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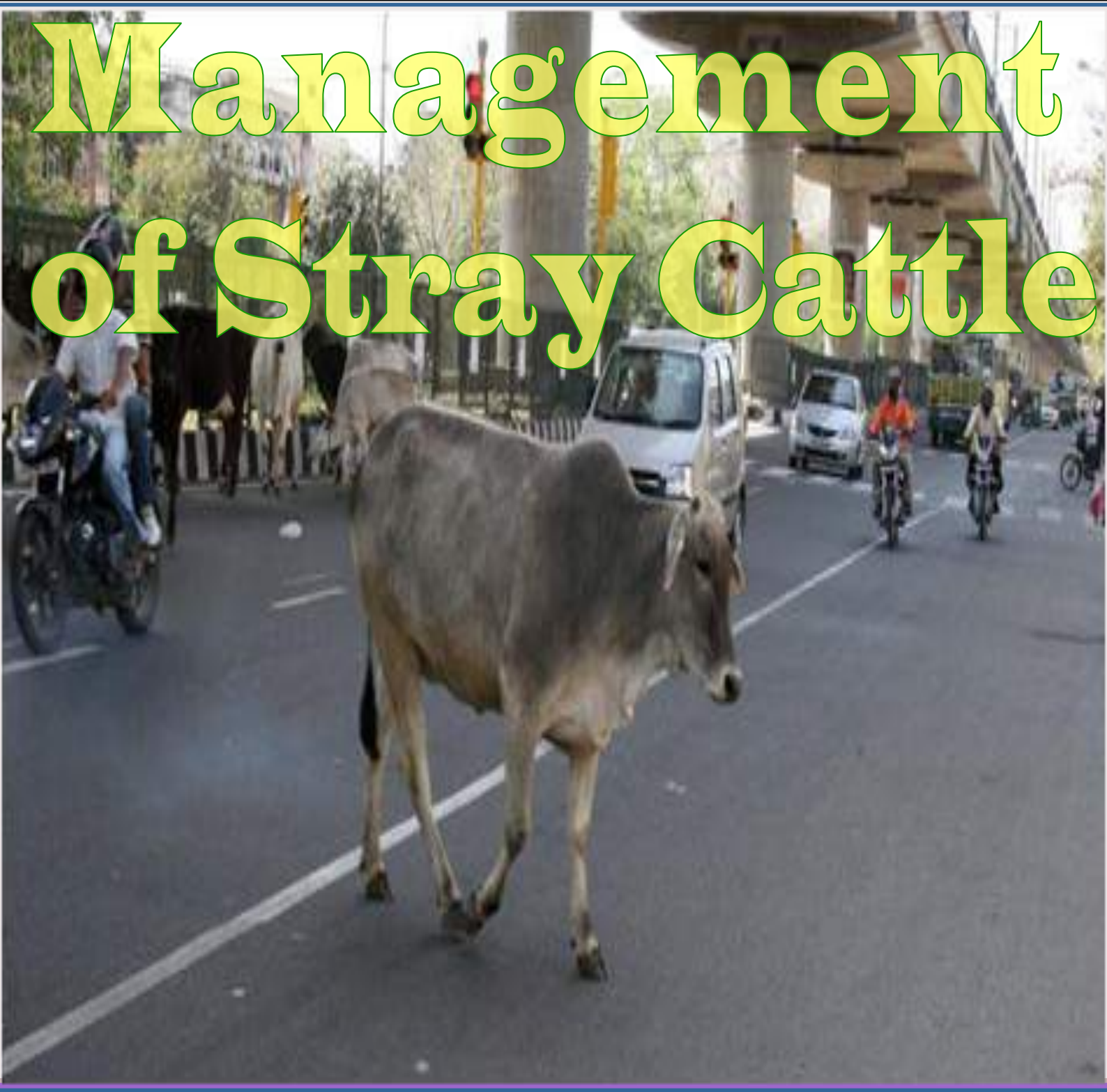
Management of Stray Cattle



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Nutraceuticals in Companion and Laboratory Animal Nutrition

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Abstract

Nutraceuticals are food products that are found to have nutritional and health benefits. Several nutraceuticals have been identified. S-adenosyl methionine (SAM-e), silymarin, omega-3 essential fatty acids, glucosamine (GLM), prebiotics and probiotics,superoxide dismutase (SOD), Glutathione, bioflavonoids, Dimethylsulphoxide (DMSO),methyl-sulfonyl-methane (MSM), Polysulfated Glycosaminoglycan (GAGPS), vitamin E, conjugated linoleic acid (CLA), cholesterol reducers, plant extract/essential oils and vitamin like compounds are some of the predominant nutraceuticals. SAM converts methionine to cysteine and maintains glutathione concentrations. It prevents apoptosis, modulates cytokine expression, decrease lipid accumulation, fibrosis and hepatocellular damage. Silymarin acts as anti-inflammatory and antifibrotic. Omega-3 essential fatty acids are considered to be anti-inflammatory. Prebiotics and probiotics improve host intestinal micro-flora. GLM and GAGPS have chondroprotective action. Free radical scavengers such as SOD, bioflavonoids, glutathione and Dimethylsuphoxide (DMSO) were found to effectively quench the oxygen-derived species (superoxide, hydrogen peroxide, hydroxyl radical). Vitamin E acts as chain blocker of lipid peroxidation. CLA is an anti-carcinogenic, and anti-athirogenic. Plant extracts such as garlic oil, methanol, organo essential oil etc. have been used attributed to their antimicrobial property. Despite of several advantages they do have limitations.

Key words: *Nutraceuticals, Companion animals, Health benefits*

INTRODUCTION

It is a term combining "nutrition" and "pharmaceutical", is a food or food product providing health and medical benefits, such as preventing and treating disease.Such products may include isolated nutrients, dietary supplements with specific vitamins and minerals, herbal extracts and scientifically engineered diets. Pet owners are commonly used these supplements /herbs/botanicals for their animals. Nutraceuticals are not subject to the same

testing and regulations as pharmaceutical drugs. Therefore, their bioavailability and actual concentrations of active ingredients can vary considerably.

Classification of Nutraceuticals

1. **Nutrients**: Substances which are having established nutritional functions such as vitamins, minerals, amino acids and fatty acid etc.
2. **Herbals**: Herbs(or) botanical products as concentrates and extracts. e.g. aloevera, ehedra, garlic, Echinacea, willow bark etc.
3. **Dietary supplements**:Substances derived from other sources. e.g. pyruvate, chondroitinsulphate and steroid hormone precursors etc.

Kalia (2005) classified nutraceuticals into seven groups

1. Dietary fibre
2. Probiotics
3. Prebiotics
4. Poly unsaturated fatty acids.
5. Antioxidant
6. Polyphenols
7. Spices

Examples for Nutraceuticals

- Chondroprotective agents include oral nutraceuticals and injectable glycosaminoglycans. These products may inhibit mediators of inflammation and stimulate metabolic activity of synoviocytes and chondrocytes.
- The combination of glucosamine hydrochloride, chondroitin sulfate and manganese ascorbate (GCM) is a commonly used nutraceutical in osteoarthritic companion animals.
- Some products are prone to contamination (example), omega-3 fatty acids can be contaminated with mercury, lead and polychlorinated biphenyls (PCBs),and herbal products may be contaminated with pesticides and herbicides.

S-adenosyl methionine (SAM-e)

Liver disease

- Oxidative stress plays a major role in most forms of cellular damage, and is defined as an imbalance between oxidant and antioxidant systems.
- The liver has many complex antioxidant systems, and glutathione plays a key role. Glutathione has a very short half-life (around two to three hours), and glutathione levels decrease rapidly following one to two days of anorexia.
- The rate-limiting factor for glutathione production is the availability of cysteine, which is derived from the diet and the methionine breakdown.
- SAM-e is a key component in the biochemical pathway that helps convert methionine to cysteine, and, therefore, helps maintenance of glutathione concentrations. In addition to this key antioxidant function, SAM-e also plays a role in preventing apoptosis in normal cells, modulating cytokine expression and stabilizing membrane functions.
- In animal models of liver disease, SAM-e decreased lipid accumulation, fibrosis, hepatocellular damage and increased survival.
- The main problem with providing SAM-e is the pharmacokinetics – tablets are

enteric coated and should not be crushed or split. In addition, food inhibits absorption and, therefore, tablets must be administered on an empty stomach. SAM-e has a short half-life and poor bioavailability.

- Side effects include nausea and poor appetite.

Silymarin

- Silymarin is the major beneficial active ingredient in milk thistle.
- Silymarin is useful for treating hepatobiliary disease due to its antioxidant, anti-inflammatory and antifibrotic properties.
- In-vitro and in-vivo studies suggest silymarin can protect the liver from a wide variety of toxins, including acetaminophen, ethanol and aflatoxin, as well as from viral, ischaemic and radiation-induced injury.
- Administration of silymarin provided complete protection against acetaminophen-induced liver toxicity in Felines, when given within four hours of toxin administration.
- Silymarin is principally excreted in bile. Despite erratic and unpredictable bioavailability, and a short plasma half-life, concentrations in the liver are usually high due to a preferential accumulation in this location.
- The dose required to achieve a therapeutic effect in companion animals is unknown –Therapeutic formulations should contain 70 to 80 per cent silymarin, but extract purity varies widely.

Cholesterol Reducers

- Dietary supplementation of garlic powder (3%) and copper (63 or 180mg/kg diet) alters lipids and cholesterol metabolism.

Omega -3 essential fatty acids.

- Numerous health benefits have been attributed to an increased N-3 EFA intake. These fatty acids have been "essential" because mammals are not able to synthesis these fat types and, therefore, they must be supplied in the diet. In general, N-3 EFAs are considered to be anti-inflammatory, whereas N-6 EFAs can be pro-inflammatory.
- A large number of studies in both humans and dogs support claims of the beneficial effects of supplementation with omega-3 EFAs in heart disease, cancer, chronic kidney disease, cognitive dysfunction, skin disease and joint disease – and new studies are constantly being published.
- The dogs supplemented with omega-3 EFAs had a higher glomerular filtration rate and decreased proteinuria, creatinine concentrations and renal interstitial fibrosis compared to the omega-6 EFA group.
- It is not just the high concentration of N-3 EFA that is important, but the ratio of N-3 EFA (high concentration) to N-6 EFA (low concentrations). This is likely to be true of the other disease processes where N-3 EFAs are thought to be beneficial, such as skin and heart disease.

- N-3 EFAs' mechanisms of action in slowing cancer growth are complex. It is assumed that the neoplastic cells have a relative inability to use proteins and fats for energy, and preferentially use carbohydrates.
- N-3 EFAs also reverse some of the catabolic changes and improve cachexia, thus improving the individual's ability to fight the disease.

Prebiotics

- Prebiotics are non-digestible feed ingredients that beneficially affect the host by selectively stimulating the growth or activity of one or a limited number of bacterial species, already resident in colon and thus attempt to improve host health. Mainly prebiotics are small fragments of carbohydrates, commercially available as oligosaccharides of galactose, fructose or mannose.
- The findings that mannon oligosaccharides MOS and Osteoarthritis (OA) successfully reduces bacterial load in the intestine of broiler birds were in accordance with the previous findings
- Yeast cell culture residue (YCR) treated broiler chicks resulted lower intestinal coliform population.

Probiotics

- Probiotics are live microbial feed supplements which beneficially affect the host by improving its intestinal microbial balance. This activity is also called support of the balance of the intestinal microflora (Fuller, 1992).
- Increase the immune response
- Compete with pathogen for important nutrients.
- Competitive exclusion.
- Enterotoxins are excluded by probiotics.
- It hampers the attachment and proliferation of pathogens.

Glucosamine (GLM)

- The use of glucosamine for treating mild OA is hugely popular in humans and pets.
- This product is available as a sole dietary supplement or as an additive incanine diets. *Perna Canaliculus* is purported to have mild anti-inflammatory and chondroprotective actions.
- Recent studies in canines showed a significant improvement in arthritic dogs fed a complete diet containing 0.3% GLM. No effect was seen on joint crepitus, range of motion (or) mobility scores. Although the study concludes that a GLM supplemented diet can alleviate symptoms of arthritis in dogs.

Free Radical Scavengers

- Another class of nutraceutical that has been promoted to reduce inflammation is the free radical scavengers such as superoxide dismutase (SOD), bioflavonoids, glutathione and Dimethylsuphoxide (DMSO).
- Oxygen-derived free radicals (superoxide, hydrogen peroxide, hydroxyl radical) are thought to play a role in the progression of DJD (full form)through their ability to damage

cells by oxidative injury. Oxidative damage leads to depolymerization of hyaluronic acid, destruction of collagen and decrease production of proteoglycans.

- Glutathione and SOD are endogenous antioxidants. While SOD acts to stabilize phagocyte cell membranes, lysosomes and reduce superoxide radical levels in tissues, with a resultant decrease in free radical generation.
- Bioflavanols are available commercially usually in combination with glucosamine and hydrolyzed collagen (or) with an assortment of other antioxidants, including selenium, vitamin E and SOD.

Methyl-Sulfonyl-Methane (MSM)

- MSM has been suggested as an agent for management of pain, inflammation and as an antioxidant.

Polysulfated Glycosaminoglycan (GAGPS)

- Chondroprotection is achieved due to the inhibition of various destructive enzymes and prostaglandins associated with synovitis and DJD.
- GAGPShas been found to inhibit neutral metalloproteinases (stromelysin, collagenase, elastase), serine proteases, hyaluronidase and a variety of lysosomal enzymes.
- The drug has also been found to inhibit PGE2 synthesis, generation ofoxygen-derived free radicals and the complement cascade.
- In addition GAGPS also has anticoagulant and fibrinolytic properties that facilitate clearing of thrombotic emboli deposited in the subchondral and synovial blood vessels.

Vitamin E

- Vitamin E is an essential nutrient made up of a family of highly lipophilic antioxidant compounds, the most bioavailable and active of which is Alpha-tocopherol.
- It plays a number of important protective roles, the most important of which is the protection of membrane phospholipids by acting as “chain blocker of lipid peroxidation” and thus prevents oxidative damage.
- It suppresses activation of inflammatory cytokines and of activation ofKupffer and stellate cells.

Conjugated Linoleic Acid (CLA)

- Dietary supplementation of CLA enhances immune response, improve feed efficiency and improve leanness in pig and mice.
- It is an effective antioxidant and has anti-carsinogenic, hupo-cholesterolemic and anti-athirogenic effects.
- CLA has the ability to affect mammary, stomach, skin and prostate cancer.
- Additionally, CLA intake results in reduced lipid uptake by adipocytes which prevents obese condition in animals.
- Levels of CLA in milk,cheese,butter,mutton and beef(4-7mg/g total fatty acid) are considerably

higher than in non-ruminant products(chicken, pork, fish).

- Dietary increase of linoleic acid(C 18:1) and linolenic acid(C18:3) through enriching the diet with cereals, oil seeds, oils is one of the strategies for increasing the CLA concentration in milk (or) other animal products as these fatty acids are precursor of CLA.

Plant Extract/ Essential oils

- Plant extracts such as garlic oil, methanol, organo essential oil etc. have been used from earlier days for various purposes because of their antimicrobial properties.
- Essential oil can be transmitted into milk and the milk flavor can be controlled by feeding dried herbs to dairy cows to increase the antioxidative property of milk, besides decreasing the rate of ammonia N production in rumen. Thus, use of plant extracts appears one of the most natural alternative to the antibiotic in animal nutrition.

Vitamin like compounds

- **L-Carnitine**: It helps in oxidation of fatty acids, promotion of certain organic acid excretion and enhancement of the rate of oxidative phosphorylation.
- **Choline**: It mainly acts as lipotropic agent and used to treat fatty liver and disrupted
  fat metabolism.
- **Vitamin F**: Involved in proper development of various membranes and synthesis of prostaglandin, leucoterines and various hydroxyl fatty acids.
- **Inositol:** It acts as lipotropic agent. It is also necessary for amino acid transport and movement of sodium and potassium.
- **Taurine**: It helps in retina photoreceptor activity, bile acid conjugation, white blood cell antioxidant activity, CNS neuro-modulation, platelet aggregation, cardiac contractility, sperm motility, growth and insulin activity.

Nutraceuticals and Reproduction

- Beneficial effects of different nutraceuticals on mammalian reproduction have been observed. Many of these nutraceuticals have been found to exert a positive effect on mammalian fertility and reproduction efficiency.
- Male reproduction- recommended for improving sperm production and quality in sub fertile male.
- A significant improvement in sperm concentration has been observed when folic acid and zinc sulphate were administered to sub fertile male.
- Arginine, vitaminB12, methylcobalamine and ginseng have been used to treat male infertility.
- Female reproduction- Feeding of linoleic and linolenic acid during peri-parturient period can stimulate the biosynthesis of prostaglandin of the (PG2) series that can benefit the postpartum uterine health of cows.
- Dietary supplementation of calcium salts rich in linoleic acid has been found

beneficial in improving reproductive efficiency in cows.

- β–carotene supplementation during the period of 10-15days through 90days postpartum increases the pregnancy rate at 120days postpartum.

New generation nutaceuticals for animals

- Calasgar (a pelleted feed supplement containing calcium, phosphorus and vitamin D3).
- Garbhamin (a bolus containing essential trace minerals in chelated form and coated vitamins.
- Goumix (a customized mineral supplement)

CONCLUSION

Nutraceuticals are active ingredients that are found in several food products, have nutritional and health benefits, it can be useful for companion animals for prevent diseases and improve their health.

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Modern Tools for Semen Evaluation of Farm Animals

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Artificial insemination (AI) is the most valuable breeding management tool available to dairy cattle breeders to improve the genetic potential of herds. The success of this technique is depends on the quality of semen used for artificial insemination. The main purpose of evaluation of semen, either fresh or frozen thawed to predict its fertility. It is well established that characteristics of bull semen vary widely, not only between the bulls, but also between the ejaculates within bulls and from time to time or season to season (Raval *et al*., 2010). Generally, at semen station of India frozen –thawed semen have been evaluated for many quality control tests as per the minimum Standard Protocol. Among them the post thaw motility examination is the most important tests. While motility is an essential indicator of healthy spermatozoa but alone is not enough to evaluate the fertilizing ability of the semen. Sperm viability and post thaw motility has not proved to be a good predictor of fertility (Martinez-Pastor *et al*., 2010). The population of exotic and their crossbred cattle in India has been ever increasing since last few decades; therefore demand for frozen semen of pure and crossbred dairy cattle is also increasing. So, effective screening methods for ejaculates prior to processing are necessary for improving reproductive performance in bulls.

SEMEN EVALUATION TECHNIQUES

1. **Gross Evaluation of semen**: Volume, color, consistency, density, pH, Scrotal circumference and microbial load of semen.

Normal value (for Cow bulls) (Shukla, 2011)

Volume- 6-12 ml
Colour- Milky white
pH- 6.4-6.5
Consistency- Thick creamy
Scrotal circumference- > 39 cm

Volume of semen helps to determining the status of the accessory gland, sperm concentration and expected dose from the semen sample. Colour of semen can be evidence of injury in the tract. Excellent quality of semen sample will have slightly acidic pH and whereas poor quality semen show pH toward neutrality. In condition like incomplete ejaculation, extensive use of bulls affects the pH of semen. Consistency of the semen should be assessed by slightly tiltling the collection tube and observing the density of semen against the natural light. Scrotal

circumference (SC) is measured by scrotal tape. It reflects the size of the testis. Scrotal circumference (SC) is the best predicts the output of sperm cells for the bulls. There is correlation between the scrotal circumference and the volume of the semen producing tissue of the bulls.

All this seminal attributes gives idea about the quality of semen and sperm producing capacity of the bulls. This also gives idea about the reproductive health and pathological condition of the semen. So further microscopic analysis of semen should be done having warm stage and with phase contrast for better assessment of sperm cells. Microscopic examinations include mass activity, initial motility, sperm vaiblity, cervical mucus penetration test and sperm function test which includes: plasma membrane, acrosomal, and DNA integrity should used as routine examination.

2. Microscopic test for evaluation of semen.

Mass activity

For recording mass activity a small drop of freshly collected neat semen was placed on clean and warm glass slide (37^0C) and observed it without cover slip under the microscope with low power magnification (10x).

Initial motility

Initial motility of semen was recorded by taking a drop of neat semen on clean and warm (35-37^0C) glass slide and placing a coverslip over it. The drop was then observed under the microscope with 40X magnification. The motility of the semen sample was estimated on the basis of number of progressive motile sperm present in the drop and the percentage was calculated on a continuous scale from 0 to 100%.

Sperm Concentration

Concentration of spermatozoa (million/ml) in the neat semen was determined by the bovine photometer $n^0$1062 (Accucell Photometer, Imv Technologies, France).

Percentage of live spermatozoa

Percentage of live spermatozoa was estimated by differential staining technique using Eosin-Nigrosin stain. The unstained spermatozoa were counted as live and pinkish or partially stained spermatozoa were classified as dead. The smears used for live sperm count were also utilized to determine the percentage of abnormal spermatozoa. Abnormalities are classified as head, mid-piece and tail defects.

Special biochemical test

Biochemical analysis of secretion components from prostate, seminal vesicles and epididymis in semen give information about the functional state of these organs (Dhurvey., et al., 2012)[9]. There are many metabolic tests available which help in assessment of semen quality. Metabolic tests such as fructolysis and oxygen consumption are important measures of sperm function (Bratton *et al*.,1956), but these tests are not done routinely because of their complexity (Seed *et al*., 1960). Metabolic activity of spermatozoa is also evaluated by resazurin reduction test. The dehydrogenase activity of semen changes the colour of resazurin firstly into pink (resurufin by an irreservible reaction) then to colourless (Hydroresurufin, by an reversible reaction). The RRT requires little equipment and is simple to apply. Many workers reported a significant correlation between RRT and fertility as RRT evaluates the metabolic status of

active spermatozoa and it is associated with the concentration of motile sperms.

Sperm functional tests

Hyo Osmotic swelling tests (HOST)

The routine methods of semen evaluation have been limited accuracy in predicting the fertilizing potential of spermatozoa in the semen sample, hence in-vitro fertilizing tests can proven to be useful in assessment of fertilizing potential of sire and can act as an effective supplement to the routine semen evaluation methods in accurate fertility evaluation of semen. Hypo-osmotic swelling tests are relatively simple tests to evaluate the functional integrity of spermatozoa membrane. The function of sperm membrane is diagnosed by hypo-osmotic swelling test (Shukla, 2011).The main principle of this test is that cell volume of spermatozoa increases when they are placed in hypotonic solution. The volume increase forces the flagellum to coil inside the membrane.

Acrosomal Intactness of Spermatozoa

The acrosomal cap is a structure covering anterior portion of the sperm head. It contains certain vital enzyme responsible for penetration of ovum. Therefore, acrosmone integrity needs to be maintained to achieve normal fertility. Significant changes in the plasma membrane and outer acrosomal membrane are observed during capacitation. These changes constitute the process of acrosome reaction. The changes during the acrosome reaction include fusion of multiple points between the two membranes and formation of vesicle made up of fragment of the two membranes. The sperm must undergo these changes in the female reproductive tract to attain optimum fertilization potential, which requires the acrosome to be structurally intact and biochemically functional. Hence, evaluation of acrosomal integrity should be integral part of semen quality testing. To fertilize an oocytes, spermatozoa must possess an intact acrosome (Shukla, 2011).

DNA Integrity

It is well established that sperm DNA quality is important in maintaining the fertility of male. Sperm DNA integrity ha an important role not only for fertilization but also for normal embryo and foetal development.DNA of the sperm can be damaged by external factors such as type of semen extender, dilution, incubation time, centrifugation and freezing thawing . The dead sperm in the semen sample produce reactive oxygen species. The reactive oxygen species causes oxidative damage to DNA and result in strand breaks and base damage (Kumar *et al*., 2013). So, Sperm DNA is increasingly being recognized as an important measure of fertilizing efficiency that has better diagnostic and prognostic capabilities than standard sperm parameters like sperm morphology, concentration and motility (Shamsi *et al*., 2008)

Routine semen parameter does not always reflect the quality of sperm DNA. Sperm DNA integrity may be evaluated in addition to routine sperm parameters to indicate the quality of spermatozoa. The assessment of quality of sperm DNA has become essential with the increase in use of assisted reproductive techniques (ART) (Shamsi et al., 2008). The most commonly used technique to assess sperm DNA integrity are the TUNEL and sperm chromatin structure assay (by acridine orange). AOT (acridine orange test) is a simplified microscopic method of SCSA

which does not require expensive flow cytometry and relies on visual interpretation of fluorescing spermatozoa and debris that fall into a broad range of colours under microscopic examination. Green sperms indicated sperms with intact (non-damaged) DNA and red / yellow sperm indicated sperm with damaged DNA.

Computer Assisted sperm analyser (CASA)

CASA refer to an automated system to visualize and digitize successive image of sperm, process and analyze the information. Result obtained by CASA include sperm count, sperm concentration, sperm motility motility, progressive motility Curvilinear Velocity (VCL), straight line velocity (VSL) of sperm, average path velocity (VAP) of sperm, Linearity (LIN), straightness (STR), amplitude of lateral head displacement (ALH) and Beat cross frequency (Kumar *et al*., 2013).

Microbial load examination

The bacterial load in the semen sample is estimated by the standard plate count method, the bacterial contaminants of semen have been a major concern for most of the frozen semen production laboratories as it adversely affect the frozen semen production and hence subsequently fertility. So, it is recommended that the bacterial load should be less than 500 CFU/ml in frozen semen (Shukla, 2011).

Cervical Mucus Penetration Test (Dhurvey *et al*., 2012)

Less than 1% of the sperm deposited in the vagina successfully penetrate the cervical mucus. Evaluation of sperm-cervical mucus includes the post-coital test, the sperm cervical mucus contact test and the *in vitro* sperm-cervical mucus penetration assay.

Post-coital test

The principle of the test is based on the examination of a drop of liquid taken from the cervical mucus, 9-24 h after mating when the female is in oestrous cycle, under the microscope and measuring the number and motilities of the spermatozoa. The numbers of motile sperm per high power microscopic field post coital are recorded and the test is considered positive when 10 or more motile sperm are found per field. Cervical mucus evaluation including volume, consistency, ferning, cellularity and pH and is of most importance for the interpretation of post-coital test results with respect to sperm function.

Sperm-cervical mucus contact test

Spermatozoon-cervical mucus contact test is done by mixing a drop of semen and a drop of cervical mucus on the slide. A cover slip placed on the slide and pressed slightly. Assessment of sperm penetration in cervical mucus is done in 400X. Change in motility pattern of spermatozoa as result of sperm agglutination indicate better sperm-cervical mucus contact test. Spermatozoa loaded with sperm agglutinins stick to glycoprotein filaments as soon as they contact cervical mucus.

In vitro cervical mucus penetration test /capillary tube test.

In the capillary tube test, spermatozoa's ability to penetrate into the cervical mucus colon, which is in a capillary tube, is tested. In the test, 5 cm long, 3 mm wide and 0.3 mm deep flat tubes are used. First, cervical mucus is aspirated in these tubes. One end is closed with a plastic tap and the sperm samples are plunged

vertically from the open end before it is left for incubation. This is based on the principal of placing the tubes directly under a microscope after incubation to evaluate the spermatozoa penetrated into the mucus. Semen sample with sperm penetration distance 30 mm or more are considered to have better chance of fertilization.

4. Zona-free hamster egg penetration test

Spermatozoon's close association with zona pellucida of ova can be used a vital characteristic exhibiting fertility of sperm. The zona free hamster oocyte penetration test is defined as the penetration ability of spermatozoa in the zona removed hamster oocytes. It is a sensitive test giving highly valuable information in determining the functions and fertilization potential of the fresh and frozen-thawed spermatozoa obtained from various animal species.

CONCLUSION

In this study, it is concluded that, conventional methods for evaluating male fertility are rather unreliable predictors of fertility because of small numbers of measured spermatozoa and the subjective evaluation of cells by the technician. This problem can be minimized by the DNA integrity, sperm viability, acrosome integrity, plasma membrane integrity, sperm count, biochemical test of semen, estimation of microbial load, cervical mucus penetration test and CASA.

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Applications of Next Generation Sequencing In Molecular Research

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Next-generation sequencing (NGS) is also known as High-throughput sequencing (or) massively parallel sequencing which has made a revolution in genomic research. Nucleic acid sequencing is a method to determine the exact order of nucleotides present in a given DNA or RNA molecule. In recent years, Next-generation sequencing technologies have dramatically increased throughput and hence they are widely used in the nucleotide sequencing. NGS mainly employs micro and nanotechnologies to reduce the size of sample components, reducing reagent costs, and enabling massively parallel sequencing reactions. They are highly multiplexed allowing simultaneous sequencing and analysis of millions of samples. Hence, NGS technology is often called as massively parallel sequencing. It can be used for sequencing of hundreds of millions of short sequences (35bp-100bp) in a single run. NGS technologies differ from the Sanger method in the aspects of massively parallel analysis, high throughput, and reduced cost.

NEED for NGS

Development of the NGS platforms and the need for the NGS increased after the completion of the Human Genome project (HGP). It took 13 years for the completion of the Human Genome Project using first-generation sequencing, known as Sanger sequencing. Since the completion of the first human genome sequence, demand for cheaper and faster sequencing methods has increased greatly. This demand leads to the development of second-generation sequencing methods, or next generation sequencing (NGS). The second complete genome of an individual was sequenced with this platform. In the past decade, several NGS platforms have been developed that provide low-cost, high-throughput sequencing. Improvements in instrumentation coupled with the development of high performance computing and bioinformatics have reduced the cost of sequencing.

WHAT NGS DOES?

1. NGS provides a much cheaper and higher throughput alternative to sequencing DNA than traditional Sanger sequencing. Genome sequencing can now be done within a day. High-throughput sequencing of the whole genome facilitates the discovery of genes and regulatory elements associated with disease.
2. Targeted sequencing allows the identification of disease-causing mutations for diagnosis of pathological conditions.
3. RNA-seq can provide information on the entire transcriptome of a sample in a single analysis without requiring previous knowledge of the genetic sequence of an organism. This technique offers a strong alternative to the use of microarrays in gene expression studies.

Different NGS technologies

Several NGS platforms are available based on the method and principle behind the sequencing technique. Advancement in the recent development and availability of the technologies has made the transformation of the NGS (2G platforms) to the 3rd generation (3G) and 4th generation (4G) sequencing machines. Currently available platforms are mentioned below

NGS or 2G platforms -

1. HiSeq & Miseq (Illumina, CA, USA)
2. Roche Applied Science 454 genome sequencer & Roche 454 GS Junior (Roche, Basel, Switzerland)
3. Applied Biosystems SOLiD 4 (Life Technologies, CA, USA)
4. Ion Torrent PGM (Life Technologies)

3rd Generation Sequencing platforms -

1. PacBio RS (Pacific BioSciences, CA, USA)
2. Heliscope sequencer (Helicos BioSciences)

4th Generation Sequencing platforms -

1. Oxford Nanopore (Oxford Nanopore Technologies, Oxford, UK)

APPLICATIONS

The field of genomics and proteomics research has undergone neoteric fluctuations as a result of next-generation sequencing (NGS). It has various advantages in the field of genomics and proteomics.

Whole Genome Sequencing

Next generation sequencing (NGS) provides a fast & thorough way to determine the genetic cause of a disease. In whole exome sequencing technique the protein coding regions to be sequenced under goes an exon-capture step by which the coding regions are selected from the total genome DNA by means of hybridization, either to a microarray or in solution. The exome comprises just over 1% of the genome and is therefore much more cost-effective and provides sequence information on protein-coding regions. Exome sequencing can also facilitate the identification of disease-causing mutations in pathogenic presentations where the exact genetic cause is not known. NGS technology along with the homozygosity mapping was used to identify two disease- causing mutations in a patient with oculocutaneous albinism and congenital neutropenia.

De nova Assembly

The de novo approaches particularly concentrate on grouping short reads into significant contigs and assembling these contigs into scaffolds to reconstruct the

original genomic DNA for novel species. Bioinformatic tools such as VCAKE, Newbler, and Velvet are helpful in assembling the DNA contigs generated by NGS platforms.

Single nucleotide variant (SNV) detection & Structural variation detection

SNV mainly aims to detect small genetic change in the DNA sequences. They are mainly carried out to assess the probability of the differences between tumor and normal genotypes. While SNVs are considered as small genetic change, whereas structural variation generally implies a large DNA alteration, approximately 1 kb to 3 Mb in length. Structural variation includes copy-number variants (CNVs), inversions and translocations.

Targeted Sequencing

Targeted sequencing is more affordable, yields much higher coverage of genomic regions of interest and reduces sequencing cost and time. Sequencing panels are developed to target hundreds of genomic regions that are hotspots for disease-causing mutations. These panels target only desired regions of the genome for sequencing, eliminating the majority of the genome from analysis. The results of disease-targeted sequencing can aid in therapeutic decision making in many diseases, including many cancers for which the treatments can be cancer-type specific.

Gene regulation and control analysis-Epigenetics

Major types of epigenetic modifications regulating gene expression are DNA methylation by covalent modification of cytosine-5′ and posttranslational modifications of histone tails. ChIP (chromatin immunoprecipitation) sequencing technique was used to identify the DNA sequences that DNA binding proteins and to identify the histone modifications. Similarly RIP sequencing techniques is carried out to identify the RNA molecules interacting with the RNA binding proteins. Methylation epigenetic studies are carried out by deep sequencing techniques which were followed by the immunoprecipitation reactions or bisulphate modifications.

RNA sequencing/Transcriptome analysis

Apart from using the NGS for sequencing the DNA molecules it is used to study RNA transcripts, typically referred to as RNA-seq or transcriptome-seq and has provided comprehensive knowledge of both genomics and genetics. RNA-sequencing data is used for *de novo* transcriptome assembly, expression profiling analysis, variant calling and transcriptomic epigenetics. RNA sequencing technology is also used for studying the Transcriptomic epigenetics. It is now widely being used in novel research areas, such as transcription start site-associated RNAs, promoter-associated RNAs, transcription-initiation RNAs (tiRNAs) and long interspersed non-coding RNAs (lincRNAs). However, more bioinformatic and bio-statistical input is required for complicated RNA-seq data analysis.

Small RNA sequencing

Now a days NGS platforms and deep sequencing technologies are widely used for predicting the small RNAs, for miRNA characterisation and also for identifying the novel miRNAs. MicroRNA expression in chicken embryos and novel miRNAs

were identified using NGS platform (454 pyrosequencing technology).

Virology

In the field of virology the high throughput technologies are being used for genome sequencing of viruses and for targeted amplification of virus to look at resistance profiles of drugs and host immunity. It is also used widely in the viral metagenomics, virus candidate pathogen discovery and viral transcriptomics. NGS platform was used for identification of 10 kb genome of a novel arenavirus.

Future Sequencing Technologies

Electron microscopy (EM) was the first proposed and attempted approach to sequence DNA molecules before the Sanger sequencing. Now the use of electron microscopy technology is being developed for single-molecule sequencing. Since scanning tunneling microscopy (STM) can reach atomic resolution, STM for single-molecule sequencing is being explored. Halcyon Molecular is developing a DNA sequencing technology by atom-by-atom identification and EM analysis. ZS Genetics is also developing EM-based technologies for single-molecule DNA sequencing.

CONCLUSIONS

Next Generation Sequencing (NGS) also known as high throughput sequencing is used for ultrafast and easy detection of gene and genome sequence. It has opened a new ground for genome sequencing in the field of life science and medicine. NGS could reveal genomic information, which may be used for development of therapeutic for personalized medicine in the future.

Consequences of Goitre in Farm Animals

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Endocrine glands are collections of specialized cells that synthesize and store their secretions, and release them directly into the blood stream. These secretions are peptide, steroid, catecholamine, or iodothyronine hormones that are transported by the blood to influence the functional activity of the target organ. They are considered as vital organs of the body and functionally, have an important role in maintenance of the vital functions of the animal. They exert a great influence on growth, production and reproduction performance of farm animals. As with other organs, they are also subjected to dysfunctions. Alterations in the structure and functions of the glands may be brought about by genetic factors, infectious agents, malnutrition and environmental factors. Similarly, the disorders affecting the endocrine organs either individually or collectively have a remarkable effect on the animal body as a whole.

Among the endocrine glands, the thyroid is one of the important organ which mediates most of the reproductive performances of domestic animals and if associated with any pathological conditions may adversely affect the production and productivity of livestock.

WHAT IS GOITRE?

Goitre is a non-neoplastic and non-inflammatory enlargement of the thyroid develops in all domestic mammals, birds, and sub-mammalian vertebrates. The term Goitre was derived from the latin word "guttur" which denotes "throat" which was named since 270 BC, long before the thyroid gland was recognized.

CAUSES OF GOITRE

- Iodine deficient diet
- Excess dietary iodine
- Goitrogenic compounds interfering with thyroxinogenesis

- Genetic enzyme defects in hormone synthesis
- Interference with iodine synthesis

All these factors result in inadequate thyroid hormone synthesis and decreased blood levels of T_4 and T_3. This low level was detected by hypothalamus and pituitary which increases the secretion of TSH, which results in hypertrophy and hyperplasia of follicular cells.

TYPES OF GOITRE

Goitre in farm animals were categorized as diffuse hyperplastic and colloid goitre, nodular thyroid hyperplasia or multinodular goitre and congenital dyshormonogenetic goitre.

Diffuse hyperplastic and colloid goitre

Diffuse hyperplastic goitre occurs as a result of iodine deficiency in farm animals which was more common in many goitrogenic areas throughout the world before the widespread addition of iodized salts to animal diets. Goitrogenic substances include thiouracil, sulfonamides and number of plants from the Family Brassicaceae. Goitrin (5-vinyl-oxazolidine-2-thione) derived from the glucosinolates of *Brassica* spp., inhibits the organification of iodine. Thiourea is one such goitrogens, which is an important ingredient of fertilizers. Further it has been reported that thiourea can induce hypothyroidism as it interferes with the biosynthesis of thyroid hormones which may cause heavy losses in production and reproduction in domestic animals.

In diffuse hyperplastic both the lobes of thyroid were uniformly enlarged and the affected lobes are firm and dark red because an extensive interfollicular capillary network develops. The lining epithelial cells are columnar with a deeply eosinophilic cytoplasm and small hyperchromatic nuclei that are often situated in the basilar part of the cell.

Colloid goitre represents the involutionary phase of diffuse hyperplastic goiter in young and adult animals. The markedly hyperplastic follicular cells continue to produce colloid, but endocytosis of colloid is decreased due to diminished pituitary TTH (Thyrotrophic hormone) levels in response to the return of blood thyroxine and triiodothyronine to normal.

In case of colloid goiter both the thyroid lobes are diffusely enlarged (Fig. 1) but more translucent and lighter in color than hyperplastic goiter. The follicles are irregular in size and shape compared to hyperplastic goiter because of varying amounts of lightly eosinophilic and vacuolated colloid in the lumen. The follicles are lined by single or multiple layers of hyperplastic follicular cells that in some follicles may form papillary projections into the lumen. The follicles are progressively distended with densely eosinophilic colloid. The follicular cells lining the macrofollicles are flattened (Fig. 2) when compared with normal histoarchitecture (Fig. 3).

Nodular thyroid hyperplasia or Multinodular goitre or Parenchymatous goitre

Nodular thyroid hyperplasia appears as a multiple white to tan nodules of varying size in species like horses, cats, and dogs. The affected lobes are moderately enlarged

Figure 1 Bilateral enlargement of thyroid gland

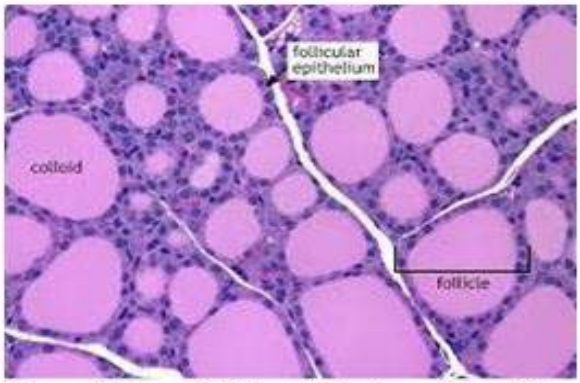

Figure 3 Normal histoarchitecture of thyroid

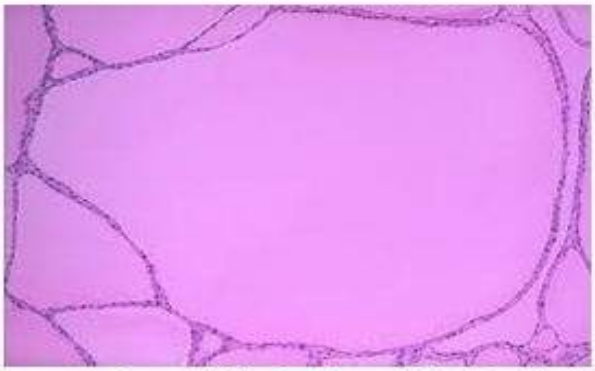

Figure 2 Thyroid follicles distended with colloid

Figure 4 Congenital goitre in a kid

and irregular in contour. In most of the animals it is endocrinologically inactive and encountered as an incidental lesion. It consists of multiple foci of hyperplastic follicular cells that are sharply demarcated but not encapsulated from the adjacent thyroid parenchyma and some hyperplastic cells form small follicles with little or no colloid.

Dyshormonogenetic or congenital goitre

Dyshormonogenetic occurs as an inability to synthesize and secrete adequate amounts of thyroid hormones before or at birth, which has been documented in human infants and in several animal species. Thyroid glands are symmetrically enlarged at birth (Fig. 4) because of an intense diffuse hyperplasia of follicular cells. Thyroid follicles are lined by tall columnar cells but often are collapsed because of a lack of colloid resulting from the marked endocytotic activity. The occurrence of high incidence of congenital goitre was due to iodine deficiency conditioned by other antithyroid compounds present in animal feeds

In ruminants, prolonged low-level exposure to thiocyanates, which are produced by ruminal degradation of cyanogenetic glucosides obtained from plants such as white clover (Trifolium), couch grass (Cynoden) and linseed meal, and by degradation of glucosinolates of the Brassica crops, are associated with congenital goitre.

Leucaena leucocephala and other legumes of the genus are native or cultivated in many sub-tropical areas and contain the toxic alkaloid mimosine, an active component to cause goitre. It is not directly goitrogenic but is converted in the rumen to 3-hydroxy-4(1H)-pyridone which prevents organic binding of iodine by the thyroid.

CONSEQUENCE OF GOITRE

- Goiter in adult animals is usually of little significance and the general health of the animal is not impaired. If thyroid hormone synthesis is drastically impaired, it affects body metabolism, which results in decreased body weight, milk production and increased reproductive and nutritional disorders.
- However, in newborn animals goiter plays a significance role as a disease, although the drastic losses of animals in endemic area are now controlled by the prophylactic use of iodized salt.
- Pregnant animals with goitre shows no evidence of thyroid dysfunction, but gestation is often significantly prolonged and there is increased incidence of dystocia with retention of fetal placenta.
- Calves, foals and kids affected with iodine deficient goiter have moderately enlarged thyroids with partial or complete hair loss and are weak at birth and frequently die within a few days after birth.
- Newborn goitrous pigs, goats and lambs frequently have myxedema and hair loss. The mortality rate is high in these species, with majority of offspring born dead or dying within a few hours of birth.

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Quality Assessment of Silage

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Forage which has been grown while still green and nutritious can be conserved through a natural 'pickling' process. Lactic acid is produced when the sugars in the forage plants are fermented by bacteria in a sealed container ('silo') with no air. Forage conserved this way is known as 'ensiled forage' or 'silage' and will keep for up to three years without deteriorating. Silage is very palatable to livestock and can be fed at any time. Silage is considered the better way to conserve forage crops. A forage crop can be cut early and only has to have 30% dry matter to be ensiled successfully (FAO, 2007). So assessing the silage quality is essential for ensiling fodders for the chemical composition changes occur or attained desirable quality of silage. The quality assessment of silage is explained hereunder,

Quality assessment

Sampling procedure for silage (Barnett, A.J.G. (1954)

1. Examine the silo and remove layer of 10-15 cm from the top
2. Collect samples from different parts and at different depths and make a composite sample
3. Take sub-sample in sterile polythene bags into three different lots

a) First lot of sub samples of fresh silage may be used for estimation of total nitrogen, crude fat and dry matter.
b) The second lot of fresh silage be used for preparation of extract for determination of pH acidity, volatile fatty acids, non-volatile organic acids, amino acids and ammonical nitrogen contents.
c) The third lot of fresh silage be dried in hot air oven at 55-60^{o}C over night for Van-soest analysis, or at 100 to 150^{o}C for eight hours for proximate

Quality indicators for Silage include

Moisture Analysis

The approximate moisture level of chopped silage can be determined by means of a "grab test."

- Squeeze the chopped forage tightly into a ball for 20 to 30 seconds, and then release quickly.
- Forage chopped into 3/8 to 1/2-inch pieces should be used.

The presence of a dark colored layer at the base of the maize grain is also an indicator for the appropriate time of harvest for silage production. Once the first grains with dark layer are noticed you should wait for 3-4 weeks more before harvesting.

Amount of Squeezing	DM %
Juice easily expressed by hand	< 20
Juice expressed with some difficulty	20-25
Little or no juice expressed but hands moist	>25
'Ball' shape	**DM %**
Ball retains its shape and some free juice expressed	< 25
Ball retains its shape but no free juice is expressed	25-30
Ball slowly falls apart	30-40
Ball rapidly falls apart	>40

At this time the average dry matter contents of the maize plant is 30-35%. After the indicated phase, the contents of dry matter decreases as the stems get broken and leaf fall off. The whole maize plant should be harvested by cutting it 10-12 cm from the ground.

Phase of vegetable	Dry matter (%)	Length of particle (cm)
Milk	20-25	3-5
Milk – Wax	25-30	1-3
Wax	30-35	0.7-1

Temperature

A 2-3 foot long temperature probes are useful for comparing silage temperatures at the surface compared to deep into the silo. These readings should be taken in the same locations as pH measurements. A silage goal for stable silage is not to exceed 20° F. of ambient environmental temperature at time of harvest. Large storage structures will retain heat longer than smaller storage structures.

Fermentation Analysis

A newer technology available in silage problem-solving is fermentation analysis. It enables us to objectively quantify what we subjectively see and smell. This can be especially useful when poor livestock performance cannot be explained by nutrient analysis.

1. High pH

Different forage types are well preserved at pH levels between 3.7 and about 4.7 due to different buffering capacities of forages i.e. maize silage at pH 3.7 to 4.2 compared to grass or legume silage at pH 4.3 to 4.7.

Some common reasons for a high silage pH include the following.

- Dry silage (> 50% DM)
- Silage not fully fermented due to early sampling time relative to harvest, cold
- weather during harvest, and slow or poor packing
- Legume silages with extremely high ash contents (> 15% of DM) and (or) high protein content (> 23-24% CP)
- Silage with excess ammonia or urea
- *Clostridial* silages
- Spoiled or moldy silages
- Silages containing manure

2. Low Lactic Acid

The presence of ***lactic acid from 8% to 10%*** indicates a good fermentation and the fermentation process progressed rapidly with a minimum of total spoilage in the pile. Lactic acid should make up over 65-70% of the total silage acids, with a lactic/acetic acid ratio of at least 3:1.

Some common reasons for low lactic acid content include the following.

- Restricted fermentation due to high DM content (especially legumes and grasses with 50% DM).
- Restricted fermentation due to cold weather.

- Sample taken after considerable aerobic exposure that has degraded lactic acid.
- Silages high in butyric acid (Clostridial silages) are usually low in lactic acid

3. High Acetic Acid

Acetic acid levels greater than 3 – 4% can result from poor fermentations, especially if lactic acid levels are significantly low. *Buchneri* inoculants are sometimes added to corn silage and high moisture corn to produce acetic acid late in the fermentation to improve bunk life. Don't mistake this for a poor fermentation. Excess acetic acid indicates the pile went through a slower fermentation with a greater loss of organic matter. The longer a pile takes to stabilize, the greater the chance of undesirable bacteria getting into the silage such as clostridiums. Extended fermentation and heat will also degrade protein so that it will vanish as ammonia.

4. High Ethanol

High ethanol indicates yeast that reduces dry matter recovery and makes the silage more prone to mould and feedout spoilage. Off-flavours in milk can also sometimes result. The presence of ethanol is more prevalent in high moisture corn and corn silage. Values usually are less than 0.5%. Usual amounts of ethanol in silages are low (< 1 to 2% of DM). Extremely high amounts of ethanol (> 3 to 4% of DM) in silages may cause off flavors in milk.

5. Ammonium-N/Total-N% (AM-N/TN)

Ammonium-N is the product of protein decomposition. While some protein breakdown will occur normally, this increases where there is either poor preservation or a slow rate of fermentation. The common objective of silage makers is to achieve AM-N/TN of less than 10%. Where this level is greater than 12-15% it is likely that the pH is also high and that significant protein decomposition has occurred. The storage life of the silage will be reduced.

6. Propionic Acid

Produces a sharp sweet smell and taste and is usually lower levels of this acid are produced during fermentation for maintaining aerobic stability. Usually found at less than 1.0% in normal silages.

7. Butyric Acid

If it is accompanied by high percent moisture and/or high ash content, then that confirms what management issue needs to be corrected. In the silo, butyric acid results in high losses of dry matter and digestible energy. In the ruminant it results in poor intakes and metabolic problems. If possible, silage high in butyric acid should be discarded. If butyric acid is present in significant amounts, it quite often means the forage crop was much too wet when chopped. The silage will have an extremely putrid smell, making it very unpleasant to handle. Quality silage should have less than 0.1%. Dr Gary Oetzel, University of Wisconsin, recommends the following butyric acid daily limits to prevent off-feed and ketosis in dairy cows:

- Fresh cows – < 50 grams
- Early lactation – <150 grams
- All other lactating cows – < 250 grams.

8. Aerobic Microbial Counts

Yeast, mold, and Bacillus population counts indicate silage bunklife and are expressed in colony forming units per gram of feedstuff (cfu/gm). Aerobic microorganisms require oxygen from air penetration, indicating aerobic instability.

9. Yeast

Yeast counts should be less than 100,000 are desirable. Yeast utilizes lactic acid as substrate in the presence of oxygen, causing the elevation of pH. Dry matter losses occur from the production of carbon dioxide, water, and heat. Yeast activity precedes mold growth.

10. Mold

Mold counts should be less than 100,000 are desirable. When lactic acid levels are diminished by yeast and pH rises above 4.5, the silage environment becomes conducive to mold growth. This results in musty, hot, energy depleted, and unpalatable silage.

11. *Bacillus*

Bacillus counts should be less than 100,000 are desirable. Fields may be highly contaminated with this aerobe at harvest. *Bacillus* is highly thermophilic in the presence of oxygen and is primarily responsible for high bound protein (ADIN) values in silages.

12. Mycotoxins

Most diagnostic laboratories and kits identify mycotoxins that are produced by field-produced molds. Gas or thin layer chromatography methods should be used when determining mycotoxin levels in forages. ELISA methods will produce false positive levels of mycotoxins. While a goal of quality silage is not to have mycotoxins, the presence of vomitoxin (DON) or zearalonone does not indicate poor quality silage. Vomitoxin may serve as a marker for other unknown mycotoxins.

Grass silage quality

Nutrient and energy content	
Dry matter (%)	30 – 45
Crude protein (%)	< 17
Crude fibre (%)	22 – 25
Ash (%)	<10
Net energy (MJ/kg DM)	6.0 – 6.4
Fermentation quality	
pH	3.5 – 4.3
Butyric acid (%)	0.0 – 0.3
Acetic acid (%)	1.5 – 3.0
Ammonical Nitrogen (%)	<8.0
Microbiological quality	
Yeast	<10,00,000 cfu/g of silage
Molds	<5,000 cfu/g of silage

CHARACTERISTICS OF SILAGE

1. Very good silage

Clean pleasant fruity odour. Uniformly green or brownish in colour with absence of butyric acid, absence of moulds, absence of sliminess and absence of proteolysis. The pH is between 3.5 and 4.2. The amount of ammonical nitrogen should be less than 10 per cent of the total nitrogen.

2. Good silage

There may be traces of butyric acid with pH is between 4.2 and 4.5. The amount of ammonical nitrogen is 10-15 per cent of the total nitrogen. Other points are same as of very good silage.

3. Fair silage

The silage is mixed with a little amount of butyric acid. There may be slight proteolysis along with some mould. The

pH is between 4.5 and 4.8, ammonical nitrogen is 15-20 per cent of the total nitrogen. Colour of silage varies between tobacco brown to dark brown.

4. Poor silage

Due to high butyric acid and high proteolysis, it has a bad smell. The silage may be infested with moulds. Less acidity, pH is above 4.8. The amount of ammonical nitrogen is more than 20 per cent. Colour tends to be blackish. (McDonald *et al.*, 2013)

CONCLUSIONS

The principle factors for evaluation of the silage are pH and fermentation acids, this can provide feedback on whether the fermentation occurred under ideal conditions or not. Other factor includes temperature, smell, and the appearance of the silage. The silage should also not have a rancid odor, associated with *clostridial* fermentation in wet silages. Quality assessment influences the silage's nutritive value and determines the potential animal production. Also it is an important indicator whether the silage has been profitable.

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Specialized Sire and Dam Lines:
its Need and Advantages

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The inbreed lines developed after selection for one or two specific traits can be called as specialized lines. Use of such specialized sire and dam lines in a crossbreeding system involving a terminal cross that offer the potential for genetic improvement of livestock.These lines are generally used in commercial broiler enterprise.Evidence depicted regarding utilization of these lines showed they theses are cost effective in commercial broiler enterprise (Smith, 1964; Moav, 1966).Further, these lines were also been used effectively for pork production profitability mostly relies on reducing the cost per unit of output.

Breeding goals in pigs in the early 1900s was for dual purposesviz., litter size and growth and were based on only phenotype almost entirely pure breeding until 1960. In the late 1980s, improved computing technologies and statistical methods allowed to select for traits with a low heritability, followed by further specialization into sire and dam lines.

There areopportunities to increase the profitability of the pork production system by genetic improvement of performance traits.Selection of superior individuals as parents within breeds and choice of breeds or composite lines to be used incrossbreeding systems are the general tools that breeders have available to bring about this genetic improvement (Clutter,2010).

Parent-offspring inbreeding programme, Full-sib inbreeding programme, Half-sib inbreeding programme and Double first cousin inbreeding programme are the methods we can use for developing inbreed lines and maintenance of these inbreed lines can be done by crossing between them. Selection within lines during developmental process is ineffective in maintaining normal performances and intense inbreeding in large number of small groups without attention to within line selection will lead to the development of more usable lines than mild inbreeding with selection.

Need for Specialized Sire and Dam Lines:

Performance traits include Production traits (growth rate, feed efficiency and carcass composition) and Reproductive traits (age at puberty, fertility and litter size).Production traits are expressed in market animals as well as animals

destined for the breeding herd, determine the efficiency of the system whereas reproductive traits are expressed in all breeding females used as parents in the terminal cross, while these same females contribute half of their genetic merit for production traits to each of their market offspring. As a result, the primary selection objective in dam lines designed to provide females for the maternal side of the terminal cross should be increased reproduction performance. Some emphasis should also be put on these female's contribution to the genetic merit for production performance of their market offspring. These specialized selection objectives are designed to produce lines that can be advantageously combined in a terminal, static cross. Similarly in broiler industry female parent stocks must produce eggs at reasonably high levels in order to keep chick product cost low. Male parent stocks are selected for their ability to contribute growth and desired carcass characters to the commercial broiler (Warwick and Legates, 1979). Thus, selection of sire and dam lines should be performed using different selection schemes.

Genetic improvement ofthese performance traits through selection of superior parents is possible to varying degrees dependingon the heritability of the trait, the amount of variation among potential replacements and most importantly, thesuperiority of the chosen replacements (clutter *et al*., 1990).Whereas, by purchasing breeding stock or semen from seed stock producers commercial producers receive the benefits of such selection primarily who operate effective selection programs within theirherds.Crossbreeding is also an important part ofcommercial production systems because of theimprovement in efficiency from heterosis and the potential to exploit differences between breeds orlines.

Lines that have superior genetic merit for reproductive traits provide females for the crossbreeding system, while lines with superior merit for production traits provide boars. Sire lines provide terminal sires that contribute a random half of their genes to each market offspring. The genes influencing reproduction that are transmitted from these boars are never expressed in their market offspring. However, the primary selection objective in the sire lines should be improving genetic merit for the production traits of economic importance in market animals. Some small amount of secondary emphasis may be put on reproductive traits to maintain an acceptable level of genetic merit in breeding females within the sire line. In this way, market offspring with high genetic potential for production traits can be produced while maintaining high genetic merit for reproductive traits in the sow herd. Because of the significant benefits of maternal heterosis gained by using crossbred females, pure breeds or lineswith superior genetic potential for reproductive traits are often used in static or rotational crosses, or to produce composite lines, from which crossbred females are generated for the terminal phase of the system.

Poultry and pigsbreeding programme work with several unrelated lines where dam and sire lines are selected separately for reproduction traits and for production traits. These lines are then crossed to

achieve the benefits of both and to benefit from heterosis in the form of vitality and production.

Advantages of specialized sire and dam lines:

Use of specialized sire and dam lines in a crossbreeding system involving a terminal cross offers the potential for genetic improvement above that realized with use of a general selection objective and also offers several important advantages. With the use of specialized breeds or lines, a suitable breeding strategy for the smallholder concept can be developed, which is otherwise complicated. In the reproduction and multiplication links the hens are kept in confinement and fed with balanced feed. Consequently, egg production traits are the most important for a viable operation. However, the end user, the smallholder with ten hens, keeps the hens in semi-scavenging conditions and consequently such traits as scavenging traits and survival traits are the most important. A way to solve that, is the use of specialized breeds or lines, as shown by Moav (1966) in which the reproduction traits are conveyed through the female line while the traits important for the end product are conveyed through the male lines.Seed stock producers can improve existing sire and dam lines for their respective role in a crossbreeding system and can develop new specialized lines to fill specific roles in a crossbreeding system by using specialized selection objectives.

Improved selection responseis expected whenever parental lines are specialised. When production is based on a pure-bred or multi-purpose population, all traits in a general breeding objective are to be improved simultaneously. In the specialised line, however, selection can be concentrated on a reduced number of traits. More selection pressure can be directed toward each trait of interest in specialized sire lines thus, for example, in a terminal sire line (from which sires are used to produce cross-bred products which are all slaughtered), all traits related to female reproduction can be widely ignored. The lower the number of traits in the breeding objective, the higher is the expected selection response for single traits. Thus, the genetic response realized in cross-bred animals is increased as they get half of their genes from each of the parental lines(Cassidy *et al*., 2004).

Specialized lines offer an even greater advantage over lines selected for general merit when there are antagonistic genetic relationships between some of the traits of interest. This is the case with some reproductive and production traits. For example, the genetic relationship between litter size and both backfat thickness and feed efficiency is estimated to be mildly antagonistic in some lines.The index recommended for use in a maternal line puts the largest weightings on the reproductive traits of litter size and 21daylitter weight, but also places some emphasis on the production traits. The general index is designed for lines providing boars used in rotational cross systems where reproductive and production traits are essentially of equal importance.

The foundation or basic breeder concerned with the development of pure line stocks however has a different production economics. He is not only concerned with the production of good quality commercial chicks but also should

produce sufficiently large number of desirable chicks from each parent to make the business of poultry breeding a commercially remunerative enterprise. To achieve this end one should develop parent stocks for high production and reproduction performance. Although this objective of breeder is not in conflict with the commercial layer production it goes against the production of commercial broilers. This is because production and reproduction traits are negatively correlated genetically with broiler traits. Hence, the development of specialized sire and dam lines is of utmost importance for production of commercial broilers. Sire and dam lines contribute differentially to commercial chick production as only less number of males are required than females. For commercial broiler production while the sire lines are exclusively developed for high growth and confirmation traits, the selection on female line is concentrated on production and reproduction traits in addition to growth rate. This helps to bring down the production cost of commercial broiler chicks

Strain cross or inbred hybrids of White Leghorn origin are used for the production of white-shelled eggs. Crossbreeding involving White or Red Cornish, White Rock and New Hampshire breeds is undertaken for the production of commercial broilers. Cornish strains or synthetic populations containing variable amounts of Cornish, Rock and Hampshire blood are used as male line and closed flocks of Rock and Hampshire strains or their strain crosses are used as female lines. Crossbreeding involving White Leghorn as male parent and Rhode Island Red or New Hampshire or Black Australorp as female parent is employed for the production of commercial layers for brown-shelled eggs.

Genetic antagonisms, such as the unfavourable relationship of lean growth rate with reproductive rate, reduce the rate of genetic progress in a composite or pure-line parent-stock. However, their impact on genetic improvement is greatly reduced by selection for complementary traits in specialized sire and dam lines. In a study, Smith (1964) concluded that selection in specialized sire and dam line is at least as efficient as selection within a single (dual purpose) line, and that the relative efficiency of the former increases if there is an unfavourable correlation between the two sets of traits under selection.

Improved leanness and a narrow margin between feed intake and potential for lean gain may also make traits of reproduction such as rebreeding performance and second parity litter size more important in some lines. Only specialized sire and dam lines will allow breeders to effectively balance genetic merit for maximum efficiency of production, quality and the reproductive performance of the sow herd.

The earliest trait recorded on pigs is the birth weight (BWT). This trait is often studied from the maternal side, because traits related to reproduction, like BWT, are strongly affected by maternal genetic effects (Arango*et al*., 2006). However, to improve sire lines, it is necessary to know the sire genetic effect on this trait to determine if piglet body weight could be genetically improved from the paternal side. As body weight is related to performances, like survival, growth rate,

carcass composition it could be a good candidate to be an early indicator trait.

Development of sire and dam lines may also provide opportunities for the future. Specialized lines may someday be used in conjunction with embryo transfer techniques by transferring sire line embryos into dam lines with superior embryo survival. In itself, the presence of diverse genetic lines will guarantee flexibility in the industry as management practices and market conditions change

SUMMARY

Use of specialized sire and dam lines in a crossbreeding system involving a terminal cross for genetic improvement shows superior results as compared to general selection methods. For such a line production one need to implement a terminal cross to identify the breeds or lines with characteristics that will best fulfill the sire and dam line roles in the cross. Further, the quality desired by consumers should be kept in mind by commercial producers in order to insure a market for their animals. Communication between seedstock supplier, commercial producer and pork processor will be essential to design and implement specialized selection objectives that allow the producer to meet these demands in an efficient manner. In the near future, information on molecular genetic markers for quality traits may be added to the selection index or used in two stage selection with the index for development of best sire and dam lines. Further, specialized lines may also be used someday in conjunction with embryo transfer techniques by transferring sire line embryos into dam lines with superior embryo survival.

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Antimicrobial Resistance: The Veterinary Use of Antimicrobials and Its Implications For Human Health

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Antimicrobial drugs are used in animals, humans, and plants to treat and prevent bacterial infections and to improve production efficiency in food-producing animals. These drugs are among the most important tools available to modern medicine. However, soon after antimicrobial drugs became readily available for use in human and veterinary medicine, it was recognized that decreased bacterial susceptibility could adversely affect clinical outcome. Variability in susceptibility to different antimicrobial drugs has become a major factor affecting the successful treatment of bacterial diseases. Along with target bacteria, commensal and transient microbial flora are exposed to varying amounts of antimicrobial drug during treatment. Although resistance in these so-called bystander bacteria might not be of consequence in one host species, these organisms can cause disease in other hosts and all resistant bacteria could serve as reservoirs of resistance genes.

The extent to which antimicrobial resistance is affecting the health of humans and animals is not known. There are concerns that emerging resistance among bacteria, if left unchecked, could escalate to the point at which efficacy of many of the most important drugs will no longer be predictable and some bacterial infections could once again become untreatable.

Since the discovery of penicillin, antimicrobial agents have been broadly used worldwide, and many countries do not have legislation to control antibiotic consumption. Currently, the prevalence of antimicrobial resistant pathogens has increased at a speed inversely proportional to the approval of new drugs. Thus, in regard to infectious diseases, the emergence of resistance is one of the top health challenges in the 21st century, especially in hospital settings. However, when considering veterinary medicine, although the amount of antibiotics consumed in livestock is almost double the amount used by humans, the role of veterinary antimicrobials use in resistance development has only recently been discussed.

Antimicrobial use in animals can contribute to the emergence of antimicrobial resistance in bacteria that may be transferred to humans, thereby reducing the effectiveness of antimicrobial drugs for treating human

disease. FDA has developed a multipronged strategy designed to limit or reverse resistance arising from the use of antibiotics in food-producing animals, while continuing to ensure the availability of safe and effective antibiotics for use in animals and humans.

Antimicrobial uses in animal production were applied in veterinary medicine and agriculture, including food animal production, pets and aquaculture. The extensive use and misuse in all settings has created strong selection pressure, which has resulted in the survival and persistence of resistant strains. In veterinary medicine, substances exhibiting antimicrobial activity are extensively used in animals for therapy, prophylaxis, metaphylaxis and growth promotion.

- **Therapeutic use** is the administration of an antimicrobial to an animal or group of animals that exhibit clinical disease. In farms, individual treatment is often impractical, particularly in food-producing animals, which are kept in larger groups. Usually, antimicrobials in such large animal groups are administered when single animals of the group present with symptoms of the disease, as it is expected that most of the group will become affected.
- **Prevention/prophylaxis** is the administration of an antimicrobial to exposed healthy animals considered to be at risk before expected onset of disease and for which no etiological agent has yet been cultured.
- **Metaphylaxis** is a term sometimes used when there is clinical disease in some animals, but all are treated with the aim of reducing the numbers of sick and/or dead animals.
- **Growth promotion** is the administration of an antimicrobial, usually as a feed additive, over a period of time to growing animals that results in improved physiological performance. At least four mechanisms have been proposed as explanations of antibiotic mediated growth enhancement: the inhibition of subclinical infections, the reduction of growth-depressing microbial metabolites, the reduction of microbial use of nutrients and the enhanced uptake and use of nutrients through the thinner.

In this context, the amount of antibiotics consumed in livestock is almost double that used by humans. This is an important reason for the emergence of intestinal resistant bacteria and, due to the similarities between veterinary and human antimicrobials, has led to cross-resistance. In other words, the same resistance mechanism confers resistance to veterinary and human antibiotics.

Incidence of antimicrobial resistance problems in human due to the usage of antimicrobials in animals:

Epidemiological and molecular observations have shown that antimicrobial resistance, as promoted by extensive antibiotic usage in animals, can increase antimicrobial resistance problems among human populations;

1. **Vancomycin-resistant Enterococci (VRE)**: Vancomycin resistant enterococci (VRE) in both animals and people have become prevalent in countries that used a glycopeptide growth promotant called avoparcin, which is structurally similar to vancomycin. Vancomycin is a very important antibiotic in human medicine that is often used a last line of defence for several types of infectious

agents. Consequent discontinuation of avoparcin's use in animals was followed by a rapid subsequent decline in the incidence of VRE in both human and animal populations.

2. ***Campylobacter*** **resistance and fluoroquinolones**: The introduction of enrofloxacin in veterinary medicine was quickly followed by the emergence of fluoroquinolone resistance among *Campylobacter* isolates from broilers, and in humans shortly thereafter. As was the case with avoparcin, resistance to fluoroquinolones in human and animal populations remained rare in countries that had not used fluoroquinolones in food animals
3. **Multi-drug Resistant *Salmonella*:** An increase in antimicrobial resistance to third-generation cephalosporins in *Salmonella* and *E.coli* was also observed following the increased usage of these antibiotics in animals. Furthermore, its withdrawal and re-introduction were subsequently followed by a decline and resurgence, respectively, in antimicrobial resistance among animal and human *Salmonella* isolates.
4. **Methicillin-resistant *Staphylococcus aureus* (MRSA):** By the 1990s, MRSA was recognized as a serious worldwide nosocomial infection. MRSA strains are resistant to beta-lactam antibiotics, including those that are not affected by penicillinase. The resistance is mediated by a mecA gene which codes for a penicillin-binding protein (PBP2a) that has low affinity for beta- lactam antibiotics. In the last few years, animals have been implicated in the maintenance, spread and transmission of some types of MRSA among humans. There is evidence that transmission of MRSA strains can occur from animals to humans, and vice-versa. MRSA has been found in humans closely associated with carrier animals; among pet owners, veterinarians and veterinary personnel as well as pig and cattle farmers. Studies identified both livestock and companion animals as potential sources of MRSA for humans, and close contact with these animals was identified as a risk factor for their carriage in people.

Veterinary-related factors influencing the global spread of antimicrobial resistance

Veterinary-related factors that influence the global spread of AMR include the following:

1. **Increase in population, demand for food animal protein and global changes in animal production systems.**

The Centre for Strategic and International Studies estimates that the world population increases by about 8,700 people every hour, 146 people every minute or 2.5 people every second. From 1950 to the year 2000, the population roughly doubled from 3 billion to 6.3 billion and is projected to continue to increase in the years to come.

Understandably, food production must also increase to meet these increased nutritional demands. However, because of urbanization and industrialization, available agricultural lands continue to shrink and livestock production has become compromised in many regions.

In reaction to the increasing demand for food and the decreasing available agricultural land, most livestock and poultry are now raised in smaller spaces at the least possible cost and pushed to the fastest possible rate of gain. This often requires reliance on antibiotics for treatment, metaphylaxis or growth

promotion; thereby creating concomitant increased rates of antimicrobial resistance.

2. **Changing trends in animal trading and increased movement of animals and animal by-products**

The international trade in livestock and livestock products is a growing business, accounting for about one sixth, by value, of all agricultural trade. To liberalize international trade, the General Agreement for Tariffs and Trade (GATT) was established in 1947. The Office International des Epizooties (OIE) was tasked to set appropriate global standards for animal health, while the Codex Alimentarius Commission sets standards for food safety.

These standards facilitated safer international movement of animals and animal by-products around the world. However, they do little to prevent the spread of AMR across the globe due to resistant bacterial organisms that may be hitchhiking in animal products and healthy animals. Increased movement of animals and animal by-products has also been facilitated by technological improvements in travel and transport systems. It used to be that food products with short shelf lives could not be moved to distant markets, but what used to take weeks and months to transport can now be moved within a day or even less. This rapid movement increases the likelihood that bacteria will remain viable while in transit, further increasing the risk that antimicrobial resistance genes can quickly spread around the world.

3. **Lack of global initiative regarding antimicrobial resistance**

In many countries there is little surveillance information regarding rates of antimicrobial usage or AMR in food or food animals. Such programs are expensive, and may also require a strong political will to counter the influence of some in the private sector who may not want information revealed that might scare consumers, jeopardize pharmaceutical sales or negatively affect exports or imports. Also, many countries have much more pressing issues such as feeding their people, fighting wars and developing their economies.

The World Health Organization (WHO), the US Centers for Disease Control and Prevention (CDC), the US Food and Drug Administration (FDA), and many other agencies involved in promotion and regulation of health activities around the world are vigorously engaged in developing programs intended to monitor the emergence of antimicrobial resistance and to decrease use of antimicrobial drugs. Veterinarians are responsible for overseeing the use of most antimicrobial drugs in animals for therapeutic or disease prevention. Veterinarians should therefore critically evaluate current antimicrobial use to identify ways to modify use without adversely affecting the health and well-being of animals or humans. Antimicrobial resistance is a global problem, in that antimicrobial resistance anywhere in the world can rapidly spread internationally. Hence, veterinarians must understand their significant professional responsibility in preventing antimicrobial resistance by mitigating the emergence and spread of antimicrobial resistance.

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Housing Management Of Dairy Cow In Tropical Climate

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Housing is one of the foremost requirements of dairy cows for better production, health and welfare (Histov *et al*., 2006). Shelter is required for protection and comfort of animal against extremes of temperature, sunlight, rainfall, humidity, frost, snowfall, strong winds, etc. Besides providing shelter from adverse weather a well-designed barn provides a clean, dry, well drained and comfortable accommodation to the animals and a pleasant efficient work place for the workers which are important for quality milk production. Uncomfortable housing have detrimental effects on housed animals which makes them not only more susceptible to diseases but also less productive. The basic justification for animal housing is that it should alter or modify the environment for the benefit of animals enclosed in it to reduce the peak stress with due consideration to the economics of construction. Under tropical climatic conditions as prevailing under most of the Indian conditions, some basic principles that should guide the dairy farmers embarking on building a farm is to reduce heat gain and promote heat loss from the structure of the animal house by radiation and conduction during summer.

Among the stressors, heat stress has been of major concern in reducing animal productivity in tropical, subtropical and arid areas. There is about 1.8 million tons annually (Rs 2,661crore) milk yield loss due to heat stress. Both the increasing ambient temperature from 25ºC to 36ºC and the increasing THI 72 to 82 have negative impact on the DMI and milk productions of cows.

Heat stress: Heat stress in dairy cows is caused by a combination of environmental factors (temperature, relative humidity, solar radiation and air movement). It is the conditions are normally associated with a decline of production and reproductive performances as to determine the activations of thermo-regulation mechanism in order to avoid hyperthermia and maintain the vital functions of the animals (Garcı´a-Ispierto *et al.,* 2007)..

Climatic factor: The main climatic factors from which protection is to be provided are high and low ambient temperature, environmental humidity, solar radiation, wind and rain. The rise in temperature and number of stress days is likely to reduce growth, milk yield and reproductive efficiency of cattle especially of high producing stock. The appropriate design of livestock buildings is fast changing and ever improving professional endeavor.

Sustainability: sustainability becomes an important keyword in connection with modern livestock production. There is an expectation from society that animal products must originate from housing environments where both the health and welfare of livestock have neither been impaired nor endangered. The development of animal production in recent decades can be characterized by intensification and specialization. Intensification means indoor animal housing all year round (non-grazing), high animal densities, a high degree of mechanization and automation (e.g. in feeding, water supply, manure removal, ventilation), a low labor requirement and often a small air volume in relation to number of animals in housing unit. Extensive rearing of livestock by grazing is being largely replaced by intensive, confined husbandry.

Design of housing: The design and management should be prepared in such a way, so that it improves the cow comfort during resting, and provide an environment where the cow can maximize heat loss during hot weather and minimize heat loss during cold weather. Choosing a particular housing system design is difficult because it is not always known how the system design will affect growth, health, and production of the animal. Access to a dry, comfortable standing area reduces the risk of lameness. A rest period on pasture helps lame cows recover.

Component of housing design

Floor: The floors should be hard, impervious to water and easy to clean. Concrete floors (3,500 psi) must have adequate texture for good footing. Secure footing reduces injuries from slipping and falling, enhances cow movement to feed, water, and stalls, and improves heat detection. In livestock housing, wood-float and broom-finished surfaces become smooth in time due to tractor scraping and constant animal traffic. Select the degree of floor roughness based on the intended use and animal type. The floors shall have a gradient of 1 in 40 to 1 in 60 towards the drains so that wash water can run into drains easily. The raised-slotted floor with thatched roof is best suited for growth, feed conversion efficiency and economic. Dairy cows always prefer soft floor, soft materials such as rubber mats and mattresses were suitable coverings and have shown good results. Ammonia emission from the compartment with the grooved solid floor operating with open perforations is reduced by 46% compared to the traditional slatted floor.

Roof: The roof should be light, strong, durable, weather proof, bad conductor of heat and free from tendency to condense moisture inside. The pitch of roof should be, 350 for thatched roof, 25 to 300 for tile roof and 12 to 180 for a sheet roof. The pitch should not exceed 450 at any circumstances.

Wall: For ordinary walls, thickness should not exceed 35 cm. Partition walls lining the open areas should be 22.5 cm (two brick) thick. Height of walls should be 2-2.5 m for houses with sloping roofs. When solid concrete walls are removed and replaced by steel piping, the roof is raised 1 m and outside paddocks is provided with palm thatch shelters, almost no trouble is experienced from climatic stress.

Type of housing:

Free stall housing - Free-stall design must consider lying/standing space along with moving or dynamic space requirements of the cow. A solid front must not interfere with the cow lunging forward. The brisket board positions the cow correctly in the stall, thus keeping the rear of the stall cleaner. The stall width of 1.22 m is adequate for cow comfort and minimizing injuries. A lateral slope of three percent across the width encourages cows to lie in the same direction, again reducing the chance of udder and teat injury from adjacent cows. A longitudinal slope of two to six percent is suggested to encourage the cows to rest toward the rear of the stall. Another design consideration is the rear curb. With curbs of 20 to 30 cm in height, manure overflow from alley scraping is minimized. The partition for free-stalls is also an important design consideration.

The cow's lying and rising space needs consist of three elements:

Body space — The space from the rear of a cow to the front of her knees.

Head space — The space ahead of a cow's body occupied by her head.

Lunge space — The additional space necessary for the thrust of a cow's head as she lunges forward during rising.

Tie-stall shed: Only in the case of purebred herds where considerable individual attention is given to cows can a tie-stall system be justified in tropical areas. The tie and feed barrier construction must allow the cow free head movements while lying down as well as standing up, but should prevent her from stepping forward into the feed trough. Stall partitions should be used at least between every second cow to prevent cows from trampling each other's teats and to keep the cow standing straight so that the manure falls in the gutter.

The surface of the free stall should be:

- Comfortable to the cows to encourage high occupancy
- Prevent hock damage and other injuries
- It should be easy to clean and be durable

The ideal lying surface is soft, absorbs moisture and does not promote the growth of bacteria. When cows are forced to lie down on hard surfaces, they do not lie down for long, are more easily unsettled and may develop knee and hock lesions and swelling (Tucker *et al*., 2003). The floor of the cubicles can be earthen with a thick layer of bedding, or can be solid, with a soft top layer. The simplest bedding is packed earth or sand, this being inexpensive but requires care to maintain a f lat surface. Sand is quickly pushed around by cows, so it should not be used with mechanical or liquid manure handling systems because it fills up storage tanks and is very abrasive, damaging equipment such as manure pumps. A concrete foundation with a disposable bedding of chopped straw, sawdust, wood shavings or crushed corn cobs is more common in Europe, because rice hulls are not readily available. Rice hulls would make ideal bedding for free stalls but their high silica content could damage liquid manure handling equipment. Hard surfaces should have a slope of at least 1% so that urine will drain into the alleys. Rubber mats and cow mattresses are new innovations for free stalls but the thin ones (10 mm or less) have short life spans. Thicker ones (25–30 mm), although more expensive,

are likely to be more cost effective in the long term. The front of the cubicles with thick bedding should be 1.2 m high and the back 0.85 m. In cubicles with solid floors, these measurements are 1.1 and 0.75 m, respectively.

Ventilation: It is necessary to remove odours and gases from the barn, and replace them with fresh air. In cold weather the ventilation rate is calculated to remove excess moisture and in hot weather it is calculated to remove excess heat. Natural ventilation using existing windows and doors is preferable because of cost. Natural ventilation relies on the wind to ventilate a barn by the cross flow of air in one side and out the other, and on the fact that hot air rises. In order for natural ventilation to work properly it is necessary to have both air inlets and exhaust openings from the barn. Windows can be used for both air inlets and air exhaust if they are adjustable and are spread evenly around the walls. Doors can also be used if you are careful. Brouk *et al*. (2005) observed that fans cool by moving air over the body of animals at a faster speed than normal air movement but when fans are not sufficient to elevate cooling levels, additional cooling can be achieved by using evaporative cooling and increase 10 percent in milk production in cows that are cooled by fans and sprinklers compared with animals in free stalls.

In cold weather, air exhaust openings will be needed. In a two-storey barn, hay chutes can be used if they have an adjustable opening. Hay chutes should only be used as a temporary fix, since they will exhaust warm moist air into the mow area of the barn. If this moist air is not exhausted from the mow, it will condense on roof members and eventually lead to deterioration of the roof. The long-term solution is to install chimneys which will exhaust the air directly to the outside.

Heat stress management: During periods of heat stress, it is necessary to reduce cow stress by increasing airflow and installing sprinkler systems. The critical areas to cool are the milking parlor, holding pen and housing area. First, these areas should provide adequate shade. Barns built with a north-south orientation allow morning and afternoon sun to enter the stalls and feeding areas and may not adequately protect the cows. Second, as temperatures increase, cows depend upon evaporative cooling to maintain core temperature. The use of sprinkler and fan systems to effectively wet and dry the cows will increase heat loss. The holding pen should be cooled with fans and sprinkler systems and an exit lane sprinkler system may be beneficial in hot climates (Garner *et al*.,1988). Fans may be installed to provide additional airflow that will increase evaporation rate. Zheng *et al.* (2009) suggests that heat stress significantly reduces the production of milk, percentage of milk fat and percentage of proteins, but that it has no effect on the content of lactose in milk.

Cold Stress: Dairy cows can withstand a significant amount of cold stress as compared to other animals. Factors affecting the ability of the cow to withstand cold temperatures include housing, pen condition, age, stage of lactation, nutrition, thermal acclimation, hairy coat and behaviour. Feed intake increases when ambient temperature drops below the lower critical temperature of the animal. Protection

from wind and moisture will reduce the lower critical temperature and minimize the effects of cold stress. When feed intake is no longer adequate to maintain both body temperature and milk production, milk production will likely decrease.

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Subclinical ketosis in dairy cows: Causes and its management

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Abstract

Subclinical ketosis (SCK) is a condition characterised by the presence of increased blood ketone concentrations without any clinical signs. Many factors are responsible for SCK. It is more common during transition period because of high negative energy balance. It has tremendous impact on the productive and reproductive performances of dairy cows. So, huge economic loss is incurred because of SCK. Prevention of ketosis is the need of the hour and this is only possible through proper feeding management, by maintaining proper BCS and monitoring SCK with easily available and cheap cow-side tests kits.

Keywords: Subclinical ketosis, Ketone, transition period, productive, reproductive, dairy cows

INTRODUCTION

As the dairy industry continues to strive for increased genetic gain in milk production, cows will continue to be at increased risk of developing subclinical ketosis (Duffield *et al*., 2000). Subclinical ketosis is simply a condition marked by increased levels of circulating ketone bodies without the presence of the clinical signs of ketosis (Anderson *et al*., 1988). There is a remarkable shift in metabolism after calving and milk production increases so rapidly that feed intake alone cannot suffice the energy requirements (Bauman and Currie, 1980; Baird, 1982). Cows with a poor adaptive response to negative energy balance develop SCK. Cows that develop ketosis in early lactation lose milk yield and are at higher risk for postpartum diseases. So, subclinical ketosis causes huge economic loss through decreased milk production and is associated with many peri-parturient diseases.

SCK and Clinical ketosis

Clinical ketosis refers to the presence of clinical signs in addition to an increase in blood ketones bodies (Andersson, 1988) but in SCK, no signs are obseved. SCK consists of a blood BHBA concentration greater than 1.4 m*M* during early lactation (Duffield *et al*., 2009). Increased concentrations of both BHBA and NEFA is used as markers of SCK.

Factors affecting Subclinical ketosis:

- Lack of nutritive feed
- Adreno-cortical insufficiency
- Hypothyroidism
- Role of insulin
- Lack of exercise
- Deficiency of vitamins and minerals

Mechanism of subclinical ketosis

Most transition dairy cows experience a negative energy balance (**NEB**) because of increased energy demands at parturition and decreased in DMI before parturition. Glycolysis fails to meet the energy demand through blood glucose, instead energy is provided by the ketone bodies. Ketone bodies are formed by ketogenesis when liver glycogen stores are depleted in the process of energy supply. The main ketone bodies that are formed are none other than acetoacetic and β-hydroxybutyric (BHB) acids. The levels of ketone bodies are regulated mainly by insulin and glucagon. This increase in ketone bodies in the blood leads to the development of various froms of ketosis.

Diagnosis

Diagnosis of subclinical ketosis depend upon the level of ketone bodies concentration above which cows are to be considered subclinically ketotic. Concentrations between 1,000 µM (10.4 mg/dL) and 1,400 µM (14.6 mg/dL) are generally considered by most of the researchers in their findings (The Mercks Veterinary Manual, 2014). Herd level testing requires at least 12 animals in the first 60 days of lactation and if >10% are subclinically ketotic, it should be considered as a herd level problem and prompt nutritional, monitoring and other management procedures are to be adopted (The Mercks Veterinary Manual, 2014).

Table 1: Fat Metabolites Level in Blood (mg/100ml)

Fat metabolites	Normal level	Sub clinical Ketosis	Clinical Ketosis
Acetoacetic acid	0.1	-	7
BHBA	8	-	30
Free Fatty acid	9	-	28

Impact of sub-clinical Ketosis in Dairy cows

Increased concentrations of BHBA or NEFA are associated with an increased risk of developing various diseases and conditions like abomasum displacement, clinical ketosis, culling, metritis, placental retention, mastitis, and lameness, reproductive disorders and changes in milk production potential of dairy cows (Duffield *et al*., 2009; McArt *et al*., 2013; Suthar *et al*., 2013). SCK also causes lameness (Suthar *et al*., 2013). The BHBA threshold varies from 0.3 (Suthar *et al*., 2013) to 1.8 m*M* (Duffield *et al*., 2009).

So, in short SCK has the following impacts in dairy cows.

i. Association with periparturient disease
ii. Impact on milk production
iii. Impact on reproductive performances
iv. High cost of subclinical ketosis treatment

Management of Sub-clinical ketosis

It includes the following broad managemental practices:

i. Monitoring of subclinical ketosis
ii. Feeding Management
iii. Management of body condition
iv. General management practices

Monitoring of subclinical ketosis

This includes the following tasks:

a. Testing the dairy cow: Pre calving & Post calving .
b. Test for detecting ketone bodies: NEFA test, BHBA test, Milk ketone and Urine ketone test .

NEFA test for SCK:

It measures serum or plasma NEFA levels in dry cows. Sampling of blood is done prior to feeding time The animals are neither to be excited at the of sampling nor be collected or measured from sick or off feed animals. If NEFA concentrations in the week before calving are greater than 0.7 mmol/L, increases risk of SCK (Osborne *et al*., 2003)

BHBA test:

This test measures serum beta-hydroxybutyrate levels in fresh cows. Sampling is taken from 8-10 fresh cows after 0-4 weeks postpartum. Sampling is done prior to feeding time. Measurement is not conducted in sick or off feed animals. BHBA concentration of 1400 µmol/L or greater is the primary risk for SCK (Duffield *et al*., 2000)

MILK KETONE TEST:

Milk ketone tests measure acetone and acetoacetate through a reaction with nitroprusside which causes a colour change from white to pink or purple. One exception is that milk ketone test that measures only BHBA. It is marketed in Europe as "Ketolac BHB", in Japan as "Sanketopaper", and in Canada as "Keto-Test". This test has a much higher sensitivity in milk (>70%) and reasonably good specificity (>70%, up to 90%) (Oetzel *et al*., 2004).

Urine Ketone Tests :

Urine ketone test is based on the same nitroprusside reaction as the milk ketone tests(Colour change from white to pink or purple). This test is highly sensitive (approaching 100%) but are poorly specific.

Feeding management:

Feeding of high bulk and low energy diets for dry cows (Oetzel, *et al*., 1998) is encouraged. Transition period diet is designed to maximize the dry matter intake to provide adequate energy density. Total mixed rations is highly recommended. Propylene glycol has been used successfully for the prevention of subclinical ketosis (Sauer *et al*., 1973). Niacin is fed prior to calving at the rate of 3 to 6 g/day, may be helpful in reducing blood levels of BHBA (Dufva *et al*., 1983). Monensin included at 30 g/ton of total ration (high group) decreased the incidence of subclinical ketosis and significantly reduced blood BHBA concentrations in the first three weeks postpartum (Sauer *et al*., 1989).

Management of body condition of cow

Over-conditioned cows is avoided in late lactation and dry period. Over-conditioning causes depressed appetite at freshening and may increase fatty liver problems. Body condition score should be 3-3.5 at calving.

General management practices

For the comport and sound productivity of dairy cows, proactive management and investigation of problems should focus on minimizing nutritional, housing, social and environmental factors. Adequate pen space per cow, adequate feed bunk space, sufficient and comfortable bedding, adequate water supply and minimization of heat stress.

CONCLUSION

Subclinical ketosis is an important and common condition in lactating dairy cows. There are several tests for subclinical ketosis available but the design and frequency of a subclinical ketosis monitoring program will depend on the purpose of the program and the frequency of disease within the herd. Certain feeding such as niacin, propylene glycol and monensin along with balanced ration is beneficial. Milk yield loss is about 7% of the total yield. The total economic loss for a single case of SCK can range from Rs 2000/- to Rs 5000/-. Early detection of SCK using a cow-side blood test followed by early treatment of SCK with oral propylene glycol reduces the negative impacts of SCK.

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Mastitis Management of Dairy Animals at organized Dairy Farms

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Mastitis is the disease of mammary gland caused by various organisms including Bacteria, fungus and occasionally by virus. Mostly, the infection enters through teat-canal and causes disease to the susceptible gland. High producing animals are more susceptible. Susceptibility is also increased to the animals milked by machine, having injury to the teat and gland, and by incomplete milking. Secretary tissues get damaged and affected gland may be rendered blind. At any time, over 30% cows may be infected. Mastitis is universally considered the most widespread and costly disease of the dairy industry. It can be defined as the inflammation of mammary gland irrespective of causes.

Mastitis is responsible for heavy economic losses due to reduced milk yield (up to 70%), milk discard after treatment (9%), cost of veterinary services (7%) and premature culling (14%) (Bhikane and Kawitkar, 2000). Importance of mastitis in commercial dairying can be well assessed by the fact that a developed country like USA has 16.5% of the cattle population suffering from clinical mastitis (Dargatz, 2009). The annual economic losses due to mastitis were calculated to be approximately Rs.7165.51 crores in India losses being almost same for cows (Rs.3649.56 crores) and buffaloes (3515.95 crores). Much economic losses occurred due to subclinical mastitis; these being 57.93% (Rs. 4151.16 crores) (NDRI News, 2012). Sharma *et al*., (2012) found that the incidence of mastitis was found to be 40% in 485 lactations of Karan Fries cows during the period 2006–08.

Mastitis is a disease which is almost impossible to eradicate from dairy herds but can be controlled to a lower level by adopting suitable udder health management programme which intern are based on two main principles viz.

a. Elimination of existing infection.

b. Prevention of new infection

Elimination of existing infection can be achieved by antibiotic therapy both during dry and lactation period. On the other hand prevention of new infection can be achieved by adopting a suitable udder health management programme. The major principles of mastitis control programme are as under.

The disease may be classified under two headings:

1. Clinical mastitis
2. Sub-clinical mastitis.

Early detection at sub-clinical stage is one of the measures to minimise the incidence of clinical mastitis in dairy animals. These unseen infections are detected by several methods, including the direct microscopic somatic cell count and the California Mastitis Test (CMT). CMT is a cowside test that can be a valuable tool, yielding rapid results. The use of the CMT on the entire

herd at monthly intervals can be extremely useful as an aid in detecting herd mastitis problems. Individual and total quarter infections can be determined and, with proper records, the level of herd mastitis can be monitored. This test yields information that can aid in determining faulty milking procedures or equipment function, as well as the effectiveness of teat dips and dry cow treatment programs. Mixed with milk, the CMT chemical or reagent reacts with leucocytes (white blood cells) that are usually present in large numbers when an infection occurs. When this reaction occurs, the reagent-milk mixture thickens or gels in proportion to the number of leucocytes present and indicates the severity of the inflammation. The greater the reaction, the higher the CMT score.

Table 1: CMT consideration table (Schalm and Noorlander, 1957)

CMT score	Consistency of milk/reagent mixture
1	No change in consistency.
2	No visible change in consistency, but when paddle is tipped a slime is momentarily seen on the bottom.
3	A gel or thick slime forms, but when the paddle is swirled the solution does not move into the centre.
4	A thick lumpy gel forms, which, when swirled, quickly moves toward the centre
5	A distinct gel forms which tends to adhere to the paddle, and during swirling a distinct central peak forms.

Treatment of CMT Positive Cows

During lactation, it is not generally recommended to treat all subclinical mastitis that is detected by the CMT alone. If you suspect that a subclinical case of mastitis may progress to clinical, rather than receding, prompt therapy should begin. Clinical cases (obvious mastitis) require early therapy. Laboratory culturing of milk from these quarters is necessary to provide the required information to prescribe proper therapy. By periodically recording your CMT results, one can monitor herd levels and investigate the possible causes early when results show elevated CMT scores from one test to the next. The test reaction is to be graded and interpreted in similar manner as discussed above.

Following of the following package of practices is very useful for the control of mastitis in dairy herds.

(i) Adoption of proper hygienic measures:

Maintenance of proper hygiene is perhaps the most important management practice in mastitis control as it affects the degree of exposure and population of microbes in the environment surrounding the cow. Most of the new infections take place during preparing the animal for milking and during the process of milking itself. So, a hygienic and clean milking byre/ place is very essential to reduce the infection rate. Teat hygiene is another important factor of reducing the exposure. It may be achieved by using pre and post milking teat-dip. Post milking teat dipping or spraying the teats with disinfectants is of special value as it removes most of the residual contamination and most importantly encourages healing of the teat sores and lesions and also prevents the growth of the pathogens in teat ducts. An effective teat dip if correctly used can

reduce the incidence of new udder infection by 50 to 90%.

The sanitary measures can be summarised as follows:

1. Teat washing with disinfectant solution and wiping with individual clean towels, prior to each milking.
2. Disinfecting of hands of milkers, milking machine clusters before milking and
3. Teat dis-infection after each milking by dipping or spraying all teats in disinfectant solution.

Suitable udder disinfectants for this purpose are as follows:

a. Iodophor solution containing 0.1 to 1.0% available iodine.
b. Chlorhexidine 0.5 or 1% in polyvinyl pyrrolidone solution or as 0.3% aqueous solution
c. Sodium hypochlorite (4% solution).

To ensure effectiveness of these disinfectants the udder must be washed clearly to remove all the organic matter before applying disinfectant solution on them.

(ii) Proper milking procedure:

Proper milking of dairy animals is important regardless of whether hand or machine milking is being followed. Rapid and full hand milking is desirable as this ensures harvesting of more milk and simultaneously prevents teat injury which might result as a consequence of improper milking method (Fisting etc). Milking management becomes more important when machine milking is followed. In addition to proper disinfecting of milking machine, the following factors must be considered.

- Establish and maintain a regular milking schedule in a stress free environment.
- Ensure that teats are clean and dry prior to milking.
- Check fore milk and udder for mastitis using strip cup or California mastitis test (CMT).
- Attach the milking unit properly.
- Minimise machine stripping and avoid liner slips.
- Avoid over milking and removing the unit under vacuum.
- Fluctuation in vacuum levels must be minimum.
- Optimum vacuum must be ensured.
- Pulsation rate should be maintained within permissible limits.
- Teat liner must be checked for rupture etc. and must be replaced at least once a month.
- Milk the infected animal in the end when all the fresh animals have been milked.
- Daily inspection of milking equipment should be a routine affair.

(iii) **Dry cow therapy:**

The dry period offers a valuable opportunity to improve udder health while cows are not lactating. On the other hand, the beginning (initial 2-3 weeks) and the final 2-3 weeks of gestation period is very vulnerable to new infections. The procedure of dry cow therapy may be carried out as follows:

- Dip all the teats in an effective teat dip after complete milking and dry completely.
- Disinfect each teat end with alcohol soaked cotton swab and infuse a single doses x syringe of a recommended antibiotic. Long acting antibiotic preparations like benzathine Cephapirin, benzathine cloxacillin, benzathine penicillin, erythomycin,

novobiocin etc, can be used successfully. A partial insertion method of administration is better than complete insertion.

- Immediately after treatment dip all the teats in an effective teat dip again.
- The target of dry cow treatment is the group of pathogen residing in the udder i.e. Streptococcus sp., staphylococcus aureus and corynebacterium pyogenes. To check the new infection that occur in the few days before calving a second treatment during the final 1 or 2 weeks period of pregnancy may be practised but with great care as there is high degree of susceptibility during this period.

Besides therapy, dry cows should be provided with an environment that is as clean and dry as possible. It is also important to provide adequate space, ventilation, and lighting to ensure cleanliness and comfort. Clipping of the hair on the udders, flanks and inside the hind leg also helps to reduce contamination. Adequate balanced dry cows feeding along with vitamin E and Selenium also appear to be effective in preventing mastitis infection at calving and early lactation as they enhance the defence mechanism. This is also helpful to ensure high milk yield in the ensuring lactation.

(iv). Quick diagnosis and appropriate therapy of affected animals during lactation.

Early detection of mastitis, preferably in sub-clinical form itself, is the key to the successful treatment of the disease. This can be better done by screening all quarter samples using California Mastitis Test (CMT) and monitoring Somatic Cell Count (SCC) at least once a month regularly. Use of strip cup is another easy test for detecting clinical mastitis. The antibiotic therapy should be done after conducting the sensitivity test and use single dose tubes and not the multiple dose bottles which can become contaminated. It is better to consult a qualified veterinarian.

(v) Segregation and culling of chronic infected animals

As soon as the mastitis is confirmed, the cow must be segregated from rest of the herd and milked and treated separately besides adopting proper hygienic measures. Selective culling of the cows with chronic mastitis (three or more episodes in a lactation) should be practised.

(vi) Monitoring udder health status:

Implementing an effective udder health monitoring system is another key principle of mastitis control. It involves the following two components:

- Monitoring udder health at herd level-bulk milk tank somatic cell count can be use for this purpose.
- Monitoring udder health of individual cows- Individual cow SCC can be used along with CMT.

For proper monitoring good record keeping is essential. Based on the current udder health status the appropriate control measures should be undertaken. Besides, periodic review of the udder health management programme is also important to take corrective measures wherever required.

(vii) Setting goals for udder health status:

Establishment of realistic periodic targets for various udder health parameters is the final step of a complete udder health management program. The goals should be realistic, economic and achievable. The

farm goals should be re-evaluated with each time period used for completion of health management cycle.

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Agriculture and Rural Tourism in India

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India's tourism industry is experiencing a strong period of growth in high spending foreign tourists, and coordinated government campaigns to promote 'Incredible India'. Tourism is termed as an instrument for employment generation, poverty alleviation and sustainable human development. Promotion of Agri-Tourism needs conceptual convergence with Rural Tourism, Eco-Tourism, Health Tourism, Adventure Tourism and culinary adventure. A novel concept of additional revenue is by developing farms into vacation ventures with hospitality facilities. Agritourism is the concept of visiting a working farm or any agricultural, horticultural or agri-business operation for the purpose of enjoyment, education or active involvement in the activities of the farm or operation. In general Agri-Tourism is the practice of attracting visitors to an area used primarily for agricultural purposes.

It may also be defined as travel, which combines agricultural or rural settings with products of agricultural operations all within a tourism experience. The product can be 'experience itself'. Rural and Agri-Tourism can be defined as "A range of activities, services and amenities provided by farmers and rural people to attract tourist to their area in order to generate extra income for their businesses".

Agri-Tourism is one alternative for improving the incomes and potential economic viability of small farms and rural communities. India is an agricultural country about 65 per cent of its population live in villages. A village is a collection of small huts in the midst of fields on which the village farmers work. Some villages are big, while others are comparatively smaller. They are generally cut off from the cities and have a different kind of life. As we rise early in the morning, we can listen to the sweet songs of the birds. We can enjoy the beauty of the rising sun and the sweet breeze of the greenery of fields around, are the various pleasures that abound in the countryside.

Establishment of Agri-Tourism units will promote livelihood security through improving the diversity and security of resources, skills and technologies that are available to agricultural commodities. It will help to achieve income, employment and economic stability in rural communities in India. It would help boosting a range of activities, services and amenities provided by farmers and rural people to attract urban tourists to their

area thus provide opportunity for urban people to get back to the roots.

Rural and Agri-Tourism in India

Agriculture is the back bone of Indian economy. This sector's contribution towards GDP is decreasing and farmers are finding it difficult to carry the agricultural activities without an additional income. Whereas tourism is termed as an instrument for employment generation, poverty alleviation and development, Rural and Agri-Tourism brings in together the declining and booming sector. Advantages of Rural and Agri-Tourism are:

1. It brings major primary sector Agriculture closer to major service sector tourism expected to create win-win situation for both the sectors.
2. Tourism sector has the potential to enlarge.
3. Agriculture sector has the capacity to absorb expansion in Tourism sector.

Scope of Rural and Agri-Tourism

1. An inexpensive gateway: the cost of food, accommodation, recreation and travel and tourism is low, widening the scope of tourism.
2. Curiosity for the urban about farming industry and life style: Rural and Urban tourism, which involves villages and agriculture, has the capacity to satisfy the curiosity of the urban segment by providing scope for re-discovering the rural life, which is rich diversity.
3. Strong family oriented recreational activities: through rural games, festivals, food, dress.
4. Finding solace with nature friendly life style: Peace and tranquillity are in-built in Rural and Agri-Tourism.
5. Nostalgic for their roots on the farm: For tourists it is like returning back to their roots.
6. Educational value of Rural and Agri-Tourism spreading knowledge about agriculture science where urban students are moving with the pace of technology.

Basic Principles of Rural and Agri-Tourism

1. Have something for visitors to see: Animals, birds, farms, culture of the village, dress and festivals.
2. Have something for visitors to do: Participating in agricultural operations, riding camel, buffalo, cooking and participating in the rural games i.e. gillidanda, gotti (marble etc.)
3. Have something for visitors to buy: Rural crafts, dress materials, farm gate fresh processed food and few items.
4. Three important factors, which contribute to the success of Rural and Agri-Tourism as service, are:

Farmer: Majority cases farmer is less educated, less exposed and innocent for him outsider as guest is (like God) and is treated wholeheartedly without any commercial motive. He entertains the quest while entertaining himself in the process he fills all the service gaps. This makes him natural businessman.

Village: Village being located far from the city lacks urban facilities but is rich in natural resources. The investment is the natural resources itself.

Agriculture field: Each field is unique which adds to the attraction of the urban population. This is the incentive wealth of the rural people.

SWAT Analysis of Rural and Agri-Tourism

Impact of Rural and Agri-Tourism

Economic impact:

- Income from entrance fees and direct payment for access right.
- Income from associated value added services.
- Development of related economic sector e.g. sustainable agriculture and forestry.
- Increase local land values.
- Increase foreign exchange.

Social impact:

- Training and skills development for provision of economic services.
- Education-primary schools/environmental education.
- Improves local infrastructure - communications/transport.
- Increased social capital-building.

Environmental impact:

- Protection and conservation of environment.
- Improved resource management practices.
- Increased multi-stakeholder will to conserve at landscape level.
- Conservation of Biodiversity.

Concluding Remark

Rural and Agri-Tourism can be an effective tool and technique to educate consumers about local agriculture. Agri tourism also showcases the diversity and uniqueness of local agriculture, thereby increasing the visibility and the appeal of local grown products. Hence the opportunities in this sector can boost the rural economy. Promotion of Rural and Agri-Tourism requires conceptual convergence like other tourisms e.g. rural tourism, eco tourism, adventure tourism for better growth.

Strengths	Weakness	Opportunities	Threats
Different variants of tourism	Inadequate infrastructure	Fast expansions	Terrorism
International cooperation	Accommodation	Fast expansions	Recession
Average length of stay	Basic amenities	Rapidly growing middle class	Inflation
	Lack of professional management		Deflation

The Present Status Of Poultry Industry In India: How Fat Our Chickens Are?

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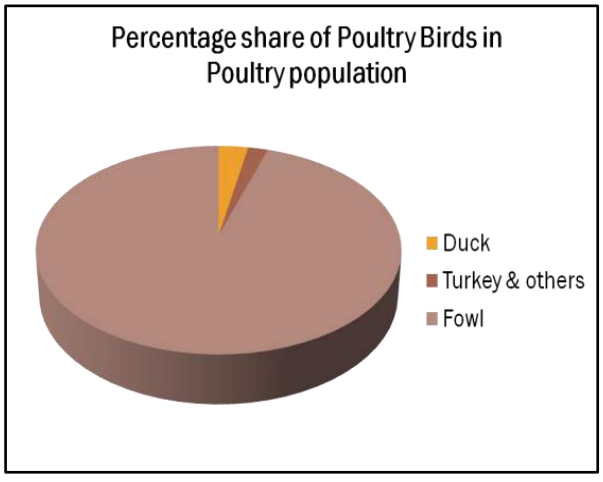
Indian Poultry Industry is 5,000 years old, since last 4 decades it began to witness remarkable growth from backyard to poultry industry. The poultry Industry of India is expected to register double-digit growth in 2015 on the back of stable feed prices and encouraging rural and urban demand. Indian broiler production at 3.8 million tons is the fourth largest in the world after US, Brazil and China. The growth is continuing at 12 to 15 per cent. India is the second largest egg producer and third largest broiler-chicken producer in the world with production estimates of 65,000 million (2.8 million tonnes) eggs and 3 million tonnes of broiler meat per year. The market is estimated to be worth about INR 90,000 Crore (EUR 12.65 Bn) (DAHD-GOI-2014). It is further estimated that there are about 60000 farms under Intensive system (some of them having more that 100000 birds) while there are about 100000 small farms scattered in rural areas practicing more extensive production systems having flock sizes ranging from 25 to 250 birds.

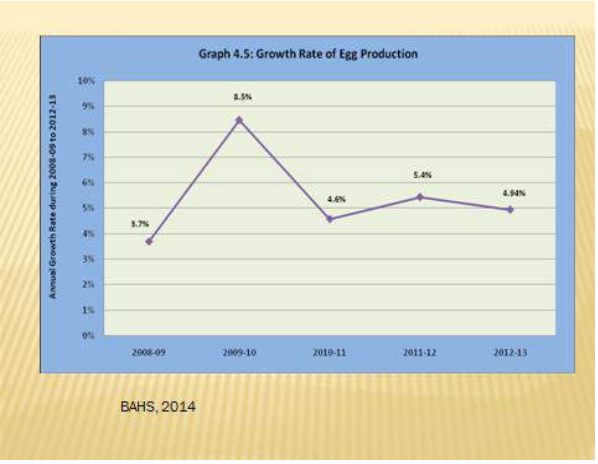
"A chicken in every pot" - 1928 Republican Party campaign slogan
"We can see a thousand miracles around us every day. What is more supernatural than an egg yolk turning into a chicken?" - S. Parkes Cadman"



Poultry farming in India, in spite of several constraints, has progressed considerably during the last decade. Poultry production in India was confined to backyards till recently. Local breed of birds were reared for the supply of eggs and meat. The increasing demand for poultry products necessitates augmenting the supply by

importing improved breeds of poultry. In 1961, the proportion of hybrid populations in the total population of poultry was about 2 percent. Within a couple of decades, these birds have dominated the market sidelining the indigenous birds. The technological advances have revolutionized the role and the structure of poultry industry in India. It became one of the most specialized enterprises in many parts of the country. A general confidence has been created among the people that green revolution has ushered an era of self-reliance in the food grain production. The rapidly growing population has created some doubts in the said hypothesis. In fact, crop production alone may not solve the food problem of the country. The advances in cereal technology, of course, can fill the empty stomach, but it may not help in the balanced growth of the human body. The chief ingredients of balanced diet also comprise proteins, fats, minerals and vitamins, which are essential for growth. The supply of these items can easily be increased through increased production of livestock products. Leading broiler integrators in India are as follows: Venkateswara Group, Pune, Suguna Poultry Farms Ltd, Coimbatore, Pioneer Poultry Group, Coimbatore, Godrej Agrovet Ltd, Mumbai, Sky Lark group, North India, Jafa com feed.

The livestock sector alone contributes nearly 25.6% of Value of Output at current prices of total value of output in Agriculture, Fishing & Forestry sector. The overall contribution of Livestock Sector in total GDP was nearly 4.11% at current prices during 2012-13 whereas the fishery accounted for 0.83 % of total GDP and 4.75 % of Agriculture sectors GDP at current prices during 2012-13 . (Department of stat-GOI 2012). Poultry consists of generally three categories namely Fowls, Ducks and Turkey & others.



Poultry enterprises in India can distinctly be grouped into two categories i.e. developmental poultry farms and commercial poultry farms.

Developmental poultry farms- It refers to village/unorganized poultry production because this enterprise operates in a low scale, using less capital and traditional technology.

The unit volume of production is low due to the above constraints.. Poultry farming was included in various Central and State Government sponsored programs, such as Integrated Rural Development Program

(IRDP), Special Livestock Production Program (SLPP), Tribal Development Program (TDP), etc. to popularize poultry farming in rural areas.

Commercial poultry production

Commercial/ industrial poultry production refer to large-scale enterprises where the number of birds per unit is large enough to reap maximum advantages of technological improvement. These enterprises present various economies of scale of operation and, thus, are able to absorb the fluctuations in demand and supply and in input cost. The growth of this sector has remained highly significant over the years.

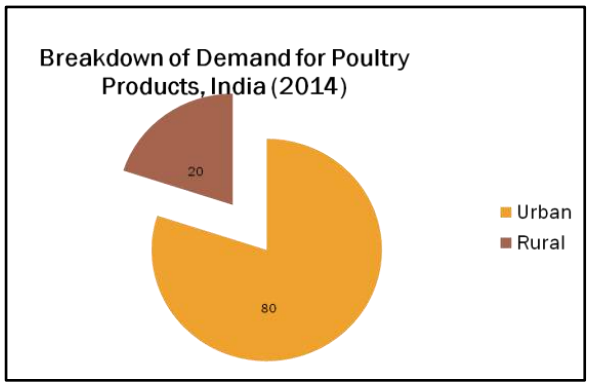
Poultry population statistics with in india and its distribution

The Total poultry population in the country is 729.2 million (19th Livestock Census-2012). The total poultry population in the country has increased by 12.39% over the previous census. The poultry population in India in 1951 was 73.5 million birds. It increased to 138.5 million in 1972 (doubled) and about four times by 1992, i.e., 307.07 million. The growth in poultry population was 5.32 percent per annum between 1951-56, 5.47 percent per annum between 1977-82, and 5.79 percent per annum (maximum) between 1982-87. The minimum growth in population was recorded between 1961-66, i.e., 0.21 percent per annum. Distribution or spread of poultry birds over the space may be examined by two approaches:

a) Distribution according to area (rural/urban) and
b) Distribution according to different regions.

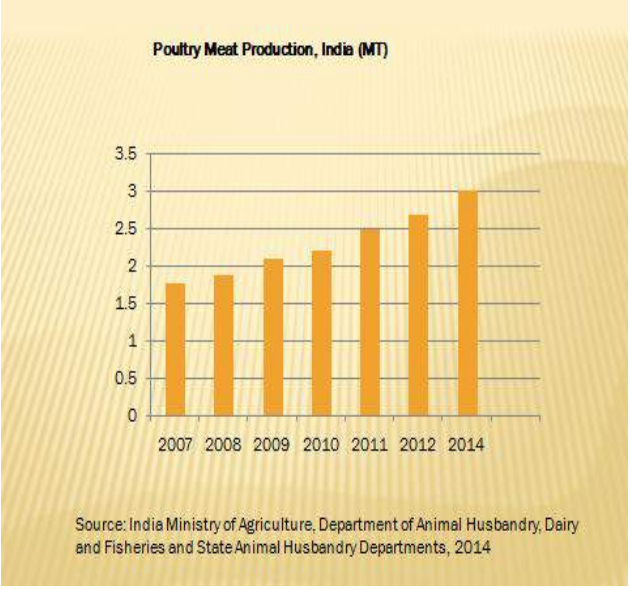
Poultry populations in rural/urban areas: Based on the Livestock Census of 1987 and 1992, the distribution of poultry reveals the following interesting features:

Rural and semi-urban area accounted for the largest number of broilers (more than 90%). Population of improved breeds of both layers and meat-type chickens increased much faster during the two periods as compared to Desi (Local) breeds. The population of broilers had increased rapidly, i.e., 21% per annum as compared to layers.



The proportion of poultry distribution in two areas did not reveal much variation during the period. The leading poultry producing states in different regions were Andhra Pradesh and Tamil Nadu in Southern Region, West Bengal and Bihar in Eastern Region, Maharashtra in Western Region and Punjab in Northern Region.

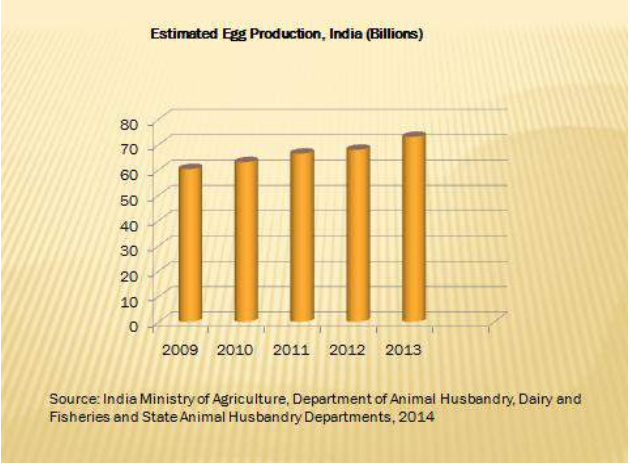
Productivity of Desi (Local) and improved birds, i.e.,eggs produced/year, also varied in different regions. Maximum productivity of Desi (Local) birds, i.e., 91eggs/year, was reported in Eastern region and minimum of 15 eggs/year, was reported in Northern Region. In case of improved birds, the productivity was highest in Southern Region (241 eggs/year), followed by 238, in Western Region, 209, in Northern region



and 204, in Eastern Region. State-wise, the productivity of Desi (Local) birds was maximum in Himachal Pradesh, i.e., 168 eggs/year and lowest in Nagaland, i.e., 79 eggs/year. In case of improved birds, the maximum productivity was 278 eggs/year, in Andhra Pradesh ,and minimum of 180 eggs/year, again in Nagaland. Regional distribution of hybrid parent stock revealed that it is heavily concentrated in Southern Region with nearly 45% of layers and 37% of broilers. The Northern region ranked second, with 27% layers and 25% broilers. It was followed by the Western Region, with nearly 20% and 25% of layer and broilers, respectively. The Eastern region had only 9% of layers and 14% of broilers. State-wise concentration of percent stock of both layer parent and broilers reveals a similar trend. The ranking of different states was Andhra Pradesh (25% and 18%), Tamil Nadu (14% and 9%), Maharashtra (12% and 18%), Punjab (10% each) and West Bengal (3% and 9%) of layers and broilers, respectively.

How to measure poultry development ?

The stage of poultry farming in different states / UTs was examined by constructing developmental indices on parameters such as layer parent stock, number of improved birds relative to the total poultry population, number of hatcheries (both in private and public sector), and performance (i.e., number of eggs produced/year).This technique was used to build indices for major poultry producing states/UTs in the country. The Poultry Development Index was constructed for the major poultry producing states of Indian Union. The states were classified in ascending order of WPDI. This implies that the state with the lowest WPDI was the first mentioned and so on. Assam & N.E. States were found in first place in the order, i.e., poultry farming is the least developed in these states, followed by Bihar, Orissa, and Himachal Pradesh, etc. Andhra Pradesh presented the most developed poultry production in India. In order to classify all states into two WPDI groups, the 0.52 level was arbitrarily chosen as the cut-off of different states classifying all states in two groups on the basis of low/high poultry farming development.



Indian Government Support

There are a several opportunities for foreign direct investment (FDI) in the poultry sector in areas like breeding, medication, feedstock, vertical integration and processing. Currently, 100% Foreign Direct Investment (FDI) is permitted in the food processing sector which covers dairy, poultry, marine, vegetables and fruits.

The Government of India also launched a National Meat and Poultry Processing Board on 19th Feb 2009 to work as a National hub for addressing all key issues related to Meat and Poultry processing sector for the systematic and proper development of this sector.

Assistance to State Poultry Farms:

Aims to strengthen existing state poultry farms so as to enable them to provide inputs, mainly in terms of providing improved stocks suitable for rural backyard rearing. Sharing pattern of funds between center & state is 80 : 20 (except for NE states for which 100% central funding is provided).

Poultry Estates (new component):

Entrepreneurship skills are to be improved through exploratory pilot component of poultry estates. It is meant primarily for educated, unemployed youth and small farmers with some margin money for making a profitable venture out of various poultry related activities in a scientific and bio secure cluster approach. Grant will be provided to states for infrastructure development on 75:25 (center : state) sharing basis and 100% grant to NABARD for other components. The components of the scheme could include strengthening of infrastructure, feed mixing plants & equipment for feed analytical laboratory, in house disease diagnostic laboratory, revolving fund for purchase of hatching eggs, parent stock, feed ingredients, marketing, consultancy etc

KEY SECTOR CHALLENGES

Despite positive forecasts and investor confidence, the poultry sector still faces certain fundamental challenges. Global trends— most prominently, sporadic bird flu outbreaks— have resulted in a widespread demand drop across the country in the past. However, the key concern is the existing lack of storage, cold chain, transport and processing facilities. High feed costs also result in an increased cost of production which translates to higher prices. Other challenges include a lack of quality standards which result in high vulnerability to disease outbreaks.

Poultry integrators have limited control over feed prices and broiler realizations; and they continue to focus on improving productivity by experimenting with feed mixes, lower mortality rates through enhanced farm management and medication, and continuous efforts towards

improving other operational parameters like hatchability, average daily weight gain and reducing selection gaps. These practices may be essential but they translate into compromising on quality.

SUMMARY AND CONCLUSIONS

The increasing demand for poultry products has transformed poultry production activity into a full fledged industry from a mere household/backyard activity until recently. Technological advances have revolutionized the role and the structure of poultry industry in India. The distribution of the poultry population suggests that it is concentrated in some limited pockets. Forty two percent of the total population of poultry is confined to the Southern region, with 22% in the Eastern Region and 20% in Western Region, with only about 16% in the Northern region. Improved poultry breeds account for 59% of the total bird population, contributing with about 89% of the total egg production in the country.

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Goat and Sheep Farming System In India And Essential Housing Manegemental Practices

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Goats and Sheep contribute significantly to the Indian economy by sustaining livelihood and supplementing income of small farmers and rural poor's. Livestock play an important role in the social community life of India &its well being is closely associated with its huge livestock population. Goat and sheep population in country is about 135.17 million and 65 million which contributes about 26.40 % and 12.71% of total livestock population in the country (BAHS, 2012). different recognised breeds of goat are found in wide range climatic condition ranging from a perennially snow cloud Himalayan region to the hot aried parts of western rajasthan & also covering lush alkaline pasture of Kashmir to sea coast of Kerala. Goats are among the main meat producing animals in India, whose meat (chevon) is one of the choicest meats and has huge domestic demand. Besides meat, goats provide other products like milk, skin, fibre and manure. The sheep is an important economic livestock species, contributing greatly to the Indian economy, especially in arid, semi arid and mountain areas. Sheep rearing is mainly based on the wool production, meat and sometimes milk is also important. Housing is an important issue for goat and sheep management because it has significant effect on physiological responses and energy expenditure (Bhatta, 2005).

Goat Production Systems in India:- There are 5 types of goat production systems in India:

1. **Transhumance system of goat production**: - It exists in J&K, Rajasthan and Himachal Pradesh and based on the Nomadic system. Nomadic people move from one to other area with their animals.
2. **Goat sesbania system**: - It mainly found in the sugar belt of Maharashtra state. Goat get sufficient amount of sesbania leaves.
3. **Plant goat production system**: - Mainly founds in north eastern part of India having rain area and natural grass like Assam, Manipur, Sikkim.
4. **Pashmina production system**:-Dry cold region of high altitude area like Laddakh.
5. **A dairy unit of domestic purpose**: - People kept 2-3 goats for meat purpose.

Traditional methods of housing: - Sheep/Goat rearing is mainly in the hand of the weaker section of community which

either do not posses land or their landholdings are so small that crop cultivation does not provide remunerative employment all the year. Due to lack of education sheep/goat owners are not able to appreciate and adopt improved sheep and goat husbandry practices brought to them by extension workers. Goat management has thus remained in a neglected state.Traditional sheep and goat housing is made of varying designs and construction materials depending upon local custom and availability. Migration and grazing practices have an impact on the present status of goat husbandry in India. Some main types of housing include:

- Housing at one corner of the main family house.
- An overhang attached to the roof of a house.
- Open yards with no roof.
- Separate houses of thatched roofs.

Extensive system of housing: -This system includes migratory, transhumance, free range grazing management of goat. It has two components which pertain to goat rearing in plains and hills. Plains were bulk of country goat population, found in the rural area, comprising a flock of 2-5 goats are raised in grazing of marginal lands &argil by-products with no special feeding. The practice of extensive system in plains is due to shortage of pasture, lack of irrigation excessive pressure of population on land.Hills when goat flocks are 100-150 in number. Goat while grazing on grass or bush also helps in dispersal of seeds and improvement in vegetation. The management of migratory flocks' needs special attention to the extent that over use of the grazing lands has to be avoided to control environment degradation. The local goat should not be allowed to mix with the migratory flocks otherwise indiscriminate mixing of breeding result. The beetle goat male kids reached a body weight only 11.5 kg. at weaning and 14.1 kg. at 6 month age when maintained under free range grazing without any supplementary feeding with over all survivability of 87.5 % up to 6 month of age.

Semi-intensive system: -A kind of comparison between extensive and intensive system is referred to as semi intensive system**.** This system is widely practiced by small and marginal farmers. The nature and extent of this system depends on the type of crops grown and their suitability to goat and sheep. Goat/sheep are left to graze /browse on the crop residue when the same has been harvested. The advantage of this system are increased fertility of the land by dropping and urine of the animal, control of wasteful habits, good growth rate, easier management and possible increased crop yield. Studies have shown that the natural grazing lands cannot support growth of kids for commercial meat production and additional supplementation with conc. mixture or leguminous fodder & tree leaves is recommended.Supply of extra energy and proteins through concentrate have been advantageous in increasing growth rate and attaining the desire slaughter weight at younger age.

Intensive system: -It includes grazing on the developed pasture and/or feeding completely in stall on cultivated fresh on consevered fodder, crop residue or concentrates. This system requires high level of labour and is only suitable for meat production from goat. Average daily

gain weight under intensive system was higher in lambs than kids while they were similar under semi intensive system. The milk yield is higher under intensive system than that under semi intensive system &extensive system.The pressure of increasing population of human and animals further justify adoption of intensive management system for livestock in general and goat in particular to ensure control & degradation of the environment.

Houses for sheep/goat in the rural area must be secure, dry, well ventilated, and free from parasites, clean, well lighted and fencing east west direction. House should be able to provide protection from rain fall, cold, direct sunshine & winds. In comfortable house is where inside temperature 15-25 ˚C and 3-5 goats are kept in house of 2.1 metre length & 1.5 metre in width.

Table 1. Floor space requirements at different age (Thomas and Sastry, 2012)

Sr. No	Type of animal	Floor space (m^2)
1.	Ram or buck in groups	1.8
2.	Ram or buck, individual	3.2
3.	Lamb or kids in groups	0.4
4.	Weaner in groups	0.8
5.	Weaner, individual	0.9
6.	Yearling, individual	0.9
7.	Yearlings in groups	0.9
8.	Ewe or doe in groups	1.0
9.	Ewe or doe, individual	1.2
10.	Ewe with lamb	1.5

Table 2. Dimension of different type of goat and sheep shed**.**

Type of shed	Size (m)	Height (m)	Maximum animals
Ewe/doe shed	15 x 4	3	60
Ram/buck shed	4 x 2.5	3	3
Lambing/kidding shed	1.5 x 1.2	3	3
Lamb/kid shed	7.5 x 4	3	75
Weaner shed	7.5 x 4	3	75
Yearling shed	10 x 5	3	50
Sick animal shed	3 x 2	3	1
Shearing shed and store room	6 x 2.5	3	-
Shepherd's room	6 x 4	3	-

Stratifid system:-This system is based on forage availability in the intensive strata is possession of layer of vegetation usually of same for height as well as where price high for dairy goat products. Under this system a breeding centre is an irrigated zone serves as nucleus with a no. of small herds.

Integrated cropping system:-Integration of crop production into crop agriculture speaks of changing pattern of management. Though it may be considered as one identical as intensive, semi intensive extensive system but it has separate identify.

Migratory system: - This is a system in which a seasonal migration of livestock & the people who tend then between lowlands & adjacent mountain. Advantages are rearing of herd 50-500. male & female graze together and they are mated at a very young age.

Different managemental practices in goat and sheep house

Sheep and goat house should be built on a well-drained area. Some housing practices may cause stress to the goat and sheep (Vandenheede and Bouissou, 1993). Water supply should be adequate in

quantity and quality. The farm should be accessible from a main traffic road. Electricity should be available for yard lights and other electrical conveniences.It is always wise to keep in mind the possibility of expansion when building housing for sheep and goats.One can prevent the sun from heating up the stall too much by placing the longitudinal axis of the stall east - west. If, on the other hand, one wants the sun to shine on the floor so that the floor dries up and parasites die, it is better to build the shed along a north - south axis (This is preferred in humid areas). Roofs can be constructed from iron sheet, grass/bushes, wood, stone/brick or earth depending on production system, material availability and climate. In the cold weather area house is covered with straw and gunny bags. In the warm and humid climate a raised area should chooses and house is made up of bamboo and rails. Following arrangement should be planned for housing of sheep and goat:-

Cold weather:-In rural area the suitable ground level house for cold weather in built with a removal earth floor & bricks wall of about 1.5 mitre height with "A" shaped roof of 3.5 mitres height in centre is made of thatched/straw/tiles asbestos. It is covered with straw. Hoppers type window like in poultry house is made painting wall from outside helpful in reducing temperature inside.

Shelter for hot area: - A shed with its main axis is east-west provide a cooler environment underneath & it was the best for hot arid climate. The open type shed has an advantage over the close ones. The width & size of the shelter varying with the animal size & for goat & sheep the optimum has been determined to 5-6 mitres. Height of the shed should be 3-5 mitres shape of roof should "A" and the wall outside is white and coloured inside. Floor space requirements are- for adult female 1-1.5 m^2, for pregnant and lactating sheep 2 m^2& for kids and lambs from birth to 3 month 0.5 m^2 & 6 month to 1 year 1.0 m^2. The sheep house should be 5-6 metres wide and 20 mitres length sufficient for 60-80 goats or sheep's. Sep of the shelter "A" shaped has advantageous over the rest in hot season as one side of the roof will save the other half from direct solar radiation

Manger: Either of cement concrete or of wood with two compartment providing food and hay & its height ranging from 45-60 cm.

Dipping tank: For protection of animals from infection, ectoparasites.

Foot bath: A foot bath made of galvanised steel sheet provided at the entrance to avoid foot rot diseases in animals.

Marking: Three means of marking are ear tattooing, ear tagging & ear notching which should be carried out with-in one week after kidding.

Dehorning: It should be practiced within 1 week of birth by using caustic potash.

Castration: It should done at the age of 2-4 week & for this Burdizzo's castrator is used.

Health care: Good hygiene & prevention treatments are vital aspect of good production.

Control of parasites: The important parasites are stomach worm, lung worm, nodular worm liver fluke & tick, lice. Phenothiazines, Thiabendazole & Tramisole are used for stomach & nodular worm.Treatment involves Vaccination, dosing (drenching), foot treatment etc.

Programme is taken up following consultation with Veterinary surgeon.

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Effect Of Buffalo Milk On The Quality Of Different Dairy Product

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Dairy industry in India has witnessed rapid growth in the last 3 decades. The milk production during 2009 was estimated to be 104.8 million tonnes of which 45–50% was converted into variety of traditional milk products. Buffalo has been an integral part of livestock agriculture in Asia. Milk accounts for about 70 per cent of the DGP from livestock sector. Buffalo is the major contributor of 55.42 per cent to India's milk production and about 65.84per cent of total buffalo milk produced in the world.

Buffalo Milk Quality: - Composition of buffalo and cow milk is given in Table 1. Buffalo milk contain higher total solids (18-20%).So it is useful for making cheese, butter fat, several kinds of traditional sweets and ice cream. Swamp buffalo milk has even higher fat (9-15%), protein (7.1%), lactose (4.90%) and ash (0.89%). Buffalo milk is healthy as it is richer in saturated fatty acids.

Bioprotective Attributes: - Buffalo milk contain high level of various bioprotective factors (such as immunoglobulin, lysozyme, lactoferrin, lactoperoxidase etc.) than that of cow milk. Various research investigations suggest the possibility of utilizing bovine cholesterol immunoglobulin for industrial production of infant formulas with enhanced bioprotective factors. Dairy foods from buffalo milk having high nutritional and Probiotical attributes. In concert with other bioprotective factors, immunoglobulin of protection primarily by binding and neutralizing toxins of viruses, and preventing contact between entero-pathogenic microorganisms and epithelial cells, thus hindering infections.

Use of buffalo milk in products making:- The buffalo milk is better suited for the manufacturing of majority of milk products like dahi, yoghurt, shrikhand, paneer, khoa, cream, cooking Butter, ghee, ice-cream, dried cream, dried butter, UHT cream, dried ice-cream mix, edible casein, caseinates, dairy whiteners and infant and health foods due to the quantitative and qualitative differences in various milk constituents and physico-chemical and functional properties of cow and buffalo milks.

Table 1: Composition of buffalo and cow milk

Constituents	Buffalo milk	Cow milk
Moisture (%)	81.00	87.50
Protein (%)	4.30	3.20
Fat (%)	6.50	4.10
Minerals (%)	0.80	0.80
Carbohydrates (gm/100g)	5.00	4.40
Energy calories (kCal)	117.00	67.00
Calcium (mg/100g)	210.00	120.00
Phosphorus (mg/100g)	130.00	90.00
Iron (mg/100g)	0.20	0.20

Consumers' Acceptance:- The Indian population like buffalo milk because it forms thick layer of cream layer (malai).It impart a distinct whitening effect to tea and coffee due to higher quantity of whey and casein proteins. When buffalo milk is boiled, release high amounts of sulphydryl compounds, which contribute to nutty, cooked flavor leading to its high acceptance as a drink. Milk product plants also prefer buffalo milk because of its high fat and solids-not-fat content.

Buffalo Milk in Traditional Products: - In India, buffalo milk is used in a lot of milk products preparation like khoa, Rabri, Kheer and Basundi. Buffalo milk results in higher yields and superior quality condensed products as compared to cow milk products.

Chhana: - The quality of buffalo milk chhana is not comparable to cow milk chhana when prepared by the same procedure employed to cow milk. Buffalo milk chhana's texture is hard and brittle, so it is unsuitable for rasogulla preparation. Treatment of buffalo milk with 25% water before coagulation and use of low strength citric acid solution were found to improve the texture of chhana. Addition of 0.3% mixture of dibasic sodium phosphate and monosodium phosphate (2:1) to buffalo milk before heating yield a chhana which is comparable to cow milk chhana suitable for rasogulla making.

Paneer: - Paneer is one of the important Indian traditional heat and acid coagulated dairy product. It is also very popular in India, Pakistan, Afghanistan, Burma and Nepal. It is used in the preparation of curries, vegetables, & sweets and other culinary dishes. The paneer made from buffalo milk is superior quality.The cow milk paneer is too soft, weak and fragile and after cooking its pieces loose their identity. The reason for such type of behaviour of cow milk paneer is now known.

Khoa: - Khoa from buffalo milk give softer and smoother than the one obtained from cow milk. Cow milk forms inferior quality khoa due to its moist surface, sticky and sandy texture and salty taste, which is not considered suitable for the manufacture of sweet, meats. Buffalo milk khoa produces milk sweets with soft texture due to the presence of proportionately higher amounts of fat.

Traditional Fermented Products: - The main fermented milk products of Asia are Dahi, Makkhan, Lassi, Butter Milk, Misti Dahi, shrikhand and related products.

Dahi: - Dahi is almost a compulsory item of food. The Dahi made from buffalo milk is

superior in body and texture because of higher total solids higher fat with bigger globules and larger proportion of solid fat, higher content of proteins, particularly caseins with bigger micelles size and presence of whole of the casein in the micelle.

Yoghurt: - Buffalo milk is better suited for manufacturing of yoghurt because its manufacture is easier and there is no need for prior concentration of milk or addition of dried milk due to higher total solids. The body and texture of the yoghurt is also superior compared to the same made from cow milk because of higher content of fat with larger proportion of solid fat and bigger size of the globules.

Misti Dahi: - Misti dahi is fermented milk product. It is most popular in West Bengal of India. It is prepared by heating buffalo milk with 12-13% cane sugar. The concentrated milk with a slightly caramelized flavour and brown colour is inoculated with a mixed starter culture (consisting of *Lactococcus lactic and lactococcus diacetylactis* strains). A firm curd with smooth body, sweet taste and pleasant aroma develops in about 8 hours incubated at 30°C.

Lassi: - Lassi is also fermented milk used a refreshing beverage, often with added sugar, salt and spices and topped with clotted cream. *Lactobacillus acidophilus* probiotic culture is used in preparation of probiotic lassi.

Cream, butter and ghee: - Buffalo milk is best for the manufacturing of cream, butter and ghee because it gives more yields due to higher content of fat. Loss of fat in skimmed milk and butter milk is less due to longer size of globule and higher proportions of solid fat in buffalo milk. Due to larger size of the globules and larger proportion of solid fat, separation of cream and churning of butter is also easier from buffalo milk. Texture of ghee is superior when made from buffalo milk due to bigger size of the grains which, in turn, are the result of larger proportions (9-12%) of high melting triglycerides compared to only 5 to 6% in cow milk fat.

Coffee and Tea Whiteners:-The yield of dairy whiteners from buffalo milk is higher due to high fat, proteins and salt content in buffalo milk. The product is superior due to its whitish colour when made from buffalo milk. The absence of carotene in buffalo milk and bigger size of the casein micelles with higher opacity compared to cow casein is responsible for better quality products from buffalo milk. The higher emulsifying capacity of buffalo milk fat is beneficial for the better dispersion of whiteners when used in tea or coffee.

Infant and health foods from buffalo milk:- Better absorption of fat due to its higher emulsifying capacity, better absorption of calcium due to higher calcium/phosphorus ratio, higher concentration of calcium, magnesium, lactoferrin, esterified cholesterol and taurine content and lower concentration of sodium, potassium, chloride, urea and free and total cholesterol in buffalo milk compared to cow milk is beneficial in human nutrition.These attributes make the buffalo milk superior than cow milk as an ingredient for infants and health foods.

Formulated Products:- Many formulated products have developed from buffalo milk such as chocolate milk powder, dried kheer mix, gulabjamun mix powder, malted milk powder, dried basundi, rasogulla powder etc.

Management of Stray Cattle in Urban Area

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Abstract

Menace of stray cattle is very prominent problems in most of the city. Common enemies of stray cattle include accidents by vehicles, dog bites, children throwing stones and irritating them. They prefers road side kacha bedding as compared to pakka road, however they prefer road surface during rainy season. Tracking the path and behavior of stray animals are essential using GPS system. Stary animals should not be punished or killed brutally as it violates the IPC- 428, 429 and also public sentiments. Shelter may be prepared in road side in fallow or government land in town or city area to control the menace of roaming on roads and dung in shelter can be collected and detoxified and value aided. Killing of stray animals may also disturb the biodiversity of system. Gosadan and Goshala need to be established for suffering animals. Animal welfare fund need to raised and generated. Sexed semen should be made available for reducing unwanted cattle on road.

Total number of livestock in India is 512.05 million (19th Census, GOI) and total cows in India is 190.90 million. However exact data of stray animals including cattle is lacking. Increasing urbanization bringing cows to vicinity of cities, where they find their way to graze on waste, garbage and tanks. Animals abandoned by farmers with the decline of agricultural activities in past decades. These animals survived and produced offspring, which have become stray animals especially cattle in the territory. Stray animals occasionally cause disturbance to the traffic when they wander onto public roads. Public and road users fills that they literally serve as “speed breaker” for motorists, hindering the road traffic on many busy route. Cattle and buffalo may also eat farmers’ crops. Prevalence of animals wandering across the public roads is common contributing to traffic accidents. Besides, concerns about animal welfare and public safety must also be taken into account when the administration is devising a strategy to control the cattle and buffalo population. Stray cattle menace is a serious issue. Cattle owners, who rear them in city area, do not bother to take them to the sheds especially during nights. Common enemies of stray cattle include dogs, children throwing stones and irritating them. Vehicles hit them regularly while crossing or moving on road. Common saying is don’t feed stray animals. You know why, "Because they breed. You're facilitating the problem if you give an animal ample food supply. But it is not true, if we will be able to manage the stray animals scientifically.

Physiology of stray animals: The physiology of stray animals is very similar

to normal animals with respect to age, stage and condition of cow.

Production status: Production status is less or very small in stray animals, however the dung and urine can be collected and utilized for benefits of agriculture or as fuel.

Figure 1 Garbage bedding for stray cattle

Behavior of stray: Behavior of stray animals are like normal animal or more refine and selective as compared to normal animals as they have choice to shift as per comfort status of environment. Stray animals by default prefer soft contented and loosen up bedding. They usually reported to prefer sand bedding which is kept construction purpose. They generally also prefers road side kacha bedding as compared to pakka road, however they prefer raised metal road surface during the time and after rain during rainy season. Stary animals may sits on garbage damping ground as it provide soft ground to the animals. Cow prefers to stay closer to road side garbage fire created by local people during winter to avoid low temperature exposure. Almost all behaviors are displayed by the animals with respect nine system of behaviors like Ingestive behavior,

Figure 2 Sand bedding & shade seeking in cows

eliminative behavior, sexual behavior, care giving or epimelitic behavior, care soliciting or et-epimelitic behavior, agonistic behavior, allelomimetic behavior, shelter selecting behavior and investigatory/ exploratory behavior. They also show refined behavior like

1. Care dependency relationship: Especially with calf and young ones.
2. Dominance-subordinate relationship:
3. Sexual relationship: This relationship is common among cyclic animals.
4. Leader-follower relationship
5. Relationship between two different species.

Inter and intra species Association: Both the association was prominent in stray cattle. They generally live in herd or group form to avoid untoward effect. Some time if one member of herd is running other also starts running as simulation model. It is frequently observed that when dog attacks on piglets, piglets start screaming and stray cow use to chase dog in favor of piglets to give temporary protection from dog.

Empty activity: Empty activity is very common in stray animals. Repetitive coping behavior help animals manage

psychological stresses efficiently. Tongue playing behavior related with stress, nutritional insufficiency and abomasal ulcers (Wiepkema et al., 1987).

Tracking the behavior and path of stray animals: Tracking the path and behavior of animals are most crucial especially with respect to stray animals using GPS system

Figure 4 Stray cattles tress passing road in Delhi

Operating stray cattle/ Rumenotomy of cattle :

Sick cows from road side when operated 70 kg plastic bag was recovered, as stony hard materials (Karuna Society for animal and Nature, Andhra Pradesh 2010). Nails and vermilions are also obtained from intestine of stray cattles.

Stray animal laws in India:

1. Animal should not be given poisonous substance
2. It is illegal to kill homeless animal, municipalities can sterilize the animals i.e., ABC (animal birth control).
3. It is illegal to maim or cause injury to any animals like throwing acid, purposely killing or injuring animals [IPC-428, 429]. If any vehicle hit the animal on road, complaint can be filed against vehicle number to nearest police station using same act of IPC.
4. Stray animal should not be used for research.
5. Cows should not be left on street as they are prone to plastic bag, garbage, broken glass, nails, wires etc.

Management of stray animals: Shelter may be prepared in road side in fallow or government land in town or city area to control the menace of roaming on roads and dung in shelter can be collected for better utilization and benefits. For stray cattle or buffalo that are reported to be sick or injured, animal management team will visit and try to locate the animal. Officers on special duty will require assessing whether the animal can be treated on site or needs to be caught and returned to an

Figure 3 Stray cattles sitting on roads at Chandigarh

animal management centre for treatment. Occasionally, injury or sickness may be so severe or untreatable that euthanasia by a Veterinary Officer might be required on the spot in the interests of the welfare of the animal. A dedicated team effort with the aim of long-term management of cattle and buffalo is required to ensure that they co-exist with local residents in harmony. To

achieve this goal, multiple approaches will be adopted and implemented in phases.

Some silent points with respect to management include:

1. Use of scientific survey to know distribution and number of cattle.
2. Use of GPS collar to track movement including distance travelled, route adopted and area in habitat or area of liking.
3. Controlling population by castration of males and sterilizing female cattle by surgery and chemical sterilization as well is very essential. As "a single cow can produce between 250 and 500 litres of methane a day" and USA claims that Indian cow even produces more than American cow and India alone contributes 15.1% of total green house gas total.
4. Special person may be appointed for on road control of animal or in problem area.
5. Relocation of cattle from problem area to other allotted place.
6. Fencing or use of cattle grid nearby roads.
7. Isolation of animals and feeding kitchen residue and special provision for green fodder/grazing facilities may be provided.
8. Re-domestication may be tried.
9. Animals may not be utilized for training or research for the veterinary near by area. As it may spread the infection to domestic animals. Sterilization may be practiced by veterinarians.
10. A ban should be imposed on rearing cattle, pig and horse rearing in city area.bli
11. License system should be established for rearing domestic animals in city area.
12. Gosadan should be full utilized and new gosadan need to be established.
13. Training regarding management of stray cattle and their control is required.
14. Rehabilitation or for adoption of cows at gosadan will need to explore.
15. Animal welfare fund need to raised and generated.
16. Sexed semen should be made available for producing predominantly female progeny which ultimately reduce number of stray cattle.
17. All cattle keepers were supposed to keep their cattle tethered especially near town and city.
18. Fine should be charged to animal owner involve in stray cattle menace
19. Adoption of stray animals should be strengthen.
20. Helpline can be started regarding dangerous stray animal in particular area.
21. Proper identification system to the cattle should be applied and tagged with name of owner in form of rumen bolus or ear chip identification device to track the owner.
22. A license system should strengthen for keeping or purchasing animals especially for welfare status and maintenance of milk quality at door.
23. Five freedoms should be maintained at farmer door step or at shelter or NGO running stray cattle farm like freedom from hunger and thirst; freedom from thermal and physical discomfort;

freedom from injury, disease and pain; freedom to express most normal patterns of behavior and freedom from fear and distress (Gill, 2015).

24. NGO should be introduced in the area for catching, controlling, feeding and treating stray animals by expert veterinary doctors.
25. Development of integrated cattle centres (gokul grams) for keeping at least 40% of stray cattle in total herd other animals may be productive with the purpose of conserving indigenous breeds.

CONCLUSION

Stray should not be considered as burden to the society. It must be managed in scientific way in special shelter farm with purpose of conserving our indigenous breed as these breeds are resistant to heat stress and teak problems and protects our biodiversity which ultimately maintain ecosystem.

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