
Feeding	Age	2-8 w	9-10 w	11 w-5 m	> 8 m	Adult
	Type	Creep	Starter	Grower	Finisher	Breeding
	Quantity	0.15	0.5	2.0	2.5	3 – 4
	Cost Rs/kg	15	12	10	10	10
	Vaccines, medicines etc. Rs /animal/pa					50
	Insurance, 6% of cost of the animals purchased, Rs /animal					160

Income

The sources of income, their quantity and value are shown below:

Table 3: Income

Description		Rate
Sale of animals	8 months of age (65/60 kg per M/F)	Rs 60 / kg live weight
	Breeding stock	Rs 3500 per male and Rs 2500

	Culled animals	per female Rs 1800 / animal
Manure Production, kg/animal/d	1.5	Rs 600/t

Other assumptions

The following are assumptions needed for computing profits and cashflow:

1. Single row shed / sty; for grower and breeding stock (females), with two cubicles at one end where two adult boars could be separately housed and a farrowing pen with at least 6 cubicles to house advanced pregnant sows separately at the time of farrowing
2. Labor: Self
3. Each sow would give birth to a minimum of 8 piglets at one time
4. Farrowing interval: 6 months (twice in a year)
5. Sale of animals: young ones (finisher) after completion of 8 months of age for slaughter; males and female pigs as breeding stock to other farmers, and culled animals.
6. Mortality: 10%, to be applied on overall profits
7. Depreciation: Building: 2½% pa, Equipment: 5% pa

Economics of a 6- animal small scale pig farm

Drove structure

It is highly essential that the expected number of animals (like young ones born, growers, pregnant sows) are known to estimate costs and returns. It requires a schedule as per the purchase of animals at the beginning to facilitate calculation of recurring expenditure and income accurately. In the current program, it is assumed that:

1. Breedable sows and boars will be purchased (5sows +1 boar) at the first year
2. The animals will be allowed natural mating at the farm and the piglets

born will be grown in the farm until they are sold for market and also as breeding stock to other needy farmers (as per the demand)

Table 4 Drove structure

Month Year	1	1 to 4	5 and 6	7	8 to 10	11 and 12
1	**P (I)** and M (I)	Gs (I)	F and W (I)	G (I)	G (I)	G and **S (I)**
				M((II)	Gs (II)	F and W (II)
II	M (III)	Gs (III)	F and W (III)	M (IV)	G (III)	F and W (IV)
	G (II)	G (II)	G and **S (II)**	G (III)	Gs (IV)	G and **S (III)**
III	M (V)	Gs (V)	F and W (V)	M (VI)	G (III)	F and W (VI)
	G (IV)	G (IV)	G and **S (IV)**	G (VI)	Gs (VI)	G and **S (V) S [P (I)]**

P = Purchase; M = Mating; Gs = Gestation; F = Farrowing; W = Weaning;

G = Growth; S = Sales; Roman number in the parentheses indicates batch number.

Management including housing, feeding, handling, disease control and sanitation etc. will be as per standards. As there is provision to feed kitchen swill and hotel wastes, only 50 % of actual feed (concentrate) allowance is taken into account.

Non – recurring expenditure

Table 5 Non-recurring expenditure

Description		N	Allowance	Cost	Total, Rs
Building	Breeding boar	1	7.0 m²/animal	Rs 300/ m²	2100
	Breeding sow	5	2.5 m²/animal	Rs 200/ m²	2500
	Grower	80	1.5 m²/animal	Rs100/ m²	12,000
	Farrowing pens	5	9 m²/animal	Rs 300/ m²	13,500
Equipment				Rs 900	900
Total					31000

Calculation

Building requirement = n x allowance x cost. For example, for boar pen of one number to house one breeding boar, 1 x 7.0 x 300 = Rs.2100

Recurring expenditure

Recurring expenditure differs between I year and the rest primarily because:

1. Animal purchase is done only during I year and adult breeding sows and boars are retained for a period of 3 years
2. Number of animals is not the same during first and second year. The following table illustrates calculation of various recurring costs. Note that insurance is done only for the animals purchased for the project.

Table 6: Recurring expenditure (I year)

Description	Rate (Rs/animal)	N

Animal purchase:	Femaie			2500	5
	Male			3500	1
Feeding cost	Age	Feed	kg/animal	Rs/kg	
	2-8w	Creep	6	15	40
	9-10 w	Starter	10	12	40
	3-8m	Grower/Finisher	100	10	40
	Adult	Breeder ration	500	10	6
	Total				
Vaccines, medicines etc.				30	46
Insurance				160	6
					TOTAL

Calculation

General rule is multiply n with rate; and in case of concentrates, multiply the product obtained with quantity. For instance, cost of sow purchase is 5 × Rs 2500 = Rs 12,500 and cost of boar is 1 x 3500 = 3500; concentrates: creep ration (2-8 weeks) 6 kg × Rs.15 × 40 no. = Rs 3600; starter (9-10 w) 10 kg × Rs 12 × 40 = Rs 4800, Grower / finisher ration 100 kg × Rs10 × 40 = Rs 40,000 Adult (breeder ration) 500 kg × Rs 10 × 12 = 30,000

Table 7: Recurring expenditure (II year onwards)

Feeding cost	Age group	Feed	kg/animal	Rs/kg	N	Rup
	2-8w	Creep feed	6	15	80	7,2(

	9-10w	Starter	10	12	80	9,6(
	3-8 m	Grower/finisher	100	10	80	80,(
	Adult	Breeder ration	500	10	6	30,(
	Total					1,2(
Vaccines, medicines etc.				30	86	2,5(
					Insurance	960
					TOTAL	130

Income

Table 8: Income (I year)

Items		n	Production, kg/animal	Total production, kg	Rate, Rs/kg	Total, Rs
Animals	Males	20	60	1200	70	84,00(
	Females	20	60	1200	70	84,00(
FYM	Total	46	1.5	20 t	600/t	12,00(
					TOTAL RECEIPTS	1,80,0(

Table 9: Income (II year)

Items		n	Production, kg/animal	Total production, kg	Rate, Rs/kg	Total, Rs
Animals	Male	40	60	2400	70	1,68,00

	Female	40	60	2400	70	1.68,00
FYM	Total	86	1.5	40 t	600/t	24,000
					TOTAL RECEIPTS	3,60,00

Table 10: Income (III year)

Items sold		N	Production	Total production	Rate, Rs	Total, Rs
Animals	Males	40	60 kg/animal	2400 kg	70/kg	1.68,0
	Females	40	60 kg/animal	2400 kg	70/kg	168,0(
Culled	Males	1	.....	.....	1800/animal	1,800
animals	Females	5	.....	.....	1800/animal	9,000
FYM	Total	86	1.5kg/animal	40 t	600/t	24,00
					TOTAL RECEIPTS	3,70,8

A look at drove schedule will indicate the number of growing animals present and animals for sale.

Cash flow

Cash-flow showing year-wise expenditure-income statement along with gross and net profits is tabulated below:

Table 11: Cash flow

Description	I year	II year	III year	Total
Non-recurring	31,000			31,000
Recurring	96,740	130,340	130,340	357,420
TOTAL EXPENDITURE	127740	130,340	130,340	388,420

Income	180000	360000	370800	910800
Gross profit	52260	229,660	240,460	522,380
Depreciation, building	775	775	775	2325
Depreciation, equipment	45	45	45	135
NET PROFIT	51440	228,840	239,640	519,920
CUMULATIVE NET PROFIT		280,280	519,920	

SECTION–IV
RABBIT PRODUCTION

22

Selection of rabbits

1. What is "Small - scale" rabbit production?

It is difficult to give a universal definition of "Small - scale rabbit production". The number of animals to qualify a rabbit farm as a small - scale unit is highly variable depending, among many factors, mainly on the actual location, region and the country in question. However, it appears reasonable to state that the minimum size of a rabbit farm that can meet the minimum needs for the sustenance of the farmer and his family is a small - scale rabbit production unit.

2. What are the factors that determine profitability of the farming unit?

A farmer venturing into small scale rabbit production for meat purpose must specifically make it certain that marketing will not be a problem. However, where market is good, there will be lesser fluctuations all through the year. Unhygienic rearing practices instill an aversion in the minds of people; hence, very good sanitation practice has to be followed and if management is not to the standards, losses due to parasites and mange (infection of skin) can be very heavy in rabbits.

Hence, profitable rabbit production on a small scale depends on:

- Use of good breeding stock from a healthy, disease-free stock
- Proper transport of the selected stock to the farm
- Good management of the breeding stock purchased.

- Proper feeding and management of females (does) during gestation (pregnancy)
- Proper feeding and management of the doe and litter (young ones) during the suckling period (milk feeding stage)
- Careful weaning followed by proper care of the weaned young ones
- Provision of adequate housing and maintenance of good sanitary conditions in the farm especially control of parasites and mange along with control of other diseases
- Keeping proper records of production
- Marketing at proper age
- Handling manure and other byproducts efficiently

3. Why should I venture into Rabbit farming

Venturing into rabbit farming is primarily on economic grounds. It is well known that investment required for rabbit farming, in terms of building and equipment, is relatively small and returns come quickly; consequently, it is easy to get in and out of the business in a short time. Rabbits are reared under complete confinement and are highly prolific when compared to other farm animals. Augmenting the above facts, labor requirement is less than in dairy/poultry farming. Market for rabbit meat is stable as it is a delicacy.

Rabbit meat is considered as a delicacy and therefore, one should look into the demand before venturing into rabbit production. This is rather unavoidable. Secondly, rabbit production requires very careful feeding management and slaughter at proper age. Rabbits are also highly susceptible to heat; hence good care during summer is mandatory.

In recent years there has been an increasing interest in the use of rabbits as a potential source of animal protein in many countries. The major reasons for this include:

1. To exploit all potential sources of animal protein as a means to ensure human protein nutrition
2. The increased cost and lack of availability of traditional sources of animal protein

3. The relatively low investment cost to start a small scale broiler rabbit unit
4. The high rate of multiplication of rabbits (high prolificacy rate)
5. Can be bred at any time of the year (not a seasonal breeder)
6. Short gestation period (30-32 days)
7. Can be reared on fodder based feed resources and kitchen wastes, as the rabbit is a non-ruminant herbivore
8. Small size of the animal results in low feeding costs and easy dressing of the carcass
9. Because of small size and docile nature, rabbits can be easily handled and managed even by small children of the household
10. Have faster growth rate and better feed conversion ability
11. Many breeds of rabbits are available that are adapted to tropical conditions
12. Rabbits fit very well into backyard farming systems
13. Usefulness of byproducts - byproducts like rabbit skin and manure are very valuable. Skin can be processed and made into many useful products
14. Manure is a valuable organic fertilizer. (Composition of manure: Nitrogen - 3.7 %, Phosphorus - 1.3 % and Potassium - 3.5 %)

On an average, an adult rabbit produces about 100-150 kg of manure per year.

15. Require very less labour when compared to other farming enterprises (family labour is sufficient)
16. Low input farming with very little capital, less feed cost, less cost of housing and less veterinary care
17. No elaborate housing is required for rabbit production. Houses/ cages can be built from locally available materials like wood or bamboo pieces. The only consideration is that the animals should be well protected from the extremes of weather conditions

18. There is no religious taboo existing on the consumption of rabbit meat
19. Rabbit meat is delicious and white meat with less of cholesterol and fat and high in protein and easily digestible
20. Rabbit fits very well into different farming systems - small scale systems and large scale systems

4. What are the important characteristics of rabbit meat?

Characteristics of rabbit meat include the following:

1. White meat with low fiber content
2. Easily digestible
3. Very palatable
4. High in protein
5. Low in cholesterol
6. Low in fat
7. Low in sodium

5. What are the differences between a Rabbit and a Hare?

Rabbits can be clearly distinguished from hares by the following features:

Rabbits are altricial, which have young ones that are born blind and hairless. In contrast, hares are precocial species ie, they are born with hairs on their body and are able to see.

Under natural conditions, all rabbits (except the Cottontail rabbit) live underground in burrows or warrens, while hares live in simple nests above the ground.

Rabbits generally live in groups but hares do not live in groups.

Hares are generally larger than rabbits, with longer ears, and have black markings on their fur.

Hares are wild (not domesticated), while rabbits are domesticated and are

often kept as house pets and for meat production.

6. Handling a rabbit

It is not at all surprising that many farmers venturing first time into rabbit farming may not have even handled a rabbit. But, obviously, proper and careful handling is very important for the animal as well as for the handler. A brief method of handling a rabbit is as follows:

- Rabbits should never be held / lifted by the ears
- They have powerful hind limbs and can kick hard
- They have powerful and sharp claws / nails that can cause severe injury to the handler. Therefore, the limbs should be turned away from the handler for better safety
- Handling should be firm and gentle

Rabbits should be held at the scruff of the neck and the body should be supported at the rump region.

Note: Improper handling will lead to fracture and luxation of lumbar vertebrae of the animal as a result of violent struggling.

7. What are the breeds of Rabbits suitable for small-scale production?

Important features of some breeds of rabbits

Breed	Color	Special features	Prolificacy
1. New Zealand White	White	Considered as the most popular meat type breed. Ears are erect. Eyes are red. Animals are large and long. Mature body weight: 4-5 kg.	Highly prolific. Have very good mothering ability
2. Soviet Chinchilla	Grey	Large-sized animal wide shoulder, well-muscled back	Prolific breed.

		Mature body weight: 4 -5 kg.	
3. New Zealand Red	Reddish-brown	Medium-sized animal, have good meat to bone ratio. Mature body weight: 2.7 - 3.6 kg	Good mothering ability.
4. Californian	White with black ears, nose, tail, feet. Eyes are dark pink.	Large-size, broad shoulders, well-muscled back. Good dressing %. Mature body weight: 4 - 4.5 kg.	Prolific.
5. Dutch	Half black and half white	Small-sized breed, early maturing, compact animals. Mature body weight: 2 - 3 kg.	Good mothering ability.
6. Flemish Giant	Ranges from grey to black, sandy, white or black.	Largest of the domestic rabbit breeds, good for fur. Mature body weight: 6 - 6.5 kg.	Prolific.

There are more than 40 well-defined breeds of domestic rabbits. Each one has some desirable features and some weaknesses. The major objective should be the production of large number of young ones that grow rapidly and economically and at the same time well adapted to the local agro-climatic conditions. Considering the above factors, it is preferable to select New Zealand White or Soviet Chinchilla or Grey Giant breed of rabbit for starting a small-scale rabbit farm, even though other breeds and their crosses are also suitable. Generally, specific breeds or crosses that are available nearby are preferable.

It is the capacity and ability of the farmer and not the breed alone that determines the success with broiler rabbits. Not with-standing this, selection of a breed needs to be considered.

Each breed has some desirable features and some shortcomings. The aim should be to choose a breed or type of animal that is very well adapted to the

local agro - climatic conditions and at the same time, grows and reproduce at least cost. For this purpose, the following factors have to be considered:

- Availability of good breeding stock
- Cost of the animal
- Acclimatization to the local conditions
- Cost of maintenance per unit size
- Quantity and quantity of meat obtained
- Cost of production
- Disease resistance
- Previous experience of the farmer

7.1. What I should look into in a good breeding stock?

1. Availability and adaptability to the local conditions
2. Prolificacy (ability of the females to produce more number of viable young ones)
3. Mothering ability (ability to take care of the young ones born) of the females
4. Rapid growth rate, docile temperament and optimum conversion ability of the young ones (kits)
5. Disease resistance

7.2. What are the important characteristics of economic importance inrabbits?

Traits of economic importance or economic traits are those traits or characters that are of major importance with respect to the economics of the enterprise. Some important economic traits in rabbits include:

1. Litter size at birth and at weaning: Litter size at birth indicates the total number of young ones born in a litter (at one kindling) and the litter size at weaning indicates the total number of kits that are weaned out of the kits born. These are very important traits that directly

influence the profitability of the enterprise. These traits though are genetically based, are also dependant upon management factors. Litter size at birth is an indirect measure of the care and management provided to the mother (dam) during, at and immediately after kindling whereas, the litter size at weaning indicates the mothering ability of the dam and the care provided to the young ones after birth.

2. Birth weight and total litter weight at weaning: The birth weight of kits is important because it influences the livability to a great extent. Kits that are very weak at birth do not grow into good weaners. Weaning is done in rabbits at 4 - 5 weeks of age. The total weight at weaning is important in that it gives an idea of the mothering ability of the dam as well as the growth rate of the kits.

3. Daily weight gain from weaning to market: This is important because fast growing kits have to be reared only for a short time before reaching market weight.

4. Feed conversion efficiency: Feed conversion efficiency is the amount of feed required for unit/per kilogram weight gain by the individual animal. This could be calculated only if proper records are kept with regard to the feeding of individual animals. This is very important because the entire profitability of the farming enterprise depends up on this factor.

5. Type and conformation score: These give an idea of the carcass production potential and carcass characteristics of the animal.

7.3. How to select a good breeding stock?

Selection of breeding animals is very important as they form the foundation stock of the farming enterprise. By careful selection, we can bring improvements in many of the economic traits (characters) and ensure profitable production.

7.3.1. Determination of sex

The sex of the animal can be determined by depressing the external genitalia to reveal the penis in males and a slit-like opening in females. Testicles descend at the age of 10 -12 weeks in males.

7.3.1.1. Selection of males (bucks)

The following points should be considered while selecting a male rabbit for breeding purpose:

* It should have good body conformation as per the breed standards
- It should have two well developed testicles
- It should be in good physical condition and health
- It should be free from genetic defects
- It should not be too fatty or too lean (should be trim)
- Hair coat should be soft, smooth and glossy
- Eyes should be bright
- It should be active and friendly with a docile temperament. Inactive bucks are usually slow breeders
- Selection should preferably be based on available records of production of their parents
- It should preferably come from families noted for large litter size (producing more number of young ones) and early sexual maturity or good growth rate

7.3.1.2. Selection of females (does)

A female rabbit (doe) should have good body conformation as per the breed standards.

- A good female rabbit should have at least eight well formed teats
- It should be in good physical condition and health
- It should be free from genetic defects
- It should be trim in condition (not too fatty or too lean)
- Hair coat should be soft, smooth and glossy
- Eyes should be bright
- It should be active and friendly with docile temperament. Inactive does are usually slow breeders and do not wean large litters
- Selection should preferably be based on available records of

production of their parents

- It should preferably come from families noted for large litter size (producing more number of young ones) and early sexual maturity or good growth rate

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Feeding Rabbits

Feeding is one of the most important factors in the management of any livestock enterprise. It is also the costliest component in the care of animals. The main objective of any farmer should be to attain the maximum benefit in terms of animal health and production at the least cost.

The twenty-four hour feed allowance of an animal is called a "ration". The ration which provides all the essential nutrients in the correct proportions to the animal for proper nourishment is called a "balanced ration".

Rabbits are similar to pigs in that they are simple - stomached or mono-gastric animals but can utilize grass/greens. But they are different from cattle, buffaloes/sheep/goats in that they can digest grass/greens only in the large intestines (hind - gut) but not in the specialized stomach (rumen). They can be fed only on feed made of ingredients from vegetable sources.

However, having a simple stomach like humans, poultry and pigs, they need to be fed at regular intervals. In fact, they become so accustomed for the timings that they expect feed to be offered at that particular time; otherwise, it causes stress.

Being a very fast - growing species, the next consideration is the quality of the feed. Feed must have all the nutrients like proteins, vitamins, minerals, energy etc. to sustain and support such a rapid growth. This is particularly true because they are stall - fed. The feed should not be stale and contaminated with microorganisms like bacteria, fungi, molds etc. Rabbits, in general, prefer to eat fresh feed.

Changes in the feed / diet should be brought about very gradually.

1. What are the requirements in a Balanced Ration?

A balanced ration should be

1. Correctly balanced
2. Highly palatable
3. Inclusive of as many ingredients as possible
4. Made of good quality materials
5. Prepared properly
6. Economic
7. Devoid of toxic principles
8. Stable over a reasonable storage time

1.1. What are the peculiarities of rabbits as far as feeding is concerned?

1.1.1. Fiber requirement

Being a species with a peculiar blend of both grass - eating animals and simple - stomached animals, diets low in fibre content causes increased incidence of intestinal problems. A high fibre diet (> 20%) usually will result in increased incidence of constipation and/or infection of the intestines (enteritis). Therefore, a medium amount of fibre (approximately 15 %) is essential to promote intestinal movements and minimize the incidence of intestinal problems.

1.1.2. Eating its own feces (Coprophagy)

Coprophagy or caecotrophy is the re-ingestion of soft faecal pellets (caecotrophs) that are excreted in the early morning directly from the anus. The expulsion of these soft pellets normally takes place 8 - 12 hours after feed intake. This starts by 3 - 4 weeks of age in kits, when they start consuming solid feed and gets well established by 4-5 weeks of age. The soft pellets contain broken down feed particles, gastric secretions and some bacteria from the caecum. This comprises twice the amount of protein and about half the fibre of hard pellets. This is a normal behavioral pattern in this species (in contrast to other species where, this is considered as a vice / abnormal

behavior).

2. Feeding rabbits

2.1. What are the general considerations in feeding rabbits?

The general considerations in the feeding of rabbits include the following:

1. Always provide balanced, fresh feed
2. Feed at least three times a day
3. Feed should have variety
4. Feed at the same time everyday
5. Remove the feed that is not consumed
6. Clean the feed trough and water trough every day
7. Do not provide feed on the floor
8. Do not feed wet fodder
9. Do not feed stale / moldy feed
10. Do not change feed suddenly

2.2. Can all rabbits be fed on the same ration/diet?

Obviously not. The different types of feed are tabulated below:

Feed for rabbits at different stages

Feed	Age/Type of animal	Remarks
Grower ration	2- 4 months	Provided for weaned animals
Adult ration	Breeding stock	Provided for breeding stock
Pregnant animal ration	Pregnant females	Provided for pregnant

	does
Ration for lactating female	Doe with litter	Provided for lactating does

2.3. What are the ingredients used for making a rabbit feed?

Ingredients for feeding rabbits are classified into a) Roughages and b) Concentrates.

2.3.1. What are roughages?

Roughages are bulky feedstuffs containing relatively more of less digestible substances with high fibre content. As a general rule it could be said that roughages contain more than 18 % of crude fibre.

Roughages used for feeding rabbits could be broadly classified into succulent roughages and dry roughages. Succulent roughages like fodder crops, tree leaves, pasture grass etc. contain more of moisture (60 - 90 %), whereas, dry roughages like straw and hay contain less moisture (10 - 15 %).

Succulent roughages can in turn be sub-divided into leguminous and non-leguminous types. The former are nutritionally very good in that they have high protein content.

In rabbit feeding, 60 % of the dry matter requirement could be met from roughages.

Note: Leguminous plants also fix atmospheric nitrogen in the soil with the help of their root nodules. This particular feature helps in reducing the cost of manuring and improves soil fertility. Another advantage with this type of fodder is that it is possible to intercrop these among other grasses, thus saving space and improving the quality of the forage.

2.3.1.1. What is the meaning of "Dry matter"?

All the feed ingredients an animal consumes consists mainly of two components namely 1) Water and 2) that which is not water; i.e., Dry matter. Since water, although extremely essential for normal health of the animal, doesn't supply any nutrients (like carbohydrates, proteins, fats, minerals and vitamins), for computation of nutrient intake by the animal, dry matter is the

criterion.

This is particularly true in case of grass - eating animals because there is a wide range in dry matter content of the feed ingredients they consume: for example, fresh grass contains a conspicuously high water content.

It is the dry matter which is converted into various nutrients by the microorganisms in their digestive system. Hence, feed intake is considered on dry matter intake for assessing nutrient sufficiency of the feed/ration.

2.3.2. What are concentrates?

Concentrates, are feedstuffs containing high nutritive value with highly digestible materials and less of fiber. These are available commercially in different brand names.

2.3.3. Commonly used ingredients in rabbit rations

The following are the ingredients generally used for preparing a rabbit feed:

1. **Maize:** Can be very well used for preparing a concentrate feed as it contains very high amount of carbohydrate. Maize grains should be coarsely ground or crushed before feeding.
2. **Sorghum:** Possesses about 95 % of the energy feeding value of maize grains. Should be crushed before feeding.
3. **Wheat bran:** Can be incorporated as it has a feeding energy value of about 85 % of that of maize grains. It has high fiber content and so should be used not more than 40 % of the ration.
4. **Rice bran:** Contains a higher percentage of fat; but, due to fiber content greater than wheat bran it has a lower feeding value than wheat bran. In addition, it has laxative effect. Hence, it should not be used more than 30-50 % of the ration.
5. **Rice polish:** This ingredient is rich in B complex vitamins and when used without de-oiling, it is rich in energy also. It is used in most animal feeds. It can be added up to 30% levels.
6. **Cassava / Tapioca:** Four parts of cassava/tapioca can replace one part of maize. It contains a toxic principle and so, it should be dried before feeding.

7. **Ground nut oil cake:** the byproduct obtained after the extraction of ground nut oil and is a good source of protein. However, it should be incorporated cautiously because of the presence of aflatoxin, in case, it is contaminated with fungus. This gets rancid if stored for a long period of time.

8. **Bengal gram:**Contains high percentage of protein. Disadvantage is that it is costly.

9. **Black gram husk:** a by product that can be easily accommodated in the ration of animals.

2.4. If I have sufficient land, can I grow fodder?

Yes. In addition to convenience in feeding and availability of fresh fodder, one can save cost on transportation and realize higher profits.

Note : Farmer can consult the nearby Department of Agriculture and/or Animal Husbandry for rooted slips/seedlings/seeds/sets of the fodder crops which are made available at subsidized rates at many centers.

2.4.1. What are the leguminous crops that can be cultivated?

1. **Stylosanthes:** mostly perennial (yields for many years) and highly suitable for intercropping with other grasses and also as a pasture grass. It is drought - tolerant, rich in crude protein content (16-17 %), tolerates a wide range of soil conditions (like laterite, acid and alkaline soils). The average yield of this crop is 40-50 t/ha/annum. Different varieties of Stylosanthes are available (like Stylosanthes scabra, Stylosanthes hemata).

2. **Centro:** a very good drought - resistant, shade - tolerant, mild acid - tolerant, perennial crop. Suitable for hot - humid climate but not for cool climate. Crude protein content averages 18-21 % and yields about 30-35 t/ha/annum.

3. **Cowpea:** an annual crop (yield for one year only) highly suitable for intercropping with other perennial grasses. Important features include tolerance to arid and semi - arid climate, drought and water - logging conditions. Crude protein content is very high (19-20 %) and the yield is around 40-45 t/ha/annum.

4. **Lucerne:** Annual as well as perennial cultivation is possible. Important features include tolerance to frost and drought conditions and suitable to cultivate in hot - humid regions. Major disadvantage is that this crop cannot tolerate water - logged conditions. Crude protein content is very high (20-22 %) and the yield is around 70-80 t/ha/annum.

5. **Sitratro:** a perennial crop highly suitable for arid and semi - arid regions. Important features include tolerance to shade, tolerance to acid soils, good for intercropping with other fodder crops. It has crude protein content of 16-18 % and the yields about 30-40 t/ha/annum.

6. **Hedge leucern (Desmanthes):** a perennial shrub growing to an average height of about 1.2 to 1.5 m (4-5 feet). It is highly palatable and can be grown as inter - crop along with fodder grass. Crude protein content is about 19-21% and the average yield, 125 t/ha/annum, as a sole crop (i.e., not as an intercrop)

7. **Agathi:** a fast growing perennial tree, highly suitable for tropical conditions. The crude protein content averages 36 % and the yields around 60 t/ha/annum.

8. **Subabul (Lucaenea):** a drought - resistant, highly nutritious, perennial fodder tree. It can grow under different conditions like dry and wastelands, acidic, alkaline and saline soils. Crude protein content is about 26 % and the yield, 40-50 t/ha/annum. Feeding of this fodder is to be limited (10 - 30 % of the fodder allowance) as the leaves have a toxic factor called mimosine.

2.4.2. What are the non - leguminous fodder crops for cultivation?

1. **Hybrid Napier grass:** a highly palatable, nutritious, high yielding, fast growing green fodder crop. This crop is highly suitable for tropical conditions. Different varieties of planting material (called Sets) are available (like CO2, CO3, NB 21 etc.). Crude protein content is 8-10 % and the yield, 200-250 t/ha/annum.

2. **Guinea grass:** A highly suitable grass for tropical conditions with different varieties (like Hamil, Mackuenii etc. as rooted slips). Crude protein content is 7 % on an average and the yield is 100-150 t/ha/annum.

3. **Anjan grass:** a drought - resistant, tropical grass. Black Anjan and White Anjan are two varieties. The crude protein is 5-6 % and the yield is about 30-45 t/ha/annum.

4. **Para grass:** a grass variety that can tolerate water - logged conditions very well. It has crude protein around 7 % and the yields 100-150 t/ha/annum.

2.4.3. What are the requirements of feed for rabbits?

Concentrate allowances for rabbits Amount of concentrate (g) per day

Type of stock	Small	Medium	Large
Young stock (weaners)	60-80	80-100	100-120
Adult (non-pregnant)	80-100	100-120	120-140
Adult male (breeding)	80-100	100-120	120-140
Pregnant female(1st 3 weeks)	100-120	140-160	160-180
Pregnant female(last week)	*Ad. lib.*	*Ad. lib*	*Ad. lib.*
Lactating doe with litter	*Ad. lib.*	*Ad. lib*	*Ad. Lib*

All animals require feed for mainly two purposes: 1) Maintenance of normal physiological functions of the body and 2) Growth, production and reproduction. Both these requirements are considered on dry matter intake of the animal.

From 3 weeks onwards, kits will begin to eat solid feed. Too much of green grass will lead to diarrhea in the case of kits and adults.

Feed intake and water intake depends up on the type of the animal, age, stage of production / physiological stage (like grower, breeder, pregnancy, lactation), climatic conditions and the type of feed. It is found that feed and water intakes increase considerably after kindling. There will be a considerable reduction in the quantity of feed consumed and an increase in the water intake by rabbits as the atmospheric temperature increases.

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Rabbit Management

Management in a rabbit farm includes

1. Management of stock purchased.
2. Management of pregnant animals.
3. Management of animal at kindling.
4. Management of newborn kits.
5. Management of growers.
6. Management during adverse climate.
7. Waste management.

1. Management of breeding stock

1.1. Males (Bucks)

Bucks can be put for breeding from 8 months of age and can be used for breeding up to the age of 3 years. Young bucks (8-12 months of age) should be allowed to mate only one doe per week and older bucks (more than 12 months of age) can be mated to 4 - 6 does in a week.

Breeding bucks should be housed individually (one animal per cage) from 3 months of age onwards. It is during this stage that they start display of aggressive behavior. Dominant males may even attack other males causing severe injuries.

Body condition should be kept trim (not too fatty or not too lean)

especially during the breeding period.

Provide proper health care and a well balanced diet. Fresh drinking water should be available always.

Proper foot care and hygiene should be practiced. The nails should be kept short and trim (not over grown).

Give adequate protection from thermal stress as animals generally show low libido especially in high environmental temperature.

The animal should be subjected to physical examination and should be screened for infectious diseases periodically.

1.2. Females (Does)

Does should be allowed to mate only after they attain 6 - 9 months of age in medium sized breeds and 9 - 12 months in large sized breeds. In the case of small sized breeds, 4 - 6 months would be the ideal stage.

It is found that small sized breeds grow and mature early (when compared to large breeds) and well fed rabbits mature early than poorly fed animals.

Management of breeding does is very important and can be conveniently divided into three phases as - during pregnancy, during lactation period and during dry period. Care during pregnancy is given separately.

During the lactation period, the doe will experience great stress and the nutritive requirements are greater than during other times. During the dry period, the doe recovers from the stress of pregnancy and lactation. The animals should be fed according to their body condition.

Before breeding, it would be better if the does are subjected to flushing (increasing the plane of nutrition), a practice that favors higher kindling percentage. Does that are subjected to flushing produce more ova and hence, produce more number of kits.

In addition, better management, disease control measures, adequate protection from adverse weather conditions, maintaining the correct male-female ratio for breeding, use of healthy males etc. are expected to improve breeding performance and efficiency.

1.3. Breeding problems

1. The buck or the doe may be of very young age or too old.
2. The doe may not be in the right receptive stage. Introduce to the buck after 4 days.
3. Too thin and weak does do not breed.
4. Does and bucks with disease and injuries do not breed.
5. Does and bucks do not bred during molting (natural falling of the hairs) time.
6. Sterility: if a buck has failed to make several does pregnant or a doe has failed to become pregnant with different bucks, they can be considered as sterile.
7. Weather: during summer months and in high humidity, breeding will be affected, leading to temporary sterility (especially in the buck).

2. Breeding behavior

2.1. Males (Bucks)

Tail flagging is a very common behavior exhibited by breeding male rabbits. The buck elevates its hind quarters and walks stiff-legged. During this time, the animal keeps its tail across its back, in a flat position and displays the underside of the tail (in coloured breeds, this will be white). The buck then circles around the cage and shows different flagging movements of the tail. This behavior, entirely limited to the male, helps in providing a visual stimulus to the female. In addition there will be release of secretions from the inguinal glands that act as olfactory stimulus.

The buck turns its hindquarters towards the doe and ejects a jet of urine. Then it circles around the cage.

2.2. Females (Does)

Female rabbits do not ovulate spontaneously like in other species of mammals. In this species, ovulation occurs only after mating, thus making this species an induced ovulator (other induced ovulator species include all cats and camels). In general, ovulation occurs in rabbits about 10 hours after mating. Some females may even fail to ovulate after mating (due to hormone

deficiency).

It is found that female rabbits vary widely in their receptivity and there exists a typical rhythm. In general, mature does become receptive to males in intervals of 4-6 days. This rhythm in reproductive activity is usually referred to as oestrus behavior rather than oestrus cycle.

A receptive doe will have a congested and moist external genitalia and show restlessness and chin rubbing. The degree of mating receptivity is indicated by the colour and the amount of moisture of the external genitalia. A doe is most receptive when the external genitalia is red and moist. During this period, the doe shows lordosis (a typical arched back condition) with raised hindquarters. Non-receptive does usually have a white-pink colour in the genitalia.

It is found that reproductive changes are more influenced by atmospheric temperature rather than duration of light. There is a drop in the conception rate during the summer months and this becomes normal once the atmospheric temperature becomes less.

2.3. Mating

The best time for mating is early morning or late evening, when the environment is cool.

The ideal buck to doe ratio is 1:10. It is preferable to leave the doe in to the cage of the buck for effective mating. When a receptive doe is placed in a buck's cage, the doe will immediately raise its hind quarters and allow mating. This depends up on the stage of receptivity. Following ejaculation, the buck falls off backwards or sideways.

A single mating is enough for a doe to get pregnant. It is preferable to observe and make sure that mating has actually taken place, before removing the doe from the buck's cage. It is better to return the doe back to her cage and bring her back into the cage of the buck for further mating, if mating has not taken place.

If the doe does not stand for mating, remove her from the buck's cage immediately and re-introduce her after 4- 5 days. Still, if mating does not take place, it is better to change the male.

Does that are not bred for a long time i.e., those that have experienced

long periods of rest, tend to become fatty and difficult to breed. In addition, does and bucks that are maintained in complete darkness cease to breed. It is found that exposing male and female rabbits to 15 - 16 hours of light improves reproductive performance.

Another important factor affecting the reproductive performance of both male and female rabbits is increased atmospheric temperature. Increased temperature results in increased embryonic mortality, thus affecting the litter size. Temperature adversely affects the feed intake also. Therefore, it is essential that both male and female rabbits should be given adequate protection from thermal stress.

In the case of backyard or small scale farming, it is better to have the doe mated for at least five times in a year so that five litters could be expected in one year.

3. Management of pregnant animals

3.1. How to detect pregnancy in Does?

Pregnancy can be detected by placing the hand over the abdomen (in between the hind legs) and palpating the growing foetus. The best time to palpate is 12-14 days after mating. On palpation, the embryos would be like large beads of about 1 - 2 cm diameter (grape-like). While palpation, exert only very light pressure on the abdomen.

Pregnancy can also be detected by "test mating" the doe with a buck. In this case, normally, pregnant does do not accept a buck. But, this cannot be considered as a foolproof test as some does accept a buck when pregnant and some may refuse a buck when non-pregnant.

Increased thickness of the mammary gland can also be considered as an indication of pregnancy.

The gestation period is 30-32 days. This may depend up on the litter size (number of young ones) to a certain extent, i.e., larger litters are carried for a shorter time than small litters.

3.2. What are the general signs of pregnancy?

1. Tendency to accumulate fat.

2. More docile nature.
3. Enlargement of the abdomen.
4. Movements becoming slow.
5. Segregating from other animals.
6. Enlargement of teats.
7. Preferring to rest most of the time.

3.3. How to take care of pregnant animals?

1. During early pregnancy, does should not be disturbed and transportation should be avoided
2. Avoid fighting with other animals; hence they are isolated into individual pens
3. Sick and aborted animals must not be in the proximity of pregnant does
4. Pregnant does must be protected from extreme cold and hot climate; wherever extreme cold is expected, room heaters may have to be installed in the house. When the weather is very hot, intermittent spray of cold water by installing showers in the house is advisable
5. Provide adequate amount of clean, fresh drinking water
6. Provide easily digestible, well balanced feed
7. Give sufficient clean bedding material

4. Management of animals at giving birth to kits (kindling)

4.1. How to know a Doe is about to kindle?

The process of delivery /parturition in rabbits is called "kindling". Kindling occurs normally in the early morning. It will be over by 30 minutes under normal cases.

Several days prior to kindling, the pregnant doe collects soft materials like pieces of hay, soft grass etc. and carries to the nest box that is provided in

the cage. A nest will be made out of this and will be lined by hairs pulled out from its own body. The young ones are delivered into this nest.

If kindling does not take place within 32 days of gestation, it is better to have Veterinary intervention. Administration of Oxytocin (1-2 IU) can be tried to induce kindling.

4.2. What I can observe during kindling?

Few hours before the actual kindling, the pregnant doe exhibits typical lack of interest in feed (anorexia) and severe restlessness. If any of these symptoms are seen, the farmer can make sure that kindling is imminent. Watch the animal from a distance. Do not disturb the animal during normal delivery. Assistance is required only when there is any difficulty (dystocia).

As the young ones are born one by one, the doe eats the placenta and cuts the umbilical cord. The survivability of the young ones is influenced by the abnormalities associated with nest building like not building a nest, delivery of young ones outside the nest and scattering of the young ones. Other features include cannibalism and failure to suckle on the first day. Provision of adequate balanced feed and water to the doe can help to prevent this condition to a great extent. It is better not to disturb the doe with kits.

4.3. What are the management steps during kindling?

5. Management of newborn kit

5.1. How to take care of the new - born kits?

The kits are born naked (without hairs on the body) and have their eyes closed. Eyes open by about 12-14 days. Hairs start appearing by 2-3 days after birth.

Tie a knot around the navel cord about 2 to 3 cm from the body of the young one by using a sterile thread. Cut the navel cord 1 cm below the knot (towards the kid). Apply antiseptic solution (like Betadine) to the cut end of the cord. Attending to the navel cord of the new born kit is very important as infection gaining entry through the navel can cause serious conditions. Allow the dam to lick the new born.

Note: The stalk hanging at the navel of the newborn dries and falls off by

itself within two days.

5.1.1. What is colostrum and why its feeding is important?

Allow the new born to suck colostrum at the earliest (i.e. within half an hour). This is very important.

Colostrum is the secretion produced by the udder immediately after kindling (up to 3 - 5 days). It contains a large amount nutrients (proteins, vitamins and minerals) and disease - resisting factors in an easily absorbable form. Hence, it protects the kits passively against many infections during early life.

Soon after birth, the intestine of the young one will be able to absorb nutrients and disease - resisting factors far better; after about 3 to 5 days of age, the capacity to absorb such factors reduces significantly. If those factors are not absorbed, they serve no purpose of disease - resistance, but act as any other protein source.

5.1.2. How does the colostrum differ from milk?

Colostrum, being the first milk produced after kindling is rich in proteins (mainly globulins which offer disease resistance to newborn kid) and minerals.

5.1.3. How are kits nursed?

Kits are nursed by the dam only 1-2 times daily. Each kit sucks milk for about 3 - 5 minutes only. This usually takes place at night time. This is sufficient because the doe's milk is very much concentrated, almost three times richer than cow's milk (protein content of rabbit milk: 13 - 15 %, lactose: 0.86 - 0.87 % and fat content: 10 - 12 %). Daily milk yield increases slowly from about 50 g in the first day to around 250 g by the 21st day of lactation. Thereafter, the milk production decreases steadily.

Agalactia or lack of milk secretion is a major problem in lactating does. This can occur at any time and can be due to hormonal disturbances or infection of the mammary gland. Environmental problems like disturbance due to very high sounds, presence of predators in the vicinity, stress etc. also leads to this problem, though to a lesser extent.

The kits depend up on only the dam's milk for at least the initial 3 weeks after birth. Better survivability and growth of the kits can be ensured by proper feeding of the doe during the nursing period (three weeks). After 3 weeks, kits

would start coming out of the nest box and start to nibble on concentrate feed and fodder.

5.1.4. The Doe has died or does not give milk or milk is insufficient for all kits; then, what to do?

Under such circumstances, a replacement doe has to be used and the process is referred to as "Fostering of kits". Fostering is the transfer of kits from one female rabbit to another for the purpose of rearing. This becomes necessary when the dam dies immediately after kindling or when the litter size is too large (more than eight). Transferring the kits to another doe would result in better survivability and growth of the kits.

Fostering should be attempted only when the kits are less than one week of age (this is the time when we can get maximum success). It will be better if the age of the kits to be fostered and the age of the foster mother's kits are almost similar (in any case, the difference in age should not be more than 3 days for successful fostering).

Introduction of new kits should preferably be done in darkness. The kits to be fostered should be introduced in to the foster mother's nest box when the foster mother is not in the cage. Once they are introduced, rub these kits with the nesting material so that they have the similar odour of the foster mother's own kits. Once the kits settle down, introduce the foster mother in to the cage.

Note: it should be borne in mind that fostering does not succeed at all times.

5.2. Care of doe with kits

Good quality balanced feed should be provided ad. lib to the doe during the nursing period. This should be supplemented with good quality forages (especially leguminous fodder). This is very important as the kits depend up on the dam's milk for at least the initial 3 weeks for survival.

Therefore, it is imperative that the doe should receive adequate nutrition for the production of sufficient quantity of milk for the kits.

Nursing does should be provided with plenty of fresh drinking water and a balanced ration for the production of adequate quantity of milk for the kits.

In case a kit accidentally falls out of the nest box, it will not be retrieved

by the dam. Therefore, the edges of the nest box should be of such a height that kits should not fall out.

5.3. Weaning

Weaning is the practice of removing the kits from the mother. Most kits are weaned from their dam (mother) by 4 - 5 weeks after birth. It is better to take the doe out of the cage and leave the kits in the same cage at the time of weaning. The doe can be kept in a cage near to the young ones immediately after weaning in order to avoid sudden separation stress / shock. It is better to record the litter weight at weaning time.

After weaning, the kits should be group - housed in a clean and dry cage kept in a well - ventilated pen. A period of one week immediately after weaning is very critical to the young ones.

6. Management of kits

6.1. General considerations:

Litter size depends up on the ovulation rate and is found to increase from first to second and third litter. Also, it is found that litter size is small for small sized breeds of rabbits when compared to large breeds.

Weight gain and growth rate of kits depend up on the breed and other management factors like feeding, protection from thermal stress, care of the dam etc.

6.2. Identification

This is essential for proper management especially under farm conditions and a compulsory requirement for insurance. The best method of permanent identification is by tattooing the inside of the ear with ink. Polyurethane ear tags could also be used as a means of identification. Self-piercing or non-piercing tags are available in the market. The help of a Veterinarian could be sought for this.

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Health Care

Several diseases/ailments have been reported in rabbits; but, it is not in the purview of this publication to give all the details. Since small - scale rabbit farmer is not likely to be well versed with treatment of rabbits, it is compulsory that he should immediately consult qualified Veterinarian to alleviate the condition/disease at the earliest. In any case, most common of the diseases that are likely to affect rabbits and those that can be easily identified by the farmers are outlined below. For no reason, the details given below be considered complete and exhaustive but, should be treated only as a guideline before Veterinary aid is actually made available at the farm.

Health is defined as the state or condition of the animal in harmony with the environment; in simple terms, absence of disease. Disease is the condition in which the animal shows physiological, anatomical or biochemical changes from the normal which in simple terms the animal is not at ease. Various factors affect the health of all animals and some of the important factors that affect health of rabbits are:

1. Extreme climatic conditions without suitable remedial measures.
2. Faulty housing facility: this includes overcrowding, slippery/improper flooring, lack of proper ventilation, mixing of different age groups, improper drainage in the shed and improper disposal of wastes.
3. Faulty health management: improper sanitation and disinfection.
4. Faulty feeding: suitable quantity of ration of recommended composition not provided leading to nutritional deficiency (ies), contaminants and/ or toxicants in feed and rarely excess feeding.

5. Lack of proper exercise and inhibition of normal behavior pattern.

1. What are the general signs of health in rabbits?

The following are the general signs of health in rabbits:

1. Normal behavior / habits, stance / posture
2. Skin / coat should be smooth and shiny without any injuries or parasites
3. Eyes bright with pink mucous membrane, without any abnormal discharge
4. Ears should be without any discharge and erect depending on the breed characteristic (ears are drooping in lop - eared rabbits)
5. Muzzle should be dry, smooth and shiny
6. Absence of abnormal nasal discharge
7. Normal feed and water consumption
8. Urine should be of light straw color and without any abnormal odor and should be clear (not cloudy)
9. Dung should be of normal color and consistency (pellet form) and of normal quantity
10. Should have normal physiological norms (Respiratory rate: 30-60 per minute, Pulse rate: 130-325 per minute and Rectal temperature: 38.5° -40° C)

2. What are the signs to detect sickness in rabbits?

Contrary to healthy ones, a sick rabbit shows any/many of the following signs:

1. Animals with the head down; dull appearance
2. Tendency to get separated from the group (except while pregnant)
3. Loss of appetite (anorexia), except while in sexual receptivity or pregnant
4. Coarse skin, rough hairs, matting of hairs, loss of hairs

5. Abnormal nasal discharge
6. Sunken appearance of eyes, shedding of tears (lacrimation)
7. Congested, pale or icteric (yellow) mucous membrane
8. Excessive salivation
9. Variation in the physiological norms
10. Changes in the color and consistency of dung and urine
11. Abnormal discharge from the genitalia

2.1. How to take care of sick ones?

Sick animals need extra care and attention when compared to healthy ones. This will help in faster recovery from the illness. A veterinarian has to be requested to visit the animal facility to inspect, diagnose and suggest remedial measure(s). However, the following general precautions can be undertaken whenever sick animal(s) is (are) identified in the farm:

1. Identify the sick animal and isolate the sick animal - separate the sick animal from the group to a separate shed (sick animal shed)
2. Movement of people to be restricted. Attendants looking after sick animals should never be allowed to handle healthy animals. The sick animal(s) has (have) to be attended as often as possible
3. Provide adequate bedding material
4. Follow strict sanitary conditions
5. Provide fresh, clean drinking water
6. Provide well balanced, easily digestible and palatable feed in divided doses
7. Avoid exposure to extreme climate. Provide adequate warmth during cold weather and vice versa. In either case, avoid exposure to too much bright light
8. In case of emergency, prompt first aid measures should be followed
9. In case of hemorrhage, tourniquet to be applied and ice packs used to stop bleeding

10. Assist in respiration in case of difficulty in breathing

3. What are the important diseases of rabbits?

Diseases (including parasitic problems) are responsible for major losses in rabbit enterprise. In majority of the farms, the profit or loss from the enterprise is determined largely based on how well the diseases and parasitic problems are controlled. The use of disease free / healthy animals (breeding stock), preventive vaccinations, prompt diagnosis and treatment and deworming program, clean and disinfected sties, clean surroundings and a good balanced ration can do a lot in preventing losses due to diseases.

Some of the common ailments in rabbits are enumerated below:

1. **Pasteurellosis:** Bacterial disease resulting in respiratory problems like snuffles, broncho-pneumonia, wry-neck and multiple abscesses.
2. **Snuffles:** is rhinitis characterized by discharge from the nostrils, pawing of the nose, loss of appetite. If not treated, it will lead to pneumonia leading to sudden death
3. **Wry-neck:** the causative bacteria migrate from the nasal cavity to the middle ear and cause inflammation leading to twisting of the neck. There will be in-coordination of gait, loss of feed intake and death.
4. **Conjunctivitis:** this occurs when the causative bacteria migrate from the nasal cavity to the eyes causing reddening and inflammation of the conjunctiva and muco-purulent discharge from the eyes
5. **Multiple abscesses:** found on any part of the body. These abscesses contain thick pus. These may spread to many visceral organs like heart, liver and lungs
6. **Coccidiosis:** common in young animals (especially weaners). Symptoms include lack of appetite, weakness, rough coat, distended abdomen, diarrhoea and jaundice
7. **Gastro-enteritis:** fatal disease of rabbits. Low temperature, rough coat, dull expression, crouched position, loss of body weight, diarrhoea etc. are the common symptoms.
8. **Mange:** is a condition affecting the skin caused by Sarcoptes mites.

Symptoms include irritation, scratching, scale formation of the affected parts, open wounds etc. The animal becomes off-feed and there will be loss of condition and death.

9. **Ear canker:** affection of the inner part of the ear causing scratching of the head and ears. There will be exudate from the affected ears.

10. **Sore hocks:** hock becomes inflamed. The affected animal shows restlessness and cannot walk freely. Animal goes off-feed with progressive loss of condition.

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Economics of Rabbit Production

Livestock farming is primarily for livelihood of the farmer and hence, it should be profitable enough for his sustenance. The returns also should encourage him to continue in the business.

For a small-scale rabbit production unit, a stock with 10 does (females) and 2 bucks (males) appear to be optimum. However, there are no set standards to designate a rabbitry unit as small-scale or otherwise. Hence, the forthcoming section will enumerate the method of working out economic returns from a rabbit farm with 10 does and 2 bucks.

1. Technical assumptions

It is essential to have a clear cut foresight for finance, building, stock schedule, items of income and expenditure etc. of the rabbit farm to be established. The following tables give the details concerning the proposed small scale rabbitry unit:

1.1. Finance

The monetary requirements for construction of shed and purchase of animals will be obtained from a lending institution (Bank). The banks give 75% of the requirement, the rest being the farmer's contribution (Entrepreneur's Margin; this is variable with different Financing Institutions). The loan needs to be repaid in five equal annual installments with an interest rate of 12% pa on the outstanding loan.

1.2. Non-recurring expenditure

Table 1: Non-recurring expenditure

Description	Area Dimension	Cost Rs.	Amount Rs
Building	10 m x 5 m	450/sq.m	22,500
Cages-Breeding bucks	60cm x 60 cm x 45 cm	500	1,000
Cages-Breeding does	90cm x 60 cm x 45 cm	600	6,000
Cages-Growers	120cm x 120cm x 45 cm	1,000	10,000
Equipment		1,500	
Total		41,000	

1.3. Other assumptions

The following are assumptions needed for computing profits and cashflow:

1. A single row shed for grower and breeding stock with necessary provision for cages
2. Labor: Self
3. Each doe would give birth to a minimum of 7 kits at one kindling
4. Kindling interval: Five per annum
5. Sale of animals: young ones (finisher) after completion of 3 months of age for slaughter and culled animals at the end of 3 years
6. Mortality: 10%, to be applied on overall profits
7. Depreciation: Building: 2½% pa, Equipment: 5% pa

2. Economics of a 12- animal small scale rabbit farm

2.1. Stock structure

It is highly essential that the expected number of animals (like young ones born, growers, pregnant does) are known to estimate costs and returns. It requires a schedule as per the purchase of animals at the beginning to facilitate calculation of recurring expenditure and income accurately.

In the current program, it is assumed that:

1. Breedable does and bucks will be purchased at the start of the project as ready to breed animals
2. The animals will be allowed natural mating at the farm and the kits (young ones) born will be grown in the farm until they are sold for market and also as breeding stock to other needy farmers (as per the demand).

Table 2: Stock structure

Week	Year I	II	III
2	Mating	Mating	Mating
7	K_I^1	K_{II}^1	K_{III}^1
11	Mating	Mating	Mating
16	K_I^2	K_{II}^2	K_{III}^2
20	Mating	Mating	Mating
25	K_I^3	K_{II}^3	K_{III}^3
29	Mating	Mating	Mating
34	K_I^4	K_{II}^4	K_{III}^4
38	Mating	Mating	Mating
43	K_I^5	K_{II}^5	K_{III}^5
52		Cleaning and disinfection of the house	

Note: It is assumed that 7 kits/mating are kindled; therefore, totally 70 kits every 9

weeks and 350 kits per annum.

3. Management including housing, feeding, handling, disease control and sanitation etc. will be as per standards which have been outlined in earlier chapters in this publication.

2.2. Recurring expenditure

Recurring expenditure differs between I year and the rest primarily because animal purchase is done only during I year, as adult breeding does and bucks are retained for only a period of 3 years.

The following table illustrates calculation of various recurring costs. Note that insurance is done only for the animals purchased for the project.

Table 3 Recurring expenditure (I year)

Description				Rate (Rs)	n
Animal purchase:	Female			250/animal	10
	Male			250/animal	2
Feeding cost	Age	Feed	kg/animal	Rs/kg	
	Grower	Grower/Finisher	0.080	12	350
	Adult buck	Breeder ration	0.150	10	2
	Adult doe	Breeder ration	0.200	10	10
	Total				
Medication (35	0 kits + 12 breeding stock)			362	1,000

Insurance		6 % of the 12 cost
		TOTAL

Calculation

General rule is multiply n with rate; and in case of concentrates, multiply the product obtained with quantity. For instance, cost of buck purchase is 2 x Rs 250 = Rs 500 and cost of doe is 10 x Rs 250 = Rs 2,500, total being Rs 3,000; concentrates: cost of grower feed is 350 no x.08kg x Rs12 x 60 days = Rs 20,160; cost of breeder ration for bucks: 2 no. x 0.15 kg x Rs10 x 365= Rs 1095; Cost of breeder ration for does: 10 no x 0.2 kg x Rs10 x 365 = Rs 7300.

Table 4: Recurring expenditure (II year onwards)

Feeding cost	Age Group	Feed	Kg/animal	Rs/Kg	N	
	Grower	Grower/finisher	0.080	12	350	2
	Adult buck	Breeder ration	0.150	10		1
	Adult doe	Breeder ration	0.200	10		7
					28,555	1
Medication					312	1
					Insurance	1
					TOTAL	2

2.3 Income

A look at stock schedule will indicate the number of growing animals present and animals for sale. The sources of income, their quantity and value are shown below:

Table 5 Income from the enterprise

Items	Description	I Year N	I Year Rs	II Year n	II Year Rs	III Year n	III Year Rs
Animals*	Growers @ Rs180/animal	350	63,000	350	63,000	350	63,0
	Culled bucks	Nil	Nil	Nil	Nil	2	360
	Culled does	Nil	Nil	Nil	Nil	10	1,80
FYM	Growers, 50g/animal/d	350	2,700	350	2,700	350	2,70
	Adults, 100g/animal/d	12	260	12	260	12	260
	Total Receipts	65,960		65,960		68,120	2,00

* Assumed that each kit weighs 2 kg with a dressing % of 60% and selling price of Rs 150/kg

2.4. Cash - flow

Table 6: Calculation of loan

Description	Rs
Non – recurring expenditure	41,000
Purchase of breeding stock	3,000
Recurring expenditure*	6,000
Total cost	50,000
Bank loan (75%)	**37,500**

* Recurring expenditure for 5 batches ≈ Rs 30,000

As indicated earlier, Banks stipulate that credit should be returned in five equal annual installments along with interest for the loan outstanding. They also require a cash-flow showing year-wise expenditure-income statement along with gross and net profits. However, in the case of rabbits repayment is possible in three years itself. The same are tabulated below:

Table 7: Cash - flow

Description	I year	II year	III year	Total
Non-recurring	38,000			38,000
Recurring	32,735	29,735	29,735	92,205
Total Expenditure	**72,855**	**31,945**	**31,945**	**1,36,745**
Income	65,960	65,960	68,120	2,00,040
Income from loan	37,500	Nil	Nil	37,500
Total Receipts	**103,460**	**65,960**	**68,120**	**2,37,540**
Gross profit	30,605	34,015	36,175	1,00,795
Loan installment	12,500	12,500	12,500	37,500
Interest	4,500	3,000	1,500	9,000
Depreciation, building	500	500	500	1,500
Depreciation, equipment	250	250	250	750
Net Profit	**12,855**	**17,765**	**21,425**	**52,045**
Cumulative Net Profit	**12,855**	**30,620**	**52,045**	

Note: Overall profit over 3 years is Rs 52,045 or ≈ Rs 17,350/pa; n other words ≈ Rs 50 per kit reared

SECTION–V
APPENDICES

Appendix – 1

Livestock Housing

Proper house is compulsory not only to protect the animals from the extremes of environment but also to get maximum production by them. It is better to have a less expensive and more comfortable house for animals.

Nomenclature of houses for various farm animals is as follows:

1. Dairy animals: Barn or Byre
2. Pigs: Sty
3. Rabbits: Hutch
4. Sheep and Goats: Pen

Housing requirements for animals vary with the species of animal as well as type or category like weaners, growers, breeders, dry animals, pregnant animals etc. The type and design of the animal house will vary according to the region / location. For example, in the plains the height of the building should be more for effecting good ventilation and in high altitude areas, the height of the house could be slightly less.

A good animal house should:

1. Provide warmth and comfort
2. Have adequate light and ventilation
3. Be convenient to clean and disinfect as and when required
4. Include good drainage facility
5. Provide safety (from injury, from escape)

6. Have separate provision for keeping animals of different categories and sick animals
7. Be labor – efficient

1. What are the benefits of proper housing?

1. House provides protection and comfortable environment for optimum production
2. It facilitates workers attending on the animals
3. Affords protection to the animal from cold, heat, wind, rain etc.
4. Feeding and watering can be easily monitored (and controlled)

2. House structure

2.1. Foundation

A strong foundation is required for any shed.

2.2. Floor

The floor of the barn should be hard and non-slippery, impervious to water and easy to clean. Generally, it is made of cement concrete or by paving bricks.

2.3. Floor space recommendations

To calculate the dimensions of any building, it is mandatory that information regarding number, type and age of animals are available along with their respective floor space requirement. If there are any restrictions on length and / or width of the sty to be constructed, such information should be taken care of while the design is finalized. Similarly, if more than one building has to be constructed, location and separation distance between the buildings also have to be finalized on scientific norms.

2.4. Wall

Wall is the structure that supports the roof and should not absorb moisture. Wall is usually made of bricks and corners are to be rounded off.

2.4.1. Why?

Sharp corners would harbor pests and parasites such as ticks, lice, insects etc., which, in turn, can cause discomfort and/or disease(s) to the animals.

2.5. Roof

Should be strong, durable, weather-proof, bad conductor of heat and should not allow condensation of water toward inner surface.

2.5.1. Material for roof

Roof can be made of thatch, asbestos, tiles, PVC sheet or RCC. PVC sheet would be ideal for a barn to house a small herd as it would be cheap, light in weight and permits natural light inside. Since, only a small herd is taken into consideration in the present case, the roof could be of a single slope (Shed – type house). For such a building, the supporting walls or posts should be higher on one side. Under rural conditions, farmer's can even go for constructing a "lean – to – type" shed; where in the shed is alongside the home.

Double slope roof should be used in large – sized barns, especially in double – row sheds that are generally used to house more than 20 animals.

2.5.1.1. What is overhang and how much is recommended?

An overhang is the projection of the roof outside eaves to prevent water/ rain – water seepage into the building. Generally, an overhang (0.9 to 1.2 m; 3 to 4 ft) is provided. The horizontal distance between tip of the overhang and the side – wall should be at least 1 m (3.3 ft).

Caution: Seepage of rain – water from the side – wall without overhang may be a problem in shed – type houses especially in medium and heavy rainfall areas.

2.5.1.2. What is Pitch and what is its purpose?

Pitch is the angle between "Run" and the roof at the eaves. Hence, pitch provides a gradient (25 to 33°) in the roof to facilitate flow of rain-water.

2.5.1.3. Can the same pitch be employed for all types of roof?

No. If the roof is made of thatches, pitch should be at least 45° to ensure quick drainage of water especially during heavy rain and prevent seepage of water into the shed through the thatch material. With tiles, a pitch of 30° is

generally advised. In case of aluminium sheets or asbestos, pitch as less as 5 to 10° also can serve the purpose.

Caution: Pitch < 45° in thatched roof buildings is likely to leak and/or give – in due to weight of water during heavy to very heavy rain.

Note:

1. The pitch angle can be approximated as the ratio of rise to span times 100
2. In hot regions, it is preferable to paint the top surface of the roof white (to reflect radiant heat) and the lower surface, black

2.6. Manger

A trough or a box like structure used to offer feed and fodder to to animals is called a "Manger". Rabbits are generally reared in cages or on litter; in either case, they require different type of feeding equipment which will be discussed under Section: Rabbits Chapter: Housing

2.6.1. What are the recommendations for manger?

1. Should be made of a hard, impervious material (preferably concrete)
2. Should be easy to clean
3. Corners and inner / outer walls should be rounded off
4. Outer wall of the manger should preferably be higher than the inner wall
5. Floor of the manger should preferably be at a higher level (so that the animals could easily reach the floor of the manger)
6. Convenient for the animal to consume feed and fodder

2.6.1.1. Why should the manger be cleaned regularly?

If the manger is not cleaned properly, fodder/or and other feed material adhering to the bottom of the manger can become moldy and cause infections. To facilitate cleaning, its corners have to be rounded off and a continuous manger is constructed so that it can be flushed with a jet of water from one end.

2.7. Gate

It is preferable to have gates made of iron bars. This would be strong and durable. Gates leading to individual sheds should be wide enough (at least 1.5 m) to allow a trolley to pass through.

2.8. Fencing

Fencing helps contain the animals within a known area and protect from intruders.

2.8.1. What are the recommendations for fencing?

1. Should be strong and durable and at the same time should not cause injury to the animals. For instance, it can't be made of barbed wire
2. The ideal height of the fence is 1.5 m and the space between the strands of wire could be 36 cm in the case of cattle and buffaloes and

2.9. Store room

A separate room for storing feed and equipments is ideal in all farms. The feed store should be dry, damp proof and rodent proof.

3. Species specific recommendations

3.1. Cattle and buffaloes

General considerations for housing of Farm Animals have been outlined under Chapter: Housing (General). In addition to those, the following are the recommendations for Cattle and buffaloes:

3.1.1. Floor space recommendations

	Floor space – Cattle and buffaloes	
Type of animal	Floor space (sq. m)*	Maximum number**
Cow	3.5	50
Buffalo	4.0	50
Breeding bull	12.0	1
Calf	2.0	30

* Covered area ** In one shed

3.1.2. Manger

A trough or a box like structure used to offer feed and fodder to cows is called a "Manger".

Under field conditions, a continuous manger is preferred over an individual manger. A feeding space of 60 – 75 cm should be provided for adult cattle and buffaloes and 40 – 50 cm for calves. This will be helpful for the animals to conveniently consume feed and / or fodder from the manger.

3.1.3. Trevis

Trevis (also called as Crush) is a device that is normally used for restraining cattle / buffaloes temporarily, especially while doing some procedures like examining the animal, putting a nose rope, administering medicines etc. Trevis can be made of iron rods, bamboo poles or wood, with removable rods in the front and backside in order to let animals in and out.

3.2. Sheep and Goats

General considerations for housing of Farm Animals have been outlined under Chapter: Housing (General). In addition to those, the following are the recommendations for Sheep and Goats:

1. Breeding rams and bucks should always be housed individually (in a single pen) away from other animals
2. Advanced pregnant ewes / does should be housed individually (in a single pen)
3. Lambs / Kids and Growers can be housed in groups

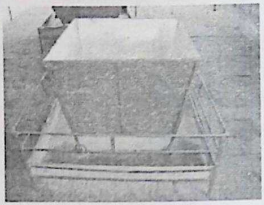
3.2.1. Floor space recommendations

Category of animal (sq. m)	Covered area (sq. m)
Lamb / Kid	0.4
Ewe /Doe	1.0

Ram / Buck	3.4
Pregnant Ewe / Doe & Lactating Ewe / Doe	2.0

3.2.2. What are the recommendations for manger?

Same as in case of Cattle and Buffaloes



A typical movable manger used for sheep / goats

3.3. Pigs

1. Each sty should have: covered area, open area, wallowing tank (except in farrowing pen), and manger and water trough. In addition to these, a farrowing pen should have guard rails and creep feeding area
2. Breeding boars should always be housed individually (in a single pen) away from other pigs
3. Advanced pregnant sows/gilts should be housed individually(in a single pen)
4. In a small – scale farm, like the one considered in this publication, gilts and dry sows could be housed together
5. Weaners / Growers can be housed in groups

Caution: wallowing tank should not be provided in a farrowing pen

3.3.1. Floor space recommendations

Floor space for different categories of pigs (per animal)

Category of animal (sq. m)	Covered area (sq. m)	Open area (sq. m)
Boar	6 – 7	8 –12
Farrowing sow	7 – 9	8 – 12
Weaner/grower	0.9 – 1.8	0.9 – 1.8
Dry sow/gilt	1.8 – 2.7	1.4 – 1.8

3.3.2. What are the special features of a farrowing sty?

This is a sty in which advanced pregnant sows are transferred and housed singly at least two weeks before the expected date of farrowing. The sow with piglets is left in this sty during the nursing period (milk feeding period, i.e., 56 days) also. The main feature of the farrowing sty is that it should provide sufficient space for the nursing sow and the piglets.

Guard rails should be provided all along the wall of the farrowing sty (25 cm from the ground and 25 cm away from the wall). This would help the piglets to run under the rails when the sow lies down along the side wall, thus escape from being crushed.

3.3.3. What are the recommendations for manger?

Same as in case of Cattle and Buffaloes

3.4. Rabbits

Rabbits, unlike other domestic animals, can run and escape easily. Only poultry are comparable to rabbits in this regard. Therefore, there are special considerations for housing rabbits; they are:

a. Rabbits like to stretch out its body and also to stand on its limbs. Therefore, house should allow the animals to stretch out and should be tall enough to allow the animal to stand

b. The floor of the pen / cage should allow urine and dung pellets to pass down so as to avoid problems like sore hock (for details see Chapter on Health care)

c. Rabbits should always be housed in such a way that they can see each

other

Female rabbits require about 12 – 14 hours of light daily so as to reproduce normally. Reduction in the duration of light results in reduction of sexual activity.

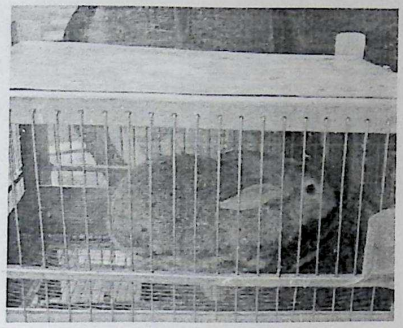
Rabbits are generally reared in cages (individual preferably, but also in community / colony cages). On floor, they are usually reared in groups on litter, which is similar to that of poultry.

3.4.1. Rabbits in cage

Cages could be made of iron mesh (1 inch size) with perforated flooring (1/2 inch size). This will help the dung pellets (droppings), urine and waste feed and spilled water to fall down. These can be collected in a faecal tray placed below the floor of the cage. This arrangement will definitely help to make cleaning of the cage and the floor of the house easy.

3.4.1.1. Optimum dimensions of cages

Animal Type	Length (cm)	Width (cm)	Height (cm)	Number
Doe	60	50	50	Single
Buck	60	50	50	Single
Grower	150	120	50	Group (20)
Doe with litter	90	60	50	Doe with litter



Rabbit in a stainless steel cage

3.4.2. Rabbits on litter

Rabbits can be housed in groups successfully. Categories of animals that can be group housed without any problem include breeding females, doe with kits, single sex group (female) and freshly – weaned young ones. The compatibility of the animals should be looked into while housing rabbits in groups. Also, it is better to house animals of similar body weight / size together. Incidence of aggressive behavior (fighting, agonistic behavior) depends upon many factors such as the age, sex, size, size of the cage, stocking density etc. The "thumb rule" to avoid agonistic interaction between group housed rabbits is "same sex and same size".

Group housing of rabbits

3.4.2.1. What are the benefits of litter / group housing? The major advantages of group housing rabbits include:

1. Improved growth
2. Can exhibit natural behavior
3. Can interact socially
4. Helps in the reduction of vices (like stereotypic behavior, aggression)

Appendix – 2

Sanitation and disinfection

Sanitation is the process of promoting hygiene and prevention of diseases by maintenance of cleanliness or sanitary conditions. This refers to a state wherein pathogenic organisms, even when present, are not a threat to the animal's health.

Disinfection indicates destruction of all vegetative forms of microorganisms, whereas spores are not destroyed. Sterilization means destruction of all infective and reproductive forms of all microorganisms (bacteria, fungi, virus, and the like).

Having an effective sanitation (cleaning) and disinfection program is a crucial step in any livestock– bio-security program. The provision of suitable house alone is not just sufficient enough to meet the requirements of animals. It is necessary that they should be periodically and systematically cleaned. The main purpose of a cleaning and disinfection program is to reduce the number of pathogens (disease – causing agents) in the environment so as to reduce the potential for diseases to occur in subsequent batches. This is the most effectiv method of prevention of diseases.

1. Sanitation

1.1. What are the steps in cleaning the house?

The following procedures are recommended for a complete housecleaning of floor houses:

1. Dung / Litter removed from the shed and shifted as far away from the shed as possible, or a minimum of 100 m

2. House to be swept thoroughly to clean all floors, lighting fixtures, fan blades, if any. Burnt – out light bulbs should be replaced and all other bulbs should be cleaned
3. All permanently installed water troughs, feeders, and any other equipment should be scraped, scrubbed, and cleaned. Miscellaneous equipments (hand feeders) to be removed from the shed to permit a thorough job of disinfection
4. The sills of the shed should be scraped and cleaned
5. All material from inside the shed and clean up litter, trash, and debris from the outside of the shed should be removed
6. The walls, feeders, drinkers and other equipment are to be thoroughly disinfected with a good disinfectant used at the rate recommended on the label
7. Start at the back and work towards the front of the building, spraying the ceiling first, then the walls, and finally the floor

1.2. How to clean the feed system?

In addition to the cleaning and disinfection practices mentioned above, all farmers should implement the following feeding – system clean – up.

1. All feed should be removed from feeding system
2. Any mold ring present in the feeders to be scraped and removed

1.3. How to clean and sanitize waterlines?

1.3.1. What is the procedure to sanitize the well?

If water in the well is used only for the animals, the well can be treated with sodium hypochlorite (household bleach) dumped directly into the well. Water is then run through all the lines until chlorine can be smelled at the end of each line. The water is allowed to stay in the lines a minimum of 24 hours.

1.3.2. How to sanitize waterlines?

The best way to distribute chlorine solution quickly throughout the drinking system is to remove the drain plug at the end of each line or to temporarily disconnect the last drinker. Some drinkers do not lend themselves

to easy cleaning.

Note: A weekly treatment with baking soda (sodium bicarbonate), made through the medicator while the animals are in the building, helps reduce slime from drinkers, valves, and pipes. A baking soda treatment should follow immediately any treatment of water with antibiotics or vitamin packs.

1.3.3. How to sanitize water in an overhead tank?

1.3.3.1. By bleaching powder

Sanitization of drinking water can be effected by addition of 3 to 5 g stabilized bleaching powder (35% chlorine) per 1000 lit so that chlorine concentration does not exceed 1 to 2 mg / lit (ppm). Water is ready for use after about an hour's time. This method is the cheapest of all methods.

Note: Bleaching powder does not dissolve easily and hence, it is first dissolved in a small quantity of water and the resultant concentrate is poured into the well / overhead tank, as the case may be.

1.3.3.2. By iodophor compounds

General rule for using iodophor compounds is to provide 1.6% of available iodine / povidone iodine.

1.3.3.3. By quaternary ammonium compounds

The active principle is alkyl dimethyl benzalkonium chloride which is also effective against algae; the latter helps control blocking of pipes by algal growth. Recommended dosage is 100 ml / 1000 lit.

1.3.3.4. By hydrogen peroxide (H_2O_2)

Stable H_2O_2 suitably stabilized is available commercially; for 1000 lit of water, 10 to 30 ml is sufficient and sanitization process needs 2 hours.

1.3.3.5. By glacial acetic acid

This method is employed only when the organisms have developed resistance to other sanitizers. The dosage is 200 ml /1000 lit.

1.4. What is the procedure to restart after cleaning?

The following checklist of procedures should put the shed and its equipment back in running order after a cleanout.

1. Make sure that all electrical circuits operate properly
2. Fill all light sockets with a clean, operative light bulb
3. Check all water lines for wear, cracks, and leaks
4. Check the feeding equipment for proper assembly
5. Operate all equipment to ensure that it runs smoothly and without abnormal noises

2. Disinfection

Disinfection involves the use of a disinfectant that will reduce or kill the pathogens. Disinfectants are more effective at warmer temperatures. There are several types of disinfectants, and the one chosen should be effective against the disease agent(s) and several commercial preparations are available in the market; the farmer can get those details from the nearby Veterinary hospital /Animal Husbandry Department.

2.1. What are the general properties of disinfectants?

General properties of common disinfectants are shown below:

Table 1. Properties and uses of some disinfectants

Properties	Chlorine	Iodine	Phenol	Quaternary Ammonium	Formaldehyd
Bactericidal	+	+	+	+	+
Bacteriostatic	-	-	+	+	+
Bacterial Spores	±	-	±	-	-
Fungicidal	±	+	+	±	+
Viricidal	±	+	+	±	+
Insects	-	-	-	-	+
Worm eggs	-	-	±	-	-

Toxicity	+	±	+	-	+
Activity with organic matter*	++++	++	+	+++	++
Personnel	+	+	-	+	-
Foot Baths	-	+	+	+	-
Residual Effects	±	±	++	+	±
Water sanitation	+	+	-	+	-
Rabbit shed	±	+	+	+	+

* Number of + indicates degree of affinity for organic material and corresponding loss of disinfecting action (negative property).

+ Positive property - Negative property ± Limited activity for specific property

2.2. What are the advantages and disadvantages of disinfectants?

Advantages and disadvantages of disinfectants are summarized below:

Table 2. Commonly used disinfectants

Disinfectant	Advantages	disadvantages
Iodine or Iodophor or organic iodine As disinfectant: 50 to 75 ppm	Effective against various pathogens; bacteria, fungi and some viruses if used in sufficient strength and are not affected by hard water or other	They are quickly and easily tied up by organic material. This renders the iodophor useless for disinfection. Therefore, rabbit sheds have to be cleaned thoroughly
As drinking	chemicals such as	before iodophor can do

water sanitizer: 25 ppm	detergents and acids which are often used in combination with disinfectants. They are speedy disinfectants and good in combinations.	their disinfecting. They leave no residual effect. Once applied to a clean surface and the iodophor has dried, the disinfecting properties are lost.
Most commonly used disinfectant	They are good foot bathes as they have a color indicator when used up. They turn a brownish orange when not effective.	
Chlorine As Disinfectant: 200 ppm	Effective against most bacteria and fungi. Chlorine disinfectants kill very rapidly and are not affected by hard water and detergents.	They are very easily tied up by organic matter and lose their disinfecting capabilities. Shed has to be thoroughly cleaned before using chlorine as a disinfectant. They have very little residual effect after they have dried. They have odor when used in high concentrations. Face masks are needed to keep fumes from nose and eyes.
As sanitizer: 50 ppm		
Quaternary Ammonias (n-alkyl dimethyl benzyl	Odorless, clear, generally non-irritating, has a deodorizing and detergent action. They kill pathogens,	Their disinfectant range is not as wide as iodine or chlorine. They are not very effective

ammonium chloride) As disinfectant 400-500 ppm As drinking water sanitizer 200 ppm	against which they are effective, very rapidly. These compounds leave a residual effect, after being applied to a surface. They continue to have a killing effect for a few hours or even a day after they have dried.	against fungi and viruses. They are less effective when tied up by organic matter.
Cresols and Cresylic Acid Disinfectant: 1 l in 4- 5 l oil or 1 l in 30 l water Best disinfectant; but most expensive	Are effective against all bacteria, most fungi and most viruses. They are also effective against insects, eggs from insects and worms. They kill quickly, penetrate organic matter and maintain their effectiveness after being in contact with organic matter, for some time. Residual disinfecting capability is very good. They retard bacterial, viral and fungal growth even having been on a surface for a month, they can also be used in water solutions and are effective.	They have a strong odour and is probably effective as long as the odor can be detected. It is also very irritating to skin, and lungs if inhaled. Persons using this disinfectant must be protected by facial breathing masks with air filters. This material is extremely combustible when mixed with oil. They are expensive and hence, are excellent terminal disinfectants.
Synthetic Phenols (Orthophenyl phenols) Disinfection: 1000 ppm Widely used and very	They kill organisms quickly and are not easily tied up by organic matter. This group leaves a residual effect. These disinfectants are effective against bacteria and some bacterial spores. They are quite	They are expensive when compared to iodine or chlorine disinfectants. Eggs of worms are destroyed by these disinfectants only when used in high concentration. They

effective	effective against fungi and for the most part, are effective against viruses.	have no color indicator to tell the user that the disinfectant is tied up by organic matter. Their residual effect is not as long lasting as creosols. High levels are needed to disinfect.
Caustic Soda (Lye) Not widely used	This disinfectant is effective against all types of bacteria, bacterial spores, fungi and most viruses. Their corrosive property destroys worm eggs.	The disinfectant is corrosive. Protective clothing (oil skins) and face masks are a must when using these disinfectants. They are usually used on floors.
Formaldehyde Gas (fumigation)	Formaldehyde gas kills bacteria fungi, viruses and insect life, if used properly.	Formaldehyde gas is noxious to humans and animals. The building has to be airtight. During the winter period it can be difficult to keep the temperature above 24°C. A dry summer heat will make it difficult to keep the relative humidity above 75%. The formaldehyde gas does not penetrate layers of organic matter (dust, feces, etc.), so the building to be disinfected has to be thoroughly cleaned.

2.3. What are the recommendations for use of disinfectants?

Table 3 Recommended uses and considerations for disinfectants

Disinfectant	Recommended Use	Considerations
Alcohol	Small utensils	Poor residual activity, fire hazard, expensive
Halogens	Water systems, foot baths	Corrosive, poor residual activity, ineffective in presence of organic material
Quaternary ammonias	feeding systems	Non-corrosive, non-irritating, limited residual activity and effectiveness with organic matter
Phenols	General hcuse use	Slightly irritating, good residual activity, effective with organic matter
Coal tar distillates	General house use	Corrosive, irritating, good residual activity, effective with organic matter
Aldehydes	Fumigation	Highly toxic, slight residual activity, effective against spores and fungus
Oxidizing agents	Small utensils	Poor residual activity, corrosive, ineffective in presence of organic material

Adapted from : Smith on internet

3. What is formaldehyde fumigation

Formaldehyde fumigation is disinfection by formaldehyde gas and it is employed for disinfecting sheds, equipment and other related material, on a regular basis. Formaldehyde (HCHO) is a gas sold commercially as a 40% solution (37% by weight) in water as formalin. It is also available in powder

form called para-formaldehyde containing 91% of formaldehyde which when heated to 232°C, liberate the gas.

3.1. What are the requirements for proper fumigation?

There are four requirements that are essential in order to obtain the maximum germicidal activity from formaldehyde. If one or more of these requirements is ignored, the germicidal effect of the gas is reduced. Requirements are:

1. Temperature: 24 to 38°C
2. Relative humidity: ≤ 75%:
3. Time: depending on temperature, humidity, concentration and area to be disinfected and
4. Concentration depends on the material to be disinfected

3.1.1. What is the method for fumigation?

The most popular method of formaldehyde fumigation is to mix the 40% formalin onto potassium permanganate ($KMnO_4$) kept in an earthen pot to liberate the gas.

3.1.1.1. Why earthen pot is used?

The reaction is exothermic (heat – producing) and, in fact, the heat generated is useful for the release of the gas. Therefore, the $KMnO_4$ crystals are kept in an earthen pot deep enough to hold the volume several times that of the combined chemicals to avoid the spillage of contents during bubbling and splattering that take place in the process.

3.1.1.2. Why formalin is added to $KMnO_4$ but not vice versa?

For the same reason (excess heat generated), KMnO4 must not be added to formalin, but the crystals must be kept first in the earthen pot and formalin is poured onto it.

3.1.1.3. How much of formalin and $KMnO_4$ have to be used?

Two parts by volume of formalin to one part by weight of $KMnO_4$ are used. Usually, 40 cc of 40% formalin and 20 g of $KMnO_4$ for every 2.83 m^3 (100 cft) is known as 1X concentration. For the same area, if the quantity of the

chemicals is doubled, it is called 2X and so on.

3.1.1.4. How to know that the quantities used were correct?

If, after the reaction, the residue is purple, the quantity of formalin added is more; when proper quantities are used, a dry, brown powder will be left.

3.1.2. How to stop the reaction after a period of time?

In the event that the fumigation must be stopped after a period of time, it can be done, most of the times, by opening the doors and curtains on the side walls. However, it can be expedited by sprinkling the fumigated floor area with ammonium hydroxide (NH_4OH) prepared to contain 26-29% ammonia. The quantity of NH_4OH required is equal to one-half of the quantity of formalin used for fumigation.

3.1.2.1. Why one has to come out quickly and close the doors?

Because, the formaldehyde gas, that is released instantaneously is harmful to the eyes of the operator.

3.1.2.2. What is the concentration required for sheds and equipments?

For fumigating equipments, 3X and for sheds, up to 5X concentration for 30 min can be practiced.

3.1.3. Is fumigation efficient for animal houses?

Not totally; Formaldehyde gas fumigation is not completely satisfactory since it is difficult to make the animal house air-tight. For more efficiency, a fan to circulate warm humid air and fumigant, and a source of humidifying moisture are essential especially because formaldehyde, being soluble in water, acts better when humidity is higher (75% or more) and temperature at or above 21.1°C (ideal 24 to 38°C).

Appendix – 3

Record Keeping

1. Farm records

In any commercial farm operation, records of all transactions have to be meticulously maintained in order to arrive at the economic returns of the enterprise. The records must be such that they are accountable, auditable, easy to maintain, easy to understand and convenient to arrive at the economic returns of the enterprise. Registers to be maintained

1.1. For accounting and audit

1. Journal 2. Ledger – feed 3. Ledger – livestock 4. Ledger – medicines 5. Ledger – equipment 6. Ledger – electricity, water and miscellaneous 7. Ledger – sales (livestock) 8. Ledger – sales (manure) 9. Ledger – sales (Gunny bags) 10. Cash – book 11. Miscellaneous register – to maintain records of land, buildings etc.

1.2. For farm operations (auditable)

1. Livestock register 2. Feed procurement and issue register 3. Medicines and vaccines register 4. Building – maintenance register 5. Equipment purchase and maintenance register 6. Miscellaneous expenditure register 7. Sales register (livestock) 8. Sales register (manure) 9. Sales register (Gunny bags) 10. Bank transactions

The registers mentioned above are neither exhaustive nor compulsory; additions/deletions can be made depending on the requirements of the farmer.

1.3. Pro forma for various farm registers

1.3.1. Livestock register

Month and year: **Breed:**

Date	Receipt	Issue	Sold	Died / Culled	Total	Closing balance	Initials

1.3.2. Feed procurement and issue register

Month and year: **Breed** **Adult / Young**

Manufacturer's name and address: **Feed:** **Batch No.**

Date	Receipt	Quantity	Amount	Issue	Balance	Remarks/Initials

1.3.3. Medicines and vaccines register

(Separate registers/pages to be allotted to each medicine/biological)

Month and year: Ingredient

Supplier's name and address:

Date	Receipt	Quantity	Amount	Issue/Discard	Batch No.	Date of manufacture	E. da

1.3.4. Building maintenance register

Date Building constructed	Cost of construction	Name of construction firm	Remarks

1.3.5. Equipment purchase/maintenance register

(Separate sheets for each of the equipments)

Date	Receipt	Quantity	Amount	Supplier details	Issued/condemned /sold	Closing balance

1.3.6. Miscellaneous expenditure register

Date	Item	Quantity	Supplier details	Amount	Issued	Closing balance	Remarks

1.3.7. Livestock sales register

Month and year: Breed: Male/Female

Date	Opening balance	Receipt	Sold	Selling price	Purchaser's details	Initials

1.3.8. Manure sales register

Month and year:

Date	Opening balance	Receipt	Sold	Selling price	Purchaser's details	Initials

1.3.9. Gunny bags sales register

Month and year:

Date	Opening balance	Receipt	Sold	Selling price	Purchaser's details	Initials

1.4. Pro forma for registers – Bank transactions

1.4.1. Journal

Date	Particulars	Ledger folio Credit	Debit	Debit (amount)	Credit (amount)

1.4.2. Ledger

Separate ledger or separate sheets within a ledger have to be maintained

for each of the items like livestock, feed, medicine, sales etc.

Debit				Credit			
Date	Particulars	Journal folio	Amount	Date	Particulars	Journal folio	Amc

1.4.3. Cash-book

Date	Receipt		Credit	
Opening balance				
	Particulars	Amount	Particulars	Amount

2. Trial balance, profit – loss A/c and balance sheet

Any farmer will be interested to know exactly the profit realized by his venture. All records are available in the registers mentioned above; they have to be properly integrated to obtain the actual balance sheet.

Appendix – 4

Waste management

Waste in the case of a livestock farm can be in the solid or liquid form; the former consists of primarily dung, waste grass and bedding etc. and liquid form consists mainly of urine, washings etc. These have to be disposed of in order to ensure proper health of animals by preventing disease entry and spread. The solid waste from a farm has economic value and hence needs to be handled in a different way than the liquid waste, which is mainly eliminated from the farm premises.

1. How to handle solid waste

Solid waste, in general, and dung, in particular, has to be removed at frequent intervals and stored in a manure (dung) pit situated away from the shed; the size of the manure pit depends on the number of animals, nature and amount of feed consumed by the animals and the duration for which it has to be stored. The dung of pigs contains on an average 0.70 % Nitrogen(N), 0.68 % Phosphorus(P) and 0.70 % Potassium(K). Rabbit manure contains Nitrogen – 3.7 %, Phosphorus – 1.3 % and Potassium – 3.5 %). This is normally used as a fertilizer for the soil and for fertilizing fish ponds. It is also suitable for production of biogas.

1.1.1. Why dung has to be removed frequently? Frequent removal of dung is warranted to:

1. Avoid contamination of feed and water
2. Avoid infections (especially parasite worm eggs / larvae, oocysts of certain protozoa and some intestinal bacteria which are infective) that can arise out of dung and other excreta. Dung can be a source of

infection to other animals, farms and humans via feed, water, fomites, rodents, other birds like crows etc.

3. Minimize production of obnoxious gases which can lead to ventilation problems
4. Minimize fly problems particularly because fresh dung is the preferred material in which flies (like house fly and stable fly) lay their eggs
5. Minimize diseases spread by flies not only to other animals in the farm but also to other farms and humans. Flies are the potential carriers of diseases like cholera, typhoid, anthrax, mastitis, dysentery etc.

Note: Flies commonly use fresh dung as a material for laying their eggs. The most important are the house fly (non-biting) and the stable fly (biting). These flies are very important in disseminating diseases to animals and humans.

1.2. Waste disposal

1.2.1. Solid waste (dung)

Dung can be removed /handled by:

1. Incineration and burial
2. Use of chemical agents
3. Manipulation of manure like spreading, drying, turning over the surface, close packing etc.

1.2.2. Liquid waste

Liquid waste is generally routed out of the house through a drainage system, which consists of portions within and outside the house, underground portion and final disposal assembly.

The drains within and outside the house are preferred to have a semicircular cross section so that accumulation of sediments is minimized with facilitation of cleaning and disinfection of the drains.

Drain pipes should:

1. Be made of non-absorbent material
2. Be laid with air – tight and water – tight joints
3. Be laid in straight lines
4. Not have right angled junctions
5. Include enough slope (gradient) to ensure a free flow of wastes
6. Never be laid under the building/sty
7. Be properly ventilated
8. Be laid in deep trenches with a firm bottom

The drain pipe should have the following features:

1. Should have a smooth internal surface
2. Should be durable
3. Internal surface should be non-corrosive
4. Should withstand changes of temperature
5. Should possess sufficient strength to withstand pressure
6. Round pipes are always better (because these offer the least resistance to flow)
7. All joints should be leak – proof

In any case, some defects that are expectable but avoidable by proper lay of the drainage grid are:

1. Blockage with solid objects like grass, straw etc.
2. Imperfect alignment
3. Imperfect laying
4. Insufficient gradient
5. Infrequent flushing
6. Presence of too many bends
7. Junctions not at suitable angles

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Indian Council of Agricultural Research (ICAR) which regulates UG Education (Agriculture, Horticulture, Fisheries etc) has mandated a course on Livestock Production and Management which is essential to understand the livestock which are part and parcel of Agriculture. With organic farming gaining momentum, knowledge of basic Animal Production is more relevant than ever before. Students and teachers depend on many publications, Indian and Foreign, during the course of study / teaching. Therefore, a book with contents conforming to the ICAR Syllabus has been long awaited.

This publication has been prepared keeping the ICAR Syllabus as the framework. The Chapters included are Domestication of livestock, Breeds, Hosing, Feeding and management, Milk production and Milking, Breeding, Control of diseases, Record keeping and Economics of milk production. A separate chapter on Poultry Farming is also included because rearing poultry is conspicuously different from that of other animals.

Each of the Chapters has "Study questions" with both objective and subjective questions which is a unique feature of this publication. Answers are provided only for objective questions. However, the questions listed are not exhaustive and the teacher can develop many more contained only by imagination.

It is hoped that this publication will be received well by all those related to the subject "Livestock Production and Management", in general and students of State Agricultural Universities, in particular.

Educationist Press
an imprint of
WRITE AND PRINT PUBLICATIONS
H-13, Bali Nagar, New Delhi - 110015
Ph: 011-45635684
Email : info@WriteAndPrint.com
Website : www.WriteAndPrint.com

₹ 1200/-
ISBN 978-81-929705-6-1
9 788192 970561

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