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Remote Sensing and its Applications in Fisheries

Shabir Ahmad Dar*[1], A. Y. Desai[2], A. N. Sayani[2], and A. S. Sodhi[1]

[1]*Govt. Degree College Kathua, Jammu- 184 101*
[2]*College of Fisheries, Junagadh Agricultural University, Veraval Gujarat-362 265*
Corresponding author: shabirsamad585@gmail.com

Given that many of the capabilities of ocean-colour data are still being actively researched, much of the potential has yet to be incorporated in an operational way into fisheries management. For example the ability to assess phytoplankton size, functional type and physiology from ocean-colour data is a relatively recent development in remote sensing, and many methods are yet to be validated extensively. However, satellite ocean-colour data has been instrumental in documenting how the recruitment mechanism can transfer phytoplankton fluctuation up the food chain to higher trophic levels (Platt et al 2003). These observations serve as key component of how phytoplankton variability is a crucial component of the pelagic ecosystem, and a measure of its temporal and spatial variability should be incorporated into ecosystem-based management (Watson *et al.,* 2003*)*. Looking to the future, one hope that all fisheries, including high-seas fisheries conducted outside the territorial waters, will be managed on an ecosystem basis. Used wisely, remote sensing is one of the keys to sustainable fisheries, not an agent of their destruction.

INTRODUCTION

Remote sensing refers to the activities of recording/observing/perceiving (sensing) objects or events at far away (remote) places. In remote sensing, the sensors are not in direct contact with the objects or events being observed. The information needs a physical carrier to travel from the objects/events to the sensors through an intervening medium. The electromagnetic radiation is normally used as an information carrier in remote sensing. The output of a remote sensing system is usually an image representing the scene being observed. A further step of image analysis and interpretation is required in order to extract useful information from the image. The human visual system is an example of a remote sensing system in this general sense. In a more restricted sense, remote sensing usually refers to the technology of acquiring information about the earth's surface (land and ocean) and atmosphere using sensors onboard airborne(aircraft, balloons) or space borne (satellites, space shuttles) platforms. Remote Sensing refers to the identification of earth features by detecting the characteristics

electromagnetic radiation that is reflected by the earth surface. Every object reflects a portion of electromagnetic radiation incident on it depending upon its physical properties. In addition, objects also emit electromagnetic radiation depending upon their temperature & emissivity. Reflectance pattern at different wave lengths for each object is different. Such a set of characteristics is known as spectral signature of the object. Visual perception of objects is the best example of remote sensing. The rapid advances in computer technology have affected all aspects of remote sensing. Of particular interest to users are the digital processing techniques developed for data analysis. Programs are available for geometric correction, image enhancement and quantitative data extraction. The speed of digital computers allows a single operator to perform data analysis for large geographic areas in a relatively short period of time.

The physical basis of remote sensing is the platforms like aircraft and satellites. Operational types of remote sensing include aerial photographs, false colour IR photos, radar imaging, thermal IR scanning and satellite remote sensing. Water temperature is another important factor in determining species distribution and thermal sensors can be used to produce maps of the sea surface temperature (SST). Such mapping can be used to identify cold water upwelling of nutrient-rich water and to locate boundary areas between warm and cold waters where certain species are know to congregate. In addition to resource detection, remote sensing can be valuable in characterizing the marine and costal environments. This may involve such activities as updating navigational charts with coastline and bathymetric data; mapping the distribution and types of coastal wetlands; identifying marine plants and sediment types in the intertidal zone and in shallow waters; and monitoring the condition of coral reefs. The sea covers two thirds of the earth's surface. To a large extent, man is dependent on it for food species which include fish, shellfish, marine mammals, turtles, aquatic plants and algae. To exploit these resources more effectively, fishermen must catch the most fish possible (within biological constraints) while, at the same time, minimizing costs and optimizing the scheduling of their operations. Reliable environmental information is required from the scientific community for these purposes. Remote observations of the sea surface can provide a significant part of the information needed to assess and improve the potential yield of the fishing grounds. In the past, remote sensing was used predominantly to assist in the efficient harvesting of natural resources. Today it is being used for resource management, conservation and exploitation. Variations in environmental conditions affect the recruitment, distribution, abundance and availability of fishery resources. It is not possible to measure remotely the

entire range of information needed to assess changes in the marine environment. Knowledge of particular conditions and processes affecting fish populations, however, may often be deduced using measurements made by remote sensors, e.g., concentration of dissolved and suspended matter, variations in primary production levels, distribution of surface isotherms, location of frontal boundaries, regions of upwelling, currents and water circulation patterns. The parameters providing information on these environmental factors may allow a forecast of fish distribution or more generally the definition of marine fish habitats. These are often easier to sense remotely than the presence of fish.

Remote sensing techniques can be utilized directly, indirectly or as general aids in the detection and assessment of fishery resources.

1. Direct Methods of Fish Detection

The most direct and simple method of remote sensing in fisheries is visual fish spotting. Fishing fleets which exploit major fisheries such as tuna and menhaden are dependant on visual fish spotting from aircraft to direct their fleets. Aerial photography per se is of little importance to the majority of commercial fisheries. The location of mobile fish schools, for example, cannot be provided fast enough to the fishermen. Aerial photography, however, can be of assistance to a fisheries scientist as it provides information about the distribution and relative abundance of pelagic fish, particularly the schooling species. The pattern of distribution and the location may identify the species observed, and the surface area of a school, measured from an aerial photograph, has been shown to be correlated with the biomass of some species. Echo-sounders and sonars have been in use as remote sensors for at least 50 years and are now widely used by the fishing fleets of the world. Sonars are useful for the detection of fish and biomass estimation. In recent years, high powered laser systems operating in the blue- green portion of the visible spectrum (lidar) have shown promise for the evaluation of fishery resources. A lidar carried on aircraft flying at an approximate altitude of 1700 m can detect fish at depths to 16 m.

2. Indirect Methods of Fishery Assessment

Estimation of a fishery resource can be assisted by the measurement of parameters which affect its distribution and abundance. Much of the researches dealing with environmental effects related to fisheries are concerned with the correlation of a single parameter with the spatial and temporal distribution of fish. It is most likely, however, that fish respond to the sum total of environmental factors. Thus, it becomes necessary to correlate a large number of parameters, obtained by remote sensing techniques, with fish distribution. The environmental parameters most commonly measured from airborne and spaceborne sensors are as follows: surface optical or bio-

optical properties (diffuse attenuation coefficient, total suspended matter, yellow substance, chlorophyll pigments and macrophytes, commonly grouped under the general term of ocean colour); surface temperature; vertical and horizontal circulation features; salinity; oil pollution; and sea state.

2.1 Surface optical properties

The optical properties in the marine surface layer are determined by the presence of dissolved and suspended matter. Under normal conditions, visible light penetrates marine waters to a depth of tens of metres. As the concentration of the water constituents increases, i.e. the water becomes more turbid, the penetration of sunlight is reduced as a result of absorption and scattering processes. Depending on the specific characteristics of the materials present in the water, i.e. on their spectral signature, the absorption and scattering processes will vary with the wavelength of the incident radiation. Multispectral observations, therefore, can be employed to estimate the nature and concentration of the water constituents. Passive sensors working in the visible wavelengths (mainly CZCS but also MSS, TM, HRV) are commonly used to image water colour. Active sensors providing their own source of illumination, e.g., lidar, can also be used but only from aircraft and for sampling, rather than for imaging purposes. The main parameters which can be derived remotely from water emergent radiation, through the use of empirically constructed algorithms, are listed below.

2.2. Diffuse attenuation coefficient

The diffuse attenuation coefficient at a specific wavelength is an apparent optical property. Its magnitude depends on the light distribution as a result of spreading, scattering and absorption that exists at the in situ point of measurement. This parameter, when correlated with Secchi disk depth and Munsell colour hues, provides the means of physically categorizing water according to colour. Its value can be interpreted as a measure of water turbidity and it constitutes a valuable tool in fisheries studies. It has been shown, for example, that turbidity and menhaden sighting in the Mississippi Sound are highly correlated.

2.3 Total suspended matter (seston)

In addition to optical parameters, the total concentration of the absorbing and scattering agents can be used to classify surface waters by means of their colour. The utilization of this parameter may be most appropriate when classifying waters where inorganic and/or organic sediments make an important contribution to the optical properties of the surface layer. It may also be appropriate if sediment concentration has to be used as a natural tracer for the identification of water movement and frontal boundaries.

2.4 Yellow substance

The term yellow substance may be defined as the material derived from the degradation of land and marine organic matter. It is an important parameter to monitor in the context of polluted coastal waters, since it may be used to

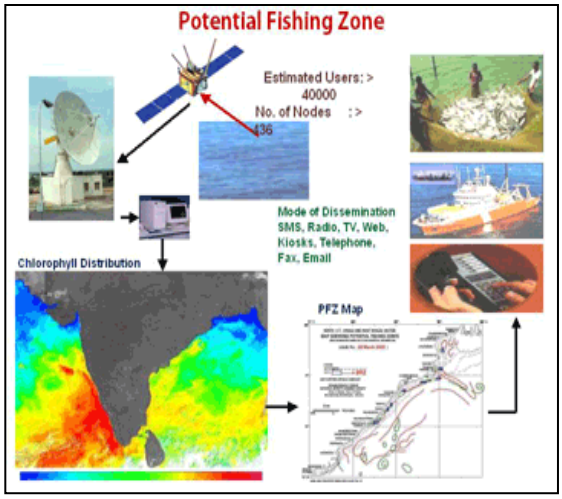
identify marine areas where the exploitation of filter feeders, e.g., shellfish, could be hazardous. In certain regions of the world, for example the North Sea, this parameter exhibits some correlation with the salinity of surface waters.

2.5 Chlorophyll pigments

The concentration of chlorophyll pigments (the photosynthetic pigments of phytoplankton) is often considered as an index of biological productivity and, in an oceanic environment, it can be related to fish production. Chlorophyll concentrations above 0.2 mg/cu.m indicate the presence of sufficient planktonic life to sustain a viable commercial fishery (Gower, 1972). Chlorophyll pigments have a specific and distinctive spectral signature since they absorb blue (and red) light and reflect strongly the green, thus affecting ocean colour. Multispectral observations from airborne or spaceborne sensors, therefore, allow the deduction of phytoplankton concentration.

2.6 Macrophytes

In coastal areas it is common to find macrophytic vegetation (seaweed). Some species are of economic importance but all species play an important role in supporting marine life. Different kinds of seaweed have different light reflection properties, for example, reflect more green or red radiation. This distinction which allows the differentiation of some seaweed species can be detected from airborne or spaceborne passive visible sensors. Due to the low intensity of the light as it leaves the water, however, it is usually more effective to employ airborne sensors such as aerial cameras or radiometers.



2.7 Surface temperature

Since 1973, the US National Oceanic and Atmospheric Administration (NOAA) has been engaged in sea surface temperature (SST) determination from satellite derived data. The process of extracting SST information from IR radiometer data is well established. Global sea surface temperature charts are produced on an operational basis. They are in the form of computer printouts or contour maps with spatially smooth and radiometrically corrected measurements. It has been possible with data derived from TIROS, NOAA and the METEOSAT satellites to produce SST charts with an accuracy of 0.5°–2°C and in near real time. The heliosynchronous satellites of the NOAA series provide high resolution (1 km) pictures twice daily while the geostationary satellites (GOES, METEOSAT) provide pictures every 1/2 hour but with a resolution of only 5 km. The geostationary satellites

are principally used for the near-equatorial area where the sensor's resolution is at its best. For latitudes higher than 40° the image distortion is generally too extreme for operational use. The occurrence of cloud or haze contaminates data to a certain extent but a knowledge of day-to-day variations or trends enables corrections to be made by interpolation. The sea truth information provided by ships is of further assistance in deducing the precise temperature fields. To date, SST maps are mainly used by the salmon and tuna fishing fleets. It is well known that some tuna species feed on the warm seaward side of thermal fronts while salmon feed on the cold landward side. The occurrence of some other species can also be correlated with SST. In addition, physical features such as gyres, eddies, inversions and upwelling which are of importance to fisheries can be detected using SST maps.

3. Potential Fishing Zone (PFZ)

Potential Fishing Zone (PFZ) forecasts are operationally disseminated to all the maritime States including the two Union Territories since 1993. An integrated approach for Potential Fishing Zone based on Chlorophyll & Sea Surface Temperature have been developed, validated and transferred to Indian National Centre for Coastal and Ocean Information Services (INCOIS) for operational use. Under INCOIS 436 nodes have been established through phone, fax, email and electronic display boards where PFZ maps are being distributed and through internet and Web-GIS further about 5700 user groups are receiving the forecast including fishery departments/ central govt. agencies/corporate and fishermen groups. About 40,000 users are benefited through PFZ forecast.

Feedback indicates that on an average 80% success rate is achieved. 18 controlled experiments shows that search time has reduced by 60-70%, average catch per unit effort has increased 2-4 times. The average increase in net profit is about 2-4 %. Potential fishing zones were initially forecasted using sea surface temperature data. Addition of chlorophyll information derived from OCEANSAT-1 introduced the important link of sea food chains and improved the accuracy of forecast. A third parameter, the Sea Surface Wind (SSW), which indicates the effect of currents on feeding grounds, has now been incorporated resulting in further improvement in forecasts.

4. Coastal Zone Studies

Under the Coastal Zone Studies project, mapping & monitoring of (i) coastal zone (on 1:25,000 scale and selected areas on 1:5000 scale), (ii) mangroves and coral reefs and (iii) development of Coastal Zone Information System was taken up by ISRO at the behest of Ministry of Environment & Forestry (MOEF). The project also includes mapping and monitoring of vital / critical habitats, marine protected areas, shore line changes and impact of sea level rise and integrated coastal zone management. Under the project satellite

data has been interpreted using digital techniques to prepare coastal landuse, mangrove maps at dominant community level, coral reefs maps at eco geomorphological level, coastal landform maps on 1:25,000 scale. Ecological Status of Marine Protected Areas has been brought out by comparing maps prepared for the period 1989-91 and 2004-06. Models have been developed to study coastal landuse changes and their impact and methodology for cadastral mapping has been developed. Models for assessing health of mangroves as well coral reefs have been developed. Data base has been created in GIS for the coastal thematic maps and Coastal Zone Information System (CZIS) has been developed for entire Indian coast. Models have been developed for preparing integrated coastal zone management plans and identifying suitable sites for mangrove plantation.

Applications of Remote Sensing in fisheries:

1) Remote sensing data help in regular management of water resources.
2) Remote sensing techniques are useful in finding different types of bioresources.
3) Remote sensing plays potential role in both rapid & comprehensive Environmental Impact Assessment.
4) For detection and monitoring of the water pollution, remote sensing prove useful.
5) Remote sensing is applicable in acquiring information regarding offshore engineering activities, fisheries surveillance, ocean features, coastal regions and storm forecast operations.
6) Remotely sensed data provides the necessary spatial data on suspended sediments, dissolved organic matter, phytoplankton, algal blooms & oil slicks etc which will useful in management of fish stocks, monitor the water quality & natural water pollution such as oil or algal blooms, which are harmful to aquatic life.
7) Remote sensing techniques are giving necessary data needed for monitoring changes on coastal erosion, shoreline monitoring & management, loss of natural habitat, sea level rise, wetland mapping urbanization, sewage disposal and aquatic population etc.
8) Remote sensing is very useful in identifying Potential Fishing Zones (PFZ). This data is very useful for fishermen because they came to know likely occurrence of fish shoals which helps them for getting more catch.

9) Continuous monitoring of land use or land cover with remote sensing imageries have been of immense use in providing information on temporal & spatial changes in area under aquaculture, mangrove areas, coral reef mapping & other land use patterns.

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Role of Hydroponic Fodder in Livestock Feeding

Preeti Mor*, Jagish Kour Reen, Rohit Kumar Lachotra and Alok Kumar Yadav

**M.V.Sc Student, ICAR-National Dairy Research Institute Karnal-132001(Haryana)*

**Corresponding author: reenjagaish119@gmail.com*

Hydroponics is a subset of hydro-culture and is a method of growing plants using mineral nutrient solutions, in water, without soil. Terrestrial plants may be grown with their roots in the mineral nutrient solution only or in an inert medium, such as perlite or gravel.Hydroponic Fodder is essentially the germination of a seed (such as maize, malt barley or oats) and sprouted into a high quality, highly nutritious, disease free animal food. This process takes place in a very versatile and intensive hydroponic growing unit where only water and nutrients are used to produce a grass and root combination that is very lush and high in nutrients. This green fodder is extremely high in protein and ME, which is highly digestible by most animals. It takes between 1 to 2 liters of water to produce one kilo of fodder as compared with 80 – 90 liters of water to grow a kilo of green grass. In the 19th century, it was discovered that soil is not essential for plant growth, as long as nutrients are present in the water supply. Since this discovery, hydroponic growing has evolved into different types, with many benefits over traditional soil-based cultivation. While it is possible to grow hydroponic fodder in any building, including a garage or basement, a greenhouse is ideal because temperature, light, and humidity can be precisely controlled. Efficient, year-round production of green fodder is not possible unless environmental conditions are optimal: approximately 70°F, 60 percent humidity, and 16 hours of light. For this reason, hydroponic growing systems usually require significant investment.

GENERAL BENEFITS OF HYDROPONIC GROWING

- Larger, higher quality crops due to controlled nutrient ratios
- No soil-borne diseases passed among crops
- Up to 90% less water is required compared to growing in soil
- High yields in minimal growing space
- Can be used in areas where soil-based cultivation isn't possible, such as locations with poor soil quality or where water supplies are limited
- No herbicides necessary because there are no weeds

ADVANTAGES OF HYDROPONICS FOR THE FARMER

- Reduced Water Usage
- Marginal Land Use
- Constant Food Supply
- Reduced Growth Time
- Reduced Labor Requirement
- Cost effective

- High Nutritional Value
- Completely Natural

ADVANTAGES OF HYDROPONIC FODDER

Hydroponic fodder has several advantages over conventionally-produced fodder. Hydroponic fodder makes very efficient use of water. There is little waste water, as animals consume the re-circulated water along with the feed. Since production is hydroponic, there is no leaching of nutrients into the environment. Hydroponic fodder production requires considerably less land to produce feed for livestock.

- **Dry and drought -prone regions**

Hydroponic fodder production is probably best-suited to semi-arid, arid, and drought-prone regions of the world. By growing fodder indoors, crop failures would no longer be a risk. Good quality forage could be produced year-round. Feed supplies would be insured. Scarce water resources could be allocated more efficiently (4).

- **Limited land**

In places where land values are extremely high or land is simply not readily available, hydroponic fodder has obvious advantages, as it can be produced in a small footprint. Because the fodder is produced continuously, there is no need for long-term feed storage and no nutrient losses that can be associated with feed storage.

- **Small-scale producers**

Requiring smaller amounts of fodder, small-scale producers may be able to build their own fodder systems for a few hundred dollars. When the investment is low and labor is unpaid, the cost of hydroponic fodder is considerably less.

- **Constant Food Supply**

Hydroponic technology has removed the need for long-term storage of feeds. Unfortunately, Hay, silage and other feeds lose some of their nutritional value during storage. Farmers using this type of fodder production are guaranteed a consistent supply of quality fodder 365 days of the year irrespective of rain, hail, Sunshine or snow. Therefore the farmer knows exactly what feed they have available every day of the year regardless of the seasonal conditions as it takes just six to eight days for the fodder to grow from a seed into a mature plant of 25cms.

THE BEST GRAINS TO USE

There are many types of grains that can be grown hydroponically. Grains such as oats, barley, wheat, sorghum and corn have all been tried. However when choosing a seed the main characteristics that come into play are their nutritional value, speed of seed growth and protein levels. The seed that has all these qualities is - Malt Barley as it is highly nutritious with a very high protein level and under the right conditions can grow to a height of 30 centimeters.

What are the different types of hydroponic growing?

While there are many types of hydroponic production, the four most popular methods are

- Drip
- Nutrient film technique (NFT)
- Raft

- Ebb and flow.

All commonly utilize a nutrient reservoir and circulation system that supplies a nutrient solution either directly to, or near, the roots of each plant. This nutrient solution can be done within a re-circulating system to decrease waste and save on nutrient costs.

Drip: In a hydroponic drip system, each plant's roots are suspended in a medium, using rock wool cubes with perlite or clay pebbles and the nutrient solution is dripped, commonly via emitters such as dripper stakes, onto the growing medium near the plant's base. Advantages of drip hydroponics include increased water efficiency and proper root aeration. Drip systems can often be found in commercial growing applications for tomato, cucumber and pepper plants

NFT: In NFT channel hydroponic systems, the roots are suspended in a channel and a shallow stream of nutrient solution is re-circulated through the bottom of the channel. A thick root mass develops inside the channel and remains moist from the nutrient film.

The main advantage of NFT hydroponics is the capability of producing very high yields in a minimal footprint of space. Water and nutrient waste is also minimized due to the re-circulating system. NFT systems are often chosen by commercial growers.

Raft: In raft hydroponic systems, plants are held up by a foam raft that floats on a basin of nutrient-rich and aerated water. Plants' roots are commonly supported by net pots filled with clay pebbles and are completely submersed in the nutrient solution.

The simple design of raft hydroponic systems makes them ideal for home or hobby enthusiasts

Ebb and flow: Also known as flood and drain, these systems feature a tray and nutrient reservoir combination. The tray can have a growing medium, such as clay pebbles rock wool, in it and be planted directly. Another option is that plants are placed in containers, such as net pots, which sit inside the tray. The tray is flooded with the nutrient solution at regular intervals, and the solution is allowed to drain back into the reservoir.

Advantages of ebb and flow hydroponics include the relatively low start-up cost and ease of use.

As feed for livestock

Fodder sprouts are tender and young, the equivalent of fresh green grass. As such, they are highly palatable and nutritious to all types and classes of livestock. On a dry matter basis, hydroponic fodder compares favorably with other nutritious feedstuffs. Because of its low dry matter content, the cost of nutrients in hydroponic fodder is also considerably more expensive than other feedstuffs. Nutritional requirements of livestock are based on dry matter intake. If fed to livestock at a rate of 2 percent of their body weight (a common recommendation), hydroponic fodder will only meet a fraction of most animals' nutritional requirements, especially the higher producing ones. Thus, hydroponic fodder, while excellent feed, is only a

nutritional supplement and an expensive one at that.

Animal performance

Fig.1 Pigs eating fodder

The companies that market hydroponic fodder systems make many claims about hydroponic fodder as superior livestock feed: better gain, improved fertility, earlier heat cycles, improved fleece quality, improved immunity, better behavior and temperament, less manure, etc. Few of these claims have been substantiated or proven to be repeatable in experiments.

CONCLUSION

This hydroponic fodder system has the potential to allow farmers to yield a fodder that has the ability to provide huge ecological and economical advantages. This is due to the reduction in the amount of land required for maximum livestock production proving to be an asset for both regions where agriculture is difficult and in densely populated areas that lack sufficient growing space. This use of lesser grazing area to feed stock could in turn provide more acreage for food crop production thus improving the economy of the land. Such a system allows the farmer to have control over the feed production 365 days of the year – rain, hail, shine or snow thus allowing the turn over of quality and quantity livestock. The farmer to now able to send stock to the markets at near peak condition, selling when the prices are suitable instead of having to accept poor market prices

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Techniques of Chromosome Banding

M. S. Darvhankar, B. D. Nawade and J. H. Kamdar

[1]Ph.D. student Dept. of Genetics and Plant Breeding,
College of Agriculture, JAU, Junagadh, [2 and 3] JRF DGR, Junagadh.

Nearly all methods of chromosome banding rely on harvesting chromosomes in mitosis. This is usually achieved by treating cells with tubulin inhibitors, such as colchicine or demecolcine (colcemid), that depolymerize the mitotic spindle and so arrest the cell at this stage. Excessively long incubations with Colcemid result in overcondensed chromosomes that band poorly and more-over some cell types, especially those from the mouse, eventually escape the Colcemid block and proceed through the cell cycle. Chromosome banding methods are either based on staining chromosomes with a dye or on assaying for a particular function. The most common methods of dye-based chromosome banding are G-(Giemsa), R-(reverse), C-(centromere) and Q-(quinacrine) banding. Bands that show strong staining are referred to as positive bands; weakly staining bands are negative bands. However the staining patterns are not black and white, different bands stain to different intensities (Francke, 1994). G-positive bands are usually just called G-bands and likewise for R-positive (R-) bands. Positive C-bands contain constitutive heterochromatin. Q-bands are considered equivalent to G-bands.

The most widely used function-based banding method is replication banding and is based on the fact that different bands replicate their DNA at different times during S phase of the cell cycle. Generally, R-band DNA is replicated earlier than G-bands (Dutrillaux *et al.,* 1976). G-bands also correspond to the condensed chromomeres of meiotic chromosomes and R-bands to the inter chromomeric regions.

USES OF CHROMOSOME BANDING

G-and R-banding are the most commonly used techniques for chromosome identification (karyotyping) and for identifying abnormalities of chromosome number, trans-locations of material from one chromosome to another, and deletions, inversions or amplifications of chromosome segments. This has had an invaluable impact on human genetics and medicine and the power of this approach has been augmented by combining cytogenetics with fluorescence in situ hybridization (FISH). The detection of chromosome deletions associated with disorders, very often contiguous gene syndromes, provided some of the first disease gene localizations in humans. Similarly, translocations have been important in pinpointing the location of disease-associated genes and the characteristic translocations associated

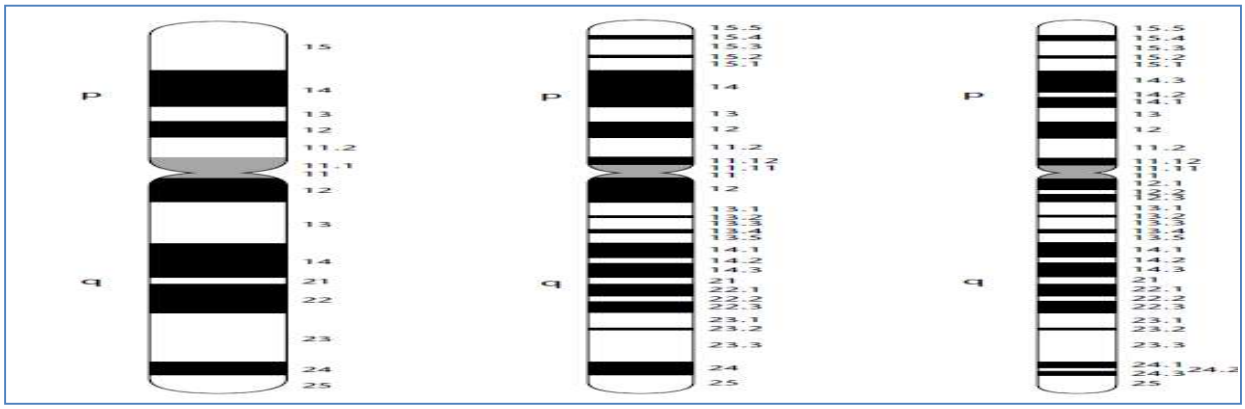

Fig. G- band ideograms of human chromosome 11 at (from left to right) 350, 550 and 850 band resolution.

with some leukaemias is impor¬tant, not only for understanding the molecular basis of these cancers, but also for their diagnosis and prognosis. One of the best examples of this is the translocation between human chromosomes 9 and 22 or the Philadelphia chromosome diagnostic of chronic myelogenous leukaemia (CML).

Comparisons of chromosome banding patterns can confirm evolutionary relationships between species and also reveal changes in karyotype that may have been important in speciation. The banding patterns of human, gorilla and chimpanzee chromosomes are almost identical, though human chromosome 2 is the result of a fusion between two great ape chromosomes. There are also extensive similarities between human chromosome bands and those of lower primates.

NUMBER AND SIZE OF BANDS

Idealized diagrams (ideograms) of G-banded chromosomes are published as standard reference points for chromosome banding. The G-bands are usually portrayed in black and the R-bands in white. Bands are numbered consecutively away from the centromere on both the short (p) and long (q) arms (Figure 1). The total number of bands or 'resolution' in the human karyotype depends on how condensed the chromosomes are, and at what stage of mitosis they are in. A 350-band resolution corresponds to chromosomes late in metaphase. High-resolution ideograms (approximately 1250-2000 bands) have also been produced for human chromosomes in mid-prophase.

BASIS FOR G-/R-BANDING

G-banding involves staining protease-treated chromosomes with Giemsa dye and is thought to result from interactions of both DNA and protein with the thiazine and eosin components of the stain. The most common R-banding method involves heat denaturing chromosomes in hot acidic saline followed by Giemsa staining. This method is thought to preferentially denature AT-rich DNA and to stain the under-denatured GC-rich regions. T-banding identifies a subset of R-bands - the most intensely staining ones - by employing either a more severe heat treatment than R-banding. It is thought to

identify the GC-richest R-bands, of which approximately half occur at telomeres in the human genome, hence the name.

The need to combine chromosome banding with fluorescence in situ hybridization has meant that banding techniques using fluorescent dyes has become more popular. Q-banding involves staining with quinacrine which reacts specifically with certain bases. Quinacrine intercalates into chromosomal DNA irrespective of sequence, but fluoresces brighter in regions of AT-rich DNA. There are a number of other molecules whose fluorescence is influenced by the base composition of the DNA to which they are bound. In addition to quinacrine, other commonly used fluorochromes with a specificity for AT-rich DNA include Hoechst 33258, DAPI (4'-6-diamidino-2-phenylindole) and daunomycin. The fluores-cence of Hoechst and DAPI is not quenched by guanine and so they give less distinct bands than those produced by quinacrine; however, daunomycin fluorescence is greatly quenched by DNA with a GC content of > 32%. DAPI staining has the advantage that it is very resistant to fading and that its excitation and emission spectra are compatible with reporter molecules and filters commonly used in FISH. Fluorochromes with a preference for GC-rich DNA include chromomycin and 7-amino actinomycin D. These dyes give an R-band-like pattern.

PATTERNS IN DNA SEQUENCE

Banding patterns can arise as a consequence of differences in the DNA sequence along chromosomes. R-and G-banding patterns are revealed on human chromosomes by FISH with Alu and LI interspersed repeats, respectively (Korenberg and Rykowski, 1988). A similar distribution has also been reported for SINEs (short interspersed elements) and LINEs (long interspersed elements) on mouse chromosomes. However, molecular studies of the human genome including sequencing show that both SINE and LINE repeats can be found in close proximity to each other. To reconcile these differences it is suggested that the SINEs located in R-bands are those that have retroposed most recently and hence are closest in sequence to the progenitor copy. These will therefore hybridize better to the SINE probes that are based on the consensus repeat sequence than to those that are more diverged, and hence will produce stronger FISH signals than their G-band counterparts.

PATTERNS IN DNA REPLICATION

Different regions of the genome replicate at different times during S phase. The relationship between timing of replication and chromosome banding is usually studied by incorporating pulses of the thymidine analogue 5-bromo-2'-deoxyuridine (BrdU) into cells during defined stages of S phase and then examining chromosomes in the subsequent metaphase. Sites of BrdU incorporation can be detected with antibodies that detect the presence of BrdU in denatured DNA. T-bands replicate on average earlier than ordinary R-bands, and DNA in G-bands is replicated even later (Dutrillaux *et al.,* 1976). Aspects of the primary DNA

sequence or chromatin structure in different types of band could influence their replication time. Also differences in replication time could influence some characteristics of chromosome bands, e.g. base composition or chromatin structure. Sites of tran¬scription at the G1/S boundary may seed the assembly of the first replication factories in early S phase and hence the most transcriptionally active regions of the genome, and the regions with the highest concentrations ofgenes, would tend to be the ones to be replicated first.

PATTERNS IN CHROMATIN STRUCTURE

Several banding techniques, especially G-banding, suggest that there are both qualitative and quantitative variations in the interaction of DNA and proteins along the length of metaphase chromosomes. The chromatin ofactive genes is generally considered to be more accessible to nuclease attack than is inactive chromatin. Consistent with this nucleases preferentially digest R-bands and T-bands of intact mitotic chromosomes, with G-bands and C-bands refractive to digestion. The extent of chromatin packaging in the interphase nucleus also differs between chromosome bands. C-band positive heterochromatin remains visibly condensed through interphase. FISH has shown that over the 150 kb to 1 Mb size range G-band chromatin is more tightly packaged than that of R-bands.

EVOLUTION OF CHROMOSOME BANDS

Whereas Q-, G- and R-banding patterns have only been observed in some eukaryotes, replication banding is almost universal among living organisms possessing chromo¬somes large enough to see by microscopy, suggesting that it is a fundamental consequence of, or requirement for, the compartmentalization of complex genomes. Chromosomes from most mammals and birds can be G-and R-banded. In addition, most reptilian chromosomes band with G-and R-banding techniques to some extent. With amphibia, fish and plants, some species band whereas others do not. The lowest vertebrates with reported good G-banding are the bony fish.

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Automatic Concentrate Feeding Station for Dairy Cattle: An Update

M. Arul Prakash[1*], A. Kumaresan[2], Shiv Prasad[3], T.K. Mohanty[4], A. Manimaran[5] and Sreela. L[6]

[1,6]Ph.D Scholar, Livestock Production Management (LPM) section, NDRI, Karnal
[2]Senior Scientist, Animal Reproduction, Gynaecology & Obstetrics, LRC, NDRI, Karnal
[3]Prinicipal scientist & In Charge, LRC, NDRI, Karnal
[4]Principal Scientist, Animal Reproduction, Gynaecology & Obstetrics, LRC, NDRI, Karnal
[5]Scientist, Animal Production Management, Cattle yard, (SRS) NDRI, Bangalore
**Corresponding author email: drarullpm@gmail.com*

Dairy cows have traditionally been fed with concentrates to supplement nutritional requirements that are not supplied by the forages. On farms where concentrates are fed in milking parlors, the opportunity for individual feeding varies considerably, depending on type of equipment and milking management practices. Then the system has changed to provide the concentrate outside the parlour. If concentrates are fed outside the parlour cause for competition and aggression during feeding because concentrates are highly valued by cows and it may increases agonistic interactions and may reduce feed intake efficiency. Such competition is unwanted because it may reduce milk production and compromises animal welfare. Large amounts of concentrates consumed in a single meal decreases ruminal PH may also cause rumen acidosis. Therefore, concentrates should better be provided in small amounts throughout the day and fed in limited amounts per installment in order to avoid over-feeding. World over dairy farmers have been using various approaches to remove or reduce the feeding of concentrates inside the parlor while trying to attain better control of feeding cows as individuals and still handle them as a group, especially in herds ranging in size from 50 to 150 cows. Computerized concentrate feeders can also eliminate the need for feed in the milking parlor, thereby increasing efficiency and there by potentially increasing profits. Because feed costs constitute 50 to 60% of

the total cost of milk production, regulating feed costs and/or improving feed utilization becomes the largest single area where profits can be increased. Due to high labor costs and attempts to reduce work, feeding systems have become increasingly mechanized, automated, and computerized. Individual animal feeding systems are rapidly gaining acceptance by dairy farmers across the globe.

❖ **Advantages of Automatic concentrate feeding station:**

- Interfaced with computer- so precisely manage the individual feeding
- Individual animal identification
- Alter daily ration
- By regulating the total amount of concentrate consumed in a day
- By regulating how much concentrate can be consumed at each meal
- Knowing how much concentrate each cow eats daily
- Control the daily intake of concentrate of individual cows in a herd
- Spread over (split) the daily ration according to farm routine activities
- Feeding varying amounts of different concentrate ingredients to each cow according to her individual requirements
- Program an individual feeding plan for each cow, based on her-lactation phase and milk yield
- Adjust feed dispensing rate
- Minimum wastage of concentrate
- Alarm signal for less feed intake and no feed intake

Fig.1: Overall advantages of individual animal feeding with AFS

Individual concentrate allotment

Individual concentrate allotment (ICA) with an identification system and computerized feeding station is an accepted method for feeding dairy cows according to their energy requirements (Livshin *et al.,* 1995). The potential for improved management with this

technology has been substantial and enhanced by the prospects of automatic milking (Devir *et al.,* 1993). To ensure more uniform consumption of concentrates, ICA feeding stations may be used with a variety of variable-time or fixed-time feeding routines (FR). **Fixed or variable FR system** has the potential to introduce regular feeding cycles for the entire herd and to promote feeding regularity by triggering mechanisms of group behavior (Livshin *et al*., 1995). A-DeLaval Neck belt (number tag, activity meter and transponder); B-Cow holding the neck belt into the AFS; C-System controller; D-ALPRO® Software; E-ALPRO windows page; F- Individual animal feeding data

Behavioural adaptation of dairy cows in AFS

The ICA feeding station requires behavioral adaptation by the cows because of the absence of visual information about the presence of feed and the limited number of feeding devices (Livshin *et al*., 1995). Earlier reports by Cassel *et al*. (1982) and Wierenga and Hopster (1990) indicate that, dairy cows were able to adapt to this type of equipment; the variability was great among cows in number of daily visits to the feeding station (Metz-Stefanovska and Spahr, 1989; Pirkelmann, 1992) and

Fig.2: Systemic diagram of RFID neck belt in AFS with Software

visiting activity depends on biological (age, weight and parity), psychological (temperament and social behavior) and technical (number and layout of feeding devices) factors (Tennessen, 1989; Wierenga and Hopster, 1990). It is known that the mean frequency of visits to a feeding station positively correlates with the frequency of ICA allotments (Wierenga and Hopster, 1991a; Pirkelmann, 1992). But ensuring the feeding regularity, in itself, may be of importance for the cow's well-being because dairy cows respond more than any other class of livestock to regularity and systematic feeding (Livshin *et al*., 1995) and they have the ability to learn quickly while adjusting to new equipment and environmental changes (Albright, 1981). Therefore, whatever routine dairy management practices like feeding, watering, etc. should be followed regularly every day (Olson, 1950) for their systemic adoption. Some observations indicate that cows were capable of recognizing the different feeding routine design in a farm and some cows have habitually grasp the periodic character of feeding station operation and the feeding interval duration, as manifested by cows crowding around a feeding station before the start of a feeding window under fixed time feeding routine (Wierenga and Hopster, 1991a; Pirkelmann, 1992). Cows seem to develop a strategy with regular visits to the feeding stations, because the cost of a visit is low and the reward is sufficiently high (Wierenga and Hopster, 1991a). The cows could have learned the times of the day when concentrates were available and that at certain times they could also expect concentrates when another cow visited the feeding station and received concentrates (Wierenga and Hopster, 1991b). In the feeding station rewarded visits were more often and more consistently followed by a visit by another cow than were unrewarded visits (Wierenga and Hopster, 1991b). Cows may also relate rewarded visits of other cows with the availability of the next feed allotment (Wierenga and Hopster, 1991a). The regularity and predictability of cow response to a specific feeding routine (Fixed or Variable) would characterize the ability of cows to adapt to the Individual concentrate allotment FR.

Moreover, an understanding of the feeding routine that is required for the proper adaptation of cow behavior is the main component of a predictable feeding environment and thus becomes an important factor for the cow's welfare

(Rutter *et al*., 1987; Wiepkema, 1988). The fixed-time and variable time feeding systems (Collis, 1980) have shown that each system evokes a typical pattern of visits to the feeding station. Automatic feeding system has the potential to introduce regular feeding cycles for the entire herd and to promote feeding regularity by synchronizing the group behavior (Humik, 1992). Any system for dairy cows, must therefore should improve farm operation efficiency and well-being of farm animals.

CONCLUSION

Growing commercial or semi-commercial dairy farms with more heads of cattle per farm require individual animal management tools. Since feeding is one of the most important determinants of dairy farm economics, farms with more than 100-150 dairy cows may go for automation in feeding to reduce wastage of feed, labour and labour cost. Automatic concentrate feeding system will satisfy the majority of needs of dairy farmers in feeding dairy cows precisely according to her nutritional requirement in commercial dairy farms.

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Therapeutic Values of Fresh Coconut Kernel

Bhopal Singh[1], Kaushik Khamrui[2], Rekha Rani[1], Rahul Nigam[1]

[1]*Research Scholar, Dairy Technology Division*
[2]*Senior Scientist, Dairy Technology Division*
ICAR- National Dairy Research Institute, Karnal, Haryana (India)
Corresponding author: bhopalbtech@gmail.com

Coconut is called as Kalpavriksha, king of palms and tree of life due to its religious importance and nutritious properties (Chan and Elevitch, 2006). It is a very versatile and indispensable fruit for most people under the tropical belt and its nuts mature within a period of 12 months after pollination. Coconut (*Cocus nucifera Linn*) belongs to the family of the *Arecaceae (Palmae)*, the subfamily *Cocoideae.* India is the third largest producer of coconut in the world followed by Indonesia and Philippines. India have highest productivity of coconut that is 7215 kg/ha compared to Indonesia and Philippines having 3630 and 3859 nuts per hectare, respectively. The per capita annual availability of coconut estimated to have been 10 nuts which is quite low compared to 222, 145 and 55 nuts in Philippines, Sri Lanka and Indonesia, respectively. In India, 90% of coconut is cultivated mainly in of Kerala, Tamil Nadu, Karnataka and Andhra Pradesh. Kerala tops in production accounting 39 percent of total production in the country (Coconut Development Board, 2012). Among the four major coconut growing states, Tamil Nadu has the highest productivity of 10484 kg/ha in the area of 4.31 lakh hectare, Andhra Pradesh, Kerala and Karnataka has a productivity of 8944 kg/ha in the area of 0.14 thousand hectare, 5188 kg/ha in the area of 0.78 lakh hectare and 7406 kg/ha in the area of 0.51 lakh hectare, respectively (Advisor, Horticulture Division, Ministry of Agriculture, Govt. of India, 2012). An average size nut weighing 400 g edible meat and water provide most of the daily required essential minerals, vitamins and energy for mankind.

COMPOSITION OF FRESH COCONUT

Coconut protein is high in nutritive value and fairly rich in lysine, methionine and tryptophan. Fresh coconut kernel is an excellent source of minerals such as copper, calcium, iron, manganese, magnesium and zinc. Very good source of

Table 1: Composition of fresh Coconut Kernel and Copra

Product	Moisture	Fat	Protein	Carbohydrate	Mineral	Fibre
Kernel (wet)	40-50%	35%	4%	8-20%	1%	2%
Copra	6-7%	62-65%	7-5%	15%	2%	3-4%

(Source: Tamilnadu Agriculture University, Expert system for coconut, 2011)

B-complex vitamins such as folates, riboflavin, niacin, thiamine and pyridoxine (Srivastava *et al.,* 2011). 100 g kernel consists of 354 calories. 100 g of fresh kernel contains 356 mg or 7.5% of daily required levels of potassium. Composition wet and dry coconut is given in the Table 1. The oil that is extracted from fresh coconut kernel is known as virgin coconut oil which shows a wide range of therapeutic functions. It is a vegetarian product so that coconut fat does not contain cholesterol. Coconut contains approximately 65% medium chain saturated fatty acids and they are directly absorbed from the intestine and sent straight to the liver to be rapidly metabolized for energy production and thus do not participate in the biosynthesis and transport of cholesterol (Enig, 2004).

Coconut oil contains mainly saturated fatty acids (SFA) (93 %) with lauric acid (C12:0) (50–55 %) being the most prevalent fatty acid present. It also contains medium chain fatty acids (MCFAs) consisting of capric acid (C6:0), caprylic acid (C8:0), capric acid (C10:0) and lauric acid (C12:0 10:0) that can be easily burned for energy rather than being stored in the body (Bhatnagar *et al.,* 2009). Hedge (2009) stated that monolaurate is only found in mother's milk fat other than coconut fat so if the coconut milk is the only substitute of mother's milk.

THERAPEUTIC VALUES OF COCONUT

Cardio protective effect

Coconut fat contains more than 65% medium chain saturated fatty acids (MCSFAs), which allows them to be directly absorbed from the intestine and sent straight to the liver to be rapidly metabolized for energy production and thus MCSFAs do not participate in the biosynthesis and transport of cholesterol (Enig, 2004).

The major fatty acids contains of coconut fat are: caprylic acid C-8:0 (8%), capric acid C-10:0 (7%), lauric acid C-12:0 (49%), myristic acid C-14:0 (18%), palmitic acid C-16:0 (8%), stearic acid C-18:0 (2%), oleic acid C-18:1 (6%), linoleic acid C-18:2 (2%) (Yong *et al*., 2009). Nevin and Rajamohan (2004) showed that VCO lowered total cholesterol, triglycerides, phospholipids, low density lipoprotein (LDL), very-low-density lipoprotein (VLDL), and increased high density lipoprotein (HDL)-cholesterol levels.

Antiatherosclerotic effect

Some of the pathogenic gram-negative bacteria with an appropriate chelator have been reported to be inactivated or killed by lauric acid and monolaurin as well as capric acid and monocaprin. *Chlamydia pneumoniae*, is suspected of playing a role in atherosclerosis by provoking an inflammatory process that result in the oxidation of lipoproteins with induction of cytokines and production of proteolystic enzymes, a typical phenomenon in atherosclerosis (Enig,

2004). Besides causing viral infection, the herpes simplex virus (HSV), cytomegalovirus (CMV) and Epstein-Barr virus (EBV) have a role in the in the pathogenesis of atherosclerotic plaques after angioplasty and the presence of viral DNA in the grafts used for bypass surgery constitute a potential risk for atherosclerosis (Ibrahim *et al.,* 2005). The components catechin and epicatechin along with condensed tannins (B-type procyanidins) were present in the water extract obtained from coconut husk fiber, that showed inhibitory activity against acyclovir-resistant herpes simplex virus type 1 (Esquenazi *et al.,* 2002). In fact, all members are killed by the fatty acids and monoglycerides (MG) from saturated fatty acids ranging from C-6 to C-14 (Eckarstein *et al.,* 2002), which include approximately 80% of the fatty acids in coconut oil. Monolaurin is not formed in the body unless there is a source of lauric acid in the diet, and coconut is a rich source of monolaurin.

Hypolipidemic effect

Mini and Rajamohan (2004) observed that the hypolipidemic effect of coconut protein is mainly due to the high content of L-arginine. Further, Nevin and Rajamohan (2004) observed that the high polyphenol content in coconut is capable of maintaining the normal levels of lipid parameters in tissues and serum which is aided by trapping of reactive oxygen species in aqueous components such as plasma and interstitial fluid of the arterial wall thereby inhibiting LDL oxidation, reversal of cholesterol transport and reducing intestinal absorption of cholesterol (Eckarstein *et al.,* 2002).

Antibacterial activity

The MCFAs and their derivatives e.g., MGs found in coconut are effective in destroying a wide assortment of lipid-coated bacteria by disintegrating their lipid membrane.

For instance, they can be effective against bacteria that can lead to stomach ulcers, sinusitis, dental cavities, food poisoning and urinary tract infections. Monoglycerides, especially monolaurin, has been used to protect intravenously administrable oil-in-water emulsion compositions against growth of *Escherechia coli (E. coli), Pseudomonas aeruginosa (P. aeruginosa), Staphylococcus aureus (S. aureus)* and *Candida albicans (C. albicans)*. The compositions can be medicaments containing lipophilic drugs, especially propanol, and/or total intravenous nutritional compositions

(Daftary *et al.,* 2008). Coconut oil, obtained from its nuts, in concentrations of 5% to 40% (w/w) exhibited bactericidal activity against *P. aeruginosa, E. coli, Proteus vulgaris* and *Bacillus subtilis*, which was attributed to monolaurin that enhanced absorptivity due to the presence of surface active emulsifying agents used in formulating the cream made from coconut oil (Oyi *et al.,* 2010). Emulsions of 1.25 mM monocaprin in citrate-lactate buffer at pH 4 to 5 caused a more than 6 to 7-log10 reduction in viable counts of *Salmonella* spp. and *E. coli* in 10 min and *Clostridium jejuni* was also more susceptible to monocaprin emulsions at low pH (Thormar *et al.,* 2006). Lauric acid, which is also present in mother's milk, helps to protect a delicate nursing baby from harmful pathogens (Thormar and Hilmarsson, 2007). Thus, like many other important medicinal plants having antibacterial property C. nucifera is also excellent against different pathogenic bacteria causing several life-threatening infection to humans (Obi *et al.,* 2005).

Anticholecystitic effect

It is urinary antiseptic and is effective in the treatment of kidney and urethral stones (Abate and Moore, 1985). Monooctanoin is a digestion product of caprylic acid, is a cholesterol solvent that has been used for the dissolution of retained cholesterol gallstones following cholecystectomy. It was observed that complete gallstone dissolution had occurred in approximately 50%-75% of patients received monooctanoin and appears promising for stone dissolution in patients in whom mechanical removal has been unsuccessful or is impossible (Abate and Moore, 1985).

Antifungal effect

The antimicrobial spectrum of monolaurin is broad including fungal species such as *Aspergillus sp., Penicillium sp., Cladosporium sp., Fusarium sp., Alternaria sp., C. albicans, Fonsecaea pedrosoi* and *Cryptococcus neoformans* (Esquenazi *et al.,* 2002). Rihakova *et al.,* (2002) reported two different types of antifungal effects in *Aspergillus niger* (A. niger), one by inhibition of spore germination and another by inhibition of the radial growth, at monolaurin concentrations of 0.5 mg/mL and more than 1 mg/mL, respectively. They can also help combat yeast overgrowth, such as *Candida* and *Thrush*. VCO has been used in the treatment of *Candida* infections full stop after infections. Ogbolu *et al*., (2007) compared the susceptibilities of the *Candida* isolates to VCO and fluconazole using the agar-well diffusion technique and found that C. albicans had 100% susceptibility to coconut oil at an minimum inhibition concentration (MIC) of 25% (1:4 dilution), while fluconazole had 100% susceptibility at an MIC of 64 µg/mL (1:2dilution). Capric acid caused the fastest and most effective killing of the *C. albicans* strains while lauric acid was the most active at lower concentrations and after a longer incubation time *C. krusei* showed the highest resistance to coconut oil with an MIC of 100% (undiluted), while fluconazole had an MIC of more than 128 µg/mL.

Antiviral effect

Coconut oil is very effective against a variety of viruses that are lipid-coated such as *visna virus, Epstein - Barr virus,*

influenza virus, leukaemia virus, Pneumono virus and *hepatitis C virus*. The MCFA in coconut oil primarily destroy these organisms by disrupting their membranes, interfering virus assembly and maturation (Arora *et al.,* 2011). The monoglycerides are active while diglycerides and triglycerides are inactive against these viruses. Of the saturated FAs, lauric acid has greater antiviral activity than either caprylic acid, capric acid, or myristic acid. Monolaurin acts by solubilizing the lipids and phospholipids in the envelope of the virus, causing the disintegration of the virus envelope (Arora *et al.,* 2011). The antiviral effects of the FAs and MGs are additive, and total concentration is critical for inactivating viruses (Enig, 2004).

Immunostimulatory effect

The coconut globulin, cocosin, is a legume class, 208 kDa reserve protein which belongs to the fourth group of proteins. Vigila and Baskaran (2008) showed an increasing levels of RBC, WBC, platelet, neutrophil, monocytes, eosinophil, B-lymphocytes, T-lymphocytes and Hb after feeding coconut protein to immuno suppressed animals, thus indicating strong immunomodulatory activity of coconut protein.

Antidiabetic effect

The coconut kernel protein has potent anti-diabetic activity through reversal of glycogen levels, activities of carbohydrate metabolizing enzymes and the pancreatic damage to the normal levels due to its effect on pancreatic β-cell regeneration by means of arginine (Salil *et al.,* 2010).

CONCLUSION

Coconut has several religious importance and nutritious properties. It contains more than 65% medium chain saturated fatty acids (MCSFAs), which allows them to be directly absorbed from the intestine and sent straight to the liver to be rapidly metabolized for energy production and thus MCSFAs do not participate in the biosynthesis and transport of cholesterol. Several studies showed the Cardio protective, antidiabetic, immunostimulatory, antifungal, antiviral, antibacterial, anticholecystitic, hypolipidemic and antiatherosclerotic effects of coconut.

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Management of Calf Pneumonia For Economical Dairy Farming

P. Manjari[1], Purnima Singh[2], Suresh Kumar[1], Anjali Kumari[3], Susavi Kumari[4] and P. Thulasiraman[1]

[1] Ph D Scholars, Dairy Cattle Physiology Division, NDRI, Karnal-132001
[2] M.V.Sc. Scholar, Dairy Cattle Physiology Division, NDRI, Karnal-132001
[3] M.V.Sc. Scholar, Livestock Production Management Section, NDRI, Karnal-132001
[4] Ph D Scholar, Livestock Production Management Section, NDRI, Karnal-132001

Calf hood diseases have a major impact on the economic viability of cattle farming. Among all the diseases, Calf Pneumonia is the most common post-mortem diagnosis in calves at 1-5 months of age. Although it often has a low mortality (about 3% in a group), it is highly infectious, affecting more than 50% of young calves. The disease is of economic importance since it increases the input costs in rearing as extra expenditure is to be made towards diagnosing and treating the disease. It also affects the future economic returns since the animals affected will frequently have permanent

lung damage, resulting in ill-thrift throughout their lives and calves destined for the food chain will take longer to fatten; those kept for breeding will often take longer to get in calf. Calves that never show pneumonia symptoms yet have been exposed to the disease and suffered lung damage appear to be healthy but will show reduced weight gain and delayed time to finishing.

AETIOLOGY AND EPIDEMIOLOGY

Pneumonia in pre-weaned calves is a multi-factorial disease

- Viruses (bovine herpesvirus 1, BoHV1; bovine respiratory syncytial virus, BRSV; parainfluenza 3 virus, PI3; bovine coronavirus)
- Bacteria (*Mycoplasma bovis, Pasteurella multocida, Mannheimia haemolytica, Haemophilus somni*)
- Environmental risk factors- low environmental temperatures and high humidity and poor ventilation
- In calves Maintained outdoors, outbreaks can occur due to sudden inclement weather

Incidences of pneumonia in calves reared indoor is more compared to those reared outdoors (Assié et al., 2004). The reasons

maybe space sharing with older animals, overcrowding, improper management, etc.

RISK FACTORS FOR PNEUMONIA

1. Housing systems

Calves have functional thermoregulatory mechanisms. Therefore, as long as healthy calves receive adequate amounts of energy and are provided with a dry, well-bedded and draft-free shelter, they are readily able to deal with outdoor temperatures. Maximum amount of heat loss from body surface of calves occur via conduction in lying down position. Therefore, the quality of bedding material is crucial for the amount of heat loss. In naturally ventilated calf barns, deep straw bedding provides superior insulation as well as higher nesting score compared to any other bedding material (Lago *et al*., 2006).

Benefits of Individual Housing System over Group Housing

- Superior individual care
- Better management
- Lower risk of infectious diseases (diarrhea and respiratory diseases)
- Earlier detection of diseases
- Better care even in adverse climatic condition

2. Ventilation

Adequate ventilation in calf barns is crucial to prevent disease due to accumulation of high levels of humidity, noxious gases, dust and bacterial content. For calf barns, ammonia levels of less than 10 ppm are recommended (Woolums *et al.,* 2009). For proper ventilation:

- Check ammonia accumulation by regular removal of urine and faeces
- Avoid solid dividers in individual housing systems
- At least 4 air changes per hour in winter and up to 40 in summer
- Adequate air outlets (ridge opening: 5 cm width for every 3 m width of the building) and inlets (eave openings: at least half the space of ridge openings)
- Sufficient difference in height between the opening (1.5 m, but preferably 2.5m)
- Recommended air space is 6 m^3 up to 6 weeks and 10 m^3 up to 12 weeks of age

3. Other factors predisposing the calves

- Mixing: calves from different sources; calves of different ages; Calves with older cattle; Vaccinated and unvaccinated animals; Sick with healthy calves
- Poor Nutrition: Inadequate milk intake; Mineral and vitamin deficiencies; Weaning and other dietary changes
- Immunity: Decline in maternal derived immunity (colostrum). In a normal calf this lasts for 12 weeks.
- Other Diseases: Calves that have had diarrhea are 3 times more likely to get pneumonia
- change of environment (outdoors to indoors)
- Under non-integrated system, additional stressors like transportation and marketing
- Other Stresses: Weaning, Castration, disbudding, etc.

Post-weaning period is often characterized by alterations in calf behavior, hormonal

mediators of stress and consequently impaired immune function (Lynch et al., 2010).

SIGNS AND SYMPTOMS

There are two types of the disease, acute and chronic.

- Dull and depressed
- High temperature (≥103.5°F or ≥39.7°C))
- Elevated respiratory rate (≥60/minute)
- Nasal discharge
- Coughing
- Reduced food intake
- Calves stand with backs arched and heads down

Chronic pneumonia is more gradual in onset with no distinct signs and the calf may show normal feeding habit but may have a slight nasal discharge, sometimes with an increased respiratory rate and cough. Both forms of the respiratory disease cause production losses as there is a reduction in live weight gain and there may be deaths in the acute syndrome

DIAGNOSTIC TESTS

The value of diagnostic tests in calf pneumonia is somewhat limited due to the multifactorial nature of the disease and the uncertainty if the pathogens recovered from samples are causative to the disease (Lorenz et al., 2011). Nasal swabs should only be used to identify upper respiratory tract viruses. Deep nasopharyngeal swabs, positive for *M. haemolytica* and *M. bovis*, have been demonstrated to be representative of isolates present in the lungs. Samples obtained from transtracheal wash and/or bronchoalveolar lavage (BAL) can be used for virology, bacteriology, cytology and parasitology. Bacteria may be more likely to frequent the lung during high stress periods due to impairment of the mucociliary escalator mechanism.Feces should be examined for lungworm larvae, even though false negatives may occur if the animals are sampled before adult lungworm become patent.

TREATMENT

Isolate individual sick calves, giving them fresh food and water. Antibiotic treatment of bacterial pneumonia must be early enough to prevent lesions forming that may resist both therapy and regeneration of normal lung parenchyma. Dose and duration of drugs must be strictly followed. Non-steroidal anti-inflammatory drugs (NSAIDs) have shown to reduce pyrexia, clinical signs, and lung pathology and improve average daily weight gains in calves with respiratory disease compared to untreated calves or calves only treated with antimicrobials. Anthelmintics in case the causative agent is parasitic. Ventilation should be improved to reduce humidity and cut numbers of pathogens and dust in air. Also, the stocking densities should be reduced and it should be ensured that different age groups of calves are kept in separate air spaces.

PREVENTION

It can be difficult to control pneumonia when calves are placed in communal pens.

- **Colostrum:** All calves must have one gallon of colostrum within 4-6 hours of birth to receive adequate immunity. Calves that are not given enough antibodies at birth are at increased risk

for pneumonia and scours throughout the entire growing period.

- **Ventilation:** Often if ammonia can be smelled it is a sign of poor ventilation.
- **Nutrition:** Feeding calves inadequately will reduce calf growth and their immune system response.

Vaccination: Vaccines are available to reduce risk of infection, however they must be used alongside an effective management programme. All vaccines are POM-V, requiring a prescription from a vet, and vets will offer guidance on which products to use. Few examples are:

- Bovilis Bovipast RSP (Intervet) is a combined viral and bacterial vaccine with agents to tackle RSV, PI3 and *Mannheimia haemolytica*. It requires two doses, the first of which can be administered from a minimum of two weeks of age. The recommendation is to vaccinate calves two weeks before a risk period, such as re-housing calves in the autumn. Calves that will be housed early in their life should be vaccinated as soon as they are old enough and then given a booster jab before the next risk period, such as changes in housing, transport or mixing groups.
- Rispoval 4 (Pfizer) contains agents for RSV, PI3, IBR and BVD. Rispoval 4 can be administered is three weeks of age. However, as maternal antibodies can interfere with the vaccine, a booster is recommended at 12 weeks if a calf is first vaccinated at any point before that. Rispoval 4 requires two doses given 3-4 weeks apart and administration is recommended two weeks before a risk period.
- Pastobov (Merial), just for *Mannheimia haemolytica*, needs two doses and should be injected (either intramuscular or subcutaneous) at a minimum of four weeks of age and again 3-4 days later. A booster should be given before a risk period and not later than one year after the first vaccination.

CONCLUSIONS

Pneumonia is a significant cause of morbidity and mortality in calves, both during the pre-weaning period and shortly following weaning. A range of events are linked with increased disease risk, including weaning management, painful procedures, housing systems and ventilation and effective preventive measures have been demonstrated. The management of pneumonia in calves is reliant on a sound understanding of aetiology and of relevant risk factors and of effective approaches to diagnosis and treatment.

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Importance Of Records Keeping In Dairy Farm

Poonam Ratwan*, Manoj Kumar, Anjali Kumari, R.K.Verma and Ritika Gupta

ICAR-National Dairy Research Institute, Karnal-132001, Haryana
**Corresponding Author- punam.ratwan@gmail.com*

A record keeping is "Systematic procedure by which the records of an organization are created, captured, maintained and disposed off". This system also ensures their preservation for evidential purposes, accurate and efficient updating, timely availability, and control of access to the them only by authorized personnel. Keeping track of what is happening on the dairy farm requires some records. Good farm management requires having a good useful set of farm records. Good records do not ensure the farm will be successful however success is unlikely without them. Farm records are just like the report cards students receive at school. With a farm report card, farmers can tell how well they are managing their operation compared to other producers in their 'class'. They can also see the strengths and weaknesses in their operation. Having accurate facts and figures is most useful when borrowing money, seeking government support and completing tax returns. From reliable farm records, equity (or proportion of total assets actually owned) can be updated to assist with future farm investment programs. Farm records can help evaluate the dairy enterprise on a mixed farm while farm advice will be more effective if the adviser knows exactly what is happening on the farm. Records and statements show what has occurred or is occurring on the farm while budgets predict what might happen in the future.

IMPORTANCE OF RECORD KEEPING

Records provide the farm manager with data, information and knowledge. Various uses for farm records are:

1. They are frequently used as a service tool. The types of services provided are income tax calculations, estate planning and business arrangement reconciliation.
2. Provide data for financial analysis and other diagnostic instruments such as identifying the strengths and weaknesses of the business.
3. Used to compare the efficiency of use of inputs such as land, labour and capital.
4. Helps in preventing inbreeding and formulating breeding programmes.
5. Used as an indicator of progress. A series of records are necessary to monitor progress.
6. They are a good forward planning tool. Past records can be used to project future cash flows for current and modified farm management practices.

TYPES OF RECORDS

With dairying being such an intensive form of livestock production, keeping track of individual animals is very

important. Such information will be essential in preparing realistic budgets for future farm developments rather than depend on generic estimates of farm performance. Keeping full records just for the sake of keeping them is a waste of time and energy. A little time spent in keeping a few orderly records that will be used is a good investment in managing the farm business. Some of the key records to keep includes:

1. **Farm diary-** A small notebook in which to record the key facts and figures of the farm business and the day-to-day activities as they occur is the most useful and practical form of record keeping. Farmers who do use a diary find that important facts and figures that could easily be lost or forgotten are permanently recorded for future reference though they may not be easy to find quickly.
2. **Crop records-** It is sometimes useful to record what happens to each plot or crop each year such as type of crop, fertiliser applications (time and amount), agronomy (seeding, weeding, sprays), visual impression of crop, harvest interval of forage crops and if known, crop yield.
3. **Livestock records-**

i) Identification Records

An identification method should be cheap, not harming the animal, reliable to read at a distance of at least 2-3 metres and by preference be permanent. Identification of the animals is of course not necessary if a farm has only one animal of a certain species, sex and age group. Intrusive methods of identification can be subdivided into 2 categories: Permanent and Non-permanent.

Permanent Identification

- Tattooing
- Brand
- Ear-notching
- Tags

Non-Permanent Identification

- Collars or neck or leg straps (chains)
- Paint and dyes

ii) Breeding Records

The importance of breeding records is to measure the productive efficiency of the herd and to enable culling and selection. The most important data in breeding records include:

- Pedigree/parentage (name or other identification of parents and grandparents).
- Fertility (dates of all services also allows calculating the number of services per conception), dates of giving birth (allows to calculate the age of first calving/giving birth and the period between successive birth.
- Birth details (number and weight of newborns, was assistance necessary? Stillborn / prenatal deaths/vitality score).

iii) Production Records

These records are useful in measuring the performance of the animals and the herd. These records are important for economical purpose. Important Production records are:-

- ***Daily milk yields***, for closer animal observations if they suddenly and unexpectedly change.
- ***Daily herd milk yield***, to check up on milk payments and to fine tune feeding programs.

- ***Regular milk composition data***, if provided by the cooperative or processor, to closely monitor the effects of diet.

iv) Feeding Records

Feeding records give information about the amount, type and quality of the feed. Feeding records can be used both for day to day management and adjustment of the feed ration. The important feeding records are:

- Produced and available fodder on farm, quantity and if possible quality of the different feeds including content of energy, protein and mineral.
- A feeding plan which tells how much feed is required per day per animal in different age groups like grown-ups, newborn, pregnant etc.)
- Left-over feed if any (per head and per feed, if possible)
- Spoilage (per batch)

v) Disease and treatment records

Disease and treatment records are necessary to keep track of the disease events in which each animal is involved during its lifetime. This can guide to better management practices by leading the attention to repeated events or certain vulnerable groups of animals over time. It provides information about the health status of each individual animal and the whole herd, and it can help ensuring important vaccinations given at the right time. On basis of the disease and treatment records, success of interventions both for prevention and treatment can also be evaluated. After treatment with dewormers, acaricides, antibiotics and other medicines, milk, eggs and meat cannot be eaten by humans for some time. The records are essential for keeping track of this e.g. when this withdrawal time is over. In organic animal husbandry, the withdrawal time is normally longer than the ordinary withdrawal time (double, or three times).

Disease and treatment records can for example involve:-

-Disease occurrence and date
-All handlings to cure diseases
-Vaccination
-Dipping/spraying
-Treatment
-De-worming
-Post-mortem

vi) Financial Records

The records of the costs and earnings related to the animal farming should be kept for cash analysis and enterprise appraisal. Economic records are of paramount interest in providing the farmer with information concerning the profitability of his farm. Moreover they are of great help in decision making at the right time. Key financial records such as interest and principal repayment schedules, to plan repayments should be kept.

vii) Reproductive records

- Dates when each cow is on heat, to manage artificial insemination (AI) programs as well as predict expected dates of calving.
- Dates and results of pregnancy diagnoses, if undertaken, to predict expected calving dates.
- Calving dates to follow through different stages of each cow's lactation and to assess weight for age of young stock. Also to update annual livestock inventory as stock change classification e.g. from calves to

yearlings. They are also useful to identify cows that are due to be mated.

viii) Growth records

- Live weight and body condition of adult cows to monitor milking performance during the entire lactation and for better planning of feeding programs.
- Live weight and body condition of young stock to monitor feeding management required to achieve growth targets.

ix) Stock purchases and sales of culls, to update livestock inventory.

x) Stock deaths and probable causes, to update livestock inventory and also monitor general herd health.

xi) Age when culled from the milking herd, reason for culling and number of lactations while in milking herd.

xii) Other dairy enterprise sales, such as stock fattened for sale, cow manure and any excess forages, for accounting purposes.

xiii) Unit costs of all major farm inputs, such as fertilisers, fuel, irrigation water, concentrates and/or their ingredients, purchased forages, stock purchases. These are necessary for routine book keeping and also to monitor seasonal changes and hence to plan future purchases.

xiv) Unit returns from all farm outputs, such as milk, culled cows and heifers, sale of steers or bulls, manure, excess feed, to plan future sales.

xv) Livestock inventory accounting- The main purpose of livestock accounts is to monitor net losses and gains in income and to distinguish the increases and decreases due to changes in market value. When quantifying total livestock value you have to take into account both changing herd size and change in unit price.

4. Plant and improvement records- Examples of relevant records include date and cost of purchase or installation, annual depreciation, insurance and registration, fuel use, hours use (to plan services), major repairs and maintenance.

5. Other key farm management records such as rates and government charges, other administrative costs such as telephone and office upkeep, labourer's wages, capital investments, unusual weather events, dates of important meetings, credit repayments, changes in valuation of capital items such as land and livestock categories.

6. Personal expenses- to ensure the manager and farm family's imputed wages are realistic and that people are living within their means. This should include a valuation of any farm produce used for personal consumption.

7. Multicolumn records- Books with multicolumn pages help with financial records. Each column can be given a heading which fits the specific situation on the farm. For example, with crops, columns could list for each plot the cost for fertiliser, seeding, spray, labour, water, machinery, harvesting, processing, transport and selling. Wages could be broken down into different farm activities. Many farmers keep all relevant records as scraps of paper in a box. Transferring them to a book will save time in the long run.

FINANCIAL RECORDS TO KEEP

Data are not knowledge and often are not even information. The conversion of data to information requires a set of principles, concepts, methodologies and formulae that are accepted as standards by the community using the information. Farm transactions can be recorded when they occur or when cash changes hand. The accrual method of accounting (when it occurs) is more useful than the cash method (when money is received or disbursed) because it documents when things were done due to management decisions at the time. To use accrual methods, resources must be inventoried regularly.Every physical item on the farm can be placed into one of five economic categories, namely:

- Assets: what is used to generate income, either owned or purchased on credit? This is a combination of physical and monetary values, with the physical quantity multiplied by a unit price to obtain its monetary value.
- Liabilities: what you still have on credit.
- Equity: assets less liabilities.
- Revenue: what your business generates.
- Expenses: the costs to your business of generating the revenue.

RECORDING DATA IN THE FARM OFFICE

One key aspect of record keeping is where, how and when they are recorded. Recommendations for setting up a farm office: Find an area at home or in the dairy shed that can be dedicated to keeping records. It must have a desk and good lighting. It must be a quiet place to set up the office files, computer and office supplies. It is important that description of any farm follows a consistent approach to allow accurate documentation of farm performance for any production or financial analysis. A suggested series of definitions of farm physical resources and herd performance are presented as:

1. ***Location of farm:*** state or province and distance from the nearest large town.

2. ***Farm area:*** farms consist of various components which should be differentiated. These are:

a) Total area of the entire farm which includes houses, dairy sheds and other buildings, infrastructure such as laneways and other non-forage production areas and areas used for other farming enterprises such as cash cropping or other livestock enterprises.

b) Area of dairy enterprise the part of the farm devoted to dairy production.

c) Forage production area, that part of the dairy enterprise devoted to growing forage for milking cows and young stock. Some may be for grazing while other areas are for 'cut and carry'.

- If the farm grows a variety of forages for the dairy enterprise, this should be included in the farm description.
- Some of this area may be owned outright by the farmer with other areas leased, and this should be included in the farm description.
- It is likely that all or most of this area is on the home farm, but for a dairy farming area in another location, this should be included in the farm description.
- It would be useful to describe physical features of the farm, such as topography (Hilly or flat) and soil type.

- ❖ A farm map overlain by clear plastic is very useful, so annual activities on each area can be recorded and updated.

3. ***Livestock:*** Throughout this book, dairy cattle have been categorised into five classes, namely:

a) Adult cows (milking and dry cows) which have had a calf. This includes first calf heifers, although sometimes it is useful to place them in a different class. These stock are collectively called the milking herd, with other dairy stock (except bulls) categorised as the replacement herd. b) Yearlings (heifers older than 12 months) yet to have a calf.

c) Heifers (3–12 months of age). d) Calves (0–3 months of age). e) Bulls (older than 12 months) including steers, used for either breeding or grown out for slaughter. All dairy farms sell stock (cull cows) for slaughter but some dairy stock may be grown out for dairy beef production, such as bulls or steers older than three months of age. In this case, they can be either considered as dairy stock or as part of a separate beef enterprise.

4. ***Water resources:*** As water is a major driver of fodder production, some description of the available water would be useful, such as:

a) Rainfall, if known, and actual months of the wet and dry seasons,

b) Irrigation water, if available from underground sources, rivers or irrigation channels with estimates of how much is used each year.

5. ***Labour resources:*** For each unit of paid labour, some estimate of weeks worked per year and average hours worked per day would be useful. It would be good to convey some idea of the role of the farming family in dairy activities such as, the farmer and/or his wife spend x hr per week in off-farm employment and the farmer's family spend y hr per week on dairy related activities.

6. ***Feed resources:*** A brief description of the feeds grown and purchased for the dairy enterprise and approximately what proportion of the annual forage consumed by the dairy stock is actually grown on the farm, with other details such as:

a) The types and sources of other forages fed to the dairy stock b) Whether some of the forage area is grazed or the entire area is harvested by hand (or machine) for feeding housed stock c) Whether some of these forages had been conserved as hay or silage d) The types and sources of concentrates (formulated and/or ingredients) fed to dairy stock

7. ***Other farm resources:*** Description of all farm buildings (and their purpose), other fixed assets and farm constructions (such as silage pits and milking equipment), machinery and farm equipment, feed and other consumable resources on hand.

8. ***Financial resources:*** Current loans (with details of repayment process) plus other current, intermediate and long-term liabilities, cash on hand, investments generating farm income and other current, intermediate and long-term assets.

9. ***Milk production:*** Total annual milk produced by the farm should be an easily accessible measure. An average annual milk yield per cow is acceptable but average milk produced/cow/day would suffice. It would also be useful to quantify

the average lactation length (the number of days milking and number of days dry), as well as some indication of milk composition (total solids, milk fat and solids-not-fat).

10. ***Key herd information:*** There are a number of useful farm measures to describe herd management. These include average age of first calving, inter-calving interval, number of services per conception (if using AI) and calf mortality (during milk feeding).

11. ***Personal information on structure of the farm business:*** It would be good to know more about the people involved in the business and how the business is structured. For example, the age of the decision makers in the farm family and their years of experience in dairying, for how many years they have been milking cows on this farm, if the business is a partnership or if there are other investors in the business. Other relevant information would be how the farm got to where it is now and where the farm family want it to be say, in one, five and ten years time. It may or may not include targets for the size of the milking herd, the annual farm milk output.

12. ***Any previous physical and financial evaluation*** of the dairy enterprise would be useful as it provides good background information on the farm and also indicates that the farmer may know what relevant data to collect. Depending on the quality of any historical data collected and its analyses to produce relevant key performance indicators, it could form a useful starting point for an ongoing farm assessment. Comparative farm performance or benchmarking appraisal of the financial performance of individual farm businesses generally forms the basis for farm management advice. This inevitably involves collecting data on that farm and comparing it with results for similar farms. This procedure is also called *benchmarking*. However if benchmarking encourages farmers to look more critically at their cost structures, it has achieved a major purpose. It is important to clearly categorise farm type, generally based on herd size or number of milking cows. For such comparative analyses to be valid, they must be restricted to farm units that use similar technology and operate under similar conditions.

CONCLUSION

Present-day farm operations are becoming more and more business oriented than earlier farm operations. Being a good producer is no longer good enough to remain in dairy business. The key to becoming a successful farmer today is being a good producer as well as a good financial manager. The first step in being a successful farm manager is keeping good, accurate records and establishing a sound record-keeping system. There is a misconception that the only reason a person needs records is so he or she can report their taxes. However, record keeping plays a much larger role in business. Farming is a business and records can be helpful in planning improvements for that business and making proper management decisions. Therefore by keeping regular and accurate dairy farm records we can increase the economical status of dairy farmer.

Oxalate Poisoning in Livestock: Control and Prevention

Rajkumar[1] and P.Sankar[2]

[1]*PhD Scholar, Department of Animal Nutrition, Madras Veterinary College, Chennai-7*
[2]*Assistant Professor, Veterinary College and Research Institute, Orathanadu-614625*

Oxalate poisoning to the livestock is very common in tropical and subtropical areas, as majority of the plants in which animal graze is rich in oxalate content. The common vegetation's which are rich in oxalate include Napiergrass, Setaria, Buffelgrass, Pangolagrass and Kikuyugrass. Oxalate poisoning occurs when the sheep or cattle which are not adapted to oxalate are allowed to graze in the fields which contains the grasses with high oxalate content. Ruminants normally are more tolerant to the oxalates as they contain oxalate degrading bacteria in the rumen therefore there is less absorption of the soluble oxalates into the blood stream. In the ruminants sheep is most susceptible to the oxalate poisoning. When more amount of oxalates are ingested by the animals then their normal rumen degrading capacity they are absorbed in the blood stream from rumen as calcium and magnesium salts, which later gets deposited in the kidney and lead them to failure. In this way both acute and chronic oxalate poisoning may have a great effect in the economy of the livestock industry.

OXALATE RICH PLANTS

There are many plants reported to contain threatening levels of Oxalates, also there are various factors responsible for the oxalate content of the plants. For example the common Napier grass which is fed to the animal is reported to contain 3.8% of soluble oxalate on the other hand Setaria grass contains 5.6% of soluble oxalate. Oxalates become more toxic as the plant matures. In summer the oxalate content may rise as the calcium content may subside. The calcium to oxalate ratio of 0.5:1is considered to be safe in the grasses. But the grasses such as Kikuyu, buffel, pangola, and green panic grasses have been reported to have calcium to oxalate ratios of 0.23:1, 0.22:1. 0.37:1, and 0.32:1, respectively, this implies that these grasses are unfit for feeding.

There are two types of oxalate present in the plants.

1. Plants whose cell sap pH is in the range of 2, have oxalates in the form of acid oxalate (eg: Potassium oxalate)
2. Plants, whose cell sap is in the range of 6, have oxalates in the form of soluble sodium and insoluble calcium and magnesium oxalates.
3. Salts of acid oxalates are responsible for both acute and chronic poisoning while soluble and insoluble forms are responsible for the only acute toxicity.

Oxalates are the common constituents of the plants, as they play various roles in the

plant metabolism. Oxalates are responsible for the Calcium regulation, various ion balance, plant protection, tissue support and heavy metal detoxification.

Plants Containing Oxalates:

Sl.No.	Scientific Name	Common Name
1	*Amaranthus spp*	Red-rooted pigweed
2	*Beta vulgaris*	Sugar beet
3	*Chenopodium spp.*	Lambs-Quarter
4	*Portulaca oleraceae*	Purslane
5	*Rumex spp.*	Sorrel, dock

Oxalate containing Grasses

Sl.No.	Scientific Name	Common Name
1	*Cenchrus ciliaris*	Buffel grass
2	*Panicum spp.*	Elephant grass
3	*Pennisetum clandestinum*	Kikuyu grass
4	*Setaria sphacelata*	Setaria grass

OXALATE METABOLISM

There are four routes by which oxalate are metabolized in ruminants when they consume oxalate rich feeds.

i) The soluble oxalate may be degraded by rumen micro flora.

ii) The soluble oxalate may combine with Calcium in the feed to become insoluble Calcium oxalate and then excreted in the feces.

iii) The soluble Calcium may be absorbed in through the rumen to the blood stream where they combine with blood Calcium to form insoluble crystals. These crystals get precipitated in the kidney during circulation making kidney prone to failure.

iv) The insoluble oxalate may pass through digestive tract without causing any harmful effects to body.

Oxalates play important role in the Calcium regulation, Ion balance, plant protection, tissue support and heavy metal detoxification. There are two types of Oxalates in the feed they are soluble and insoluble. The soluble portion of the oxalates forms complex with sodium, potassium, ammonium ions and insoluble oxalates with calcium, magnesium and iron ions. Those animals which are adapted to the oxalates utilize them very well as their ruminant micro flora contains increased oxalate degrading bacteria than the un-adopted animals. The animals get adapted very soon, in the matter of 2-3 weeks the animal's tolerance increases by 30%. The plants containing more than 2.0% of soluble oxalates can cause acute poisoning in the actively grazing animals.

TOXIC EFFECTS OF OXALATES

Factors responsible for the susceptibility of animals to oxalate poisoning are:

- Chemical form of the oxalate,
- age of the animal,
- adaptation of animals to oxalate-rich forage,
- composition of the diet
- availability of water for animals

After ingestion of oxalates it is absorbed from the intestine and they enter into the circulation were they bind with serum Calcium or Magnesium making them unavailable to the body needs. In acute ingestion of oxalates the sudden hypocalcemia impairs the normal functioning of the cell membrane, animal experiences tremors and finally die. The cellular energy metabolism is also impaired leading to cell death. In chronic intake of oxalate rich plants the oxalate crystals gets deposited in the kidney tubules causing damage to kidney.

CLINICAL SIGNS

The animal may show clinical signs within few hours of ingestion. The various clinical signs may include:

- muscle tremors
- staggering gait
- tetany,
- weakness
- reluctance to move
- depression
- diarrhea
- fluid accumulation under the skin in the dewlap areas
- recumbency resulting from hypocalcemia and hypomagnesemia
- Coma and death may result within 12 hours.

If animals survive the acute stage of oxalate poisoning they succumb to kidney failure. As a result the animals become uremic (increased serum creatinine and urea nitrogen levels) and they become anorectic and finally lead to death due to coma. In Horses there is serious disturbance in calcium to phosphorus ratio as the calcium combines with the oxalate to form insoluble calcium oxalate. As there is reduction in the serum calcium level the parathyroid hormone gets released which mobilizes the calcium from the bones. As this process continues for some time the bone becomes softer as there is drainage of calcium from the bone matrix. This leads to the condition called nutritional secondary hyperparathyroidism. Compensatory fiber proliferation takes place and the bone gets misshapen. This condition is common in the facial bones of horses giving them the name “big head disease”. Ruminants are also affected like horses but they are less prone as their rumen microbes can utilize the oxalate.

DIAGNOSIS

The oxalate poisoning can be diagnosed on the basis of

- The plants which the animal consumed,
- Clinical signs (hypocalcemia and oxalate crystals in the urine)

It is important to note that, in acute oxalate poisoning we cannot expect the oxalate crystals in the urine. Necropsy Findings:

- In acute poisoning the kidney becomes edematous, dark red in color.
- In chronic poisoning the kidney will be pale and smaller than the normal size.
- Liver may be enlarged
- Clotting time of blood may be slow after death
- Fluid accumulation around the kidney and heart

- Rumen becomes edematous and there will be presence of oxalate crystals in the rumen epithelium.

TREATMENT

Correcting the calcium balance is the first step in the treatment in the oxalate poisoning though this may not reverse the effects of the oxalate on cellular energy metabolism. Irreversible oxalate nephrosis causes great effect on cellular energy metabolism which may cause more damage than the hypocalcemia.

- Calcium borogluconate should be given intravenously or subcutaneously as 25% solution around 300-500 ml for cattle and 50-100 ml for sheep.
- We can also administer calcium gluconate, magnesium sulphate, glucose and electrolyte solution so that the kidney perfusion is maintained.
- Orally calcium hydroxide (lime water) can also be given.

CONTROL AND PREVENTION

- Livestock should not be grazed in the oxalate rich plants predominating grasslands.
- Animals should be given at least a week for adaptation so that sufficient microflora gets established in their rumen to utilize the oxalate rich plants.
- Overstocking and overgrazing may potentiate the oxalate poisoning so it must be avoided.
- When the animals are in high risk of oxalate poisoning supplementary calcium sources such as dicalcium phosphate should be fed.
- Always maintain the calcium to oxalate ratio higher than 0.5:1 in the diet.
- Livestock diets may be supplemented with straw and hay so that the total oxalate intake may be reduced.
- The oxalate rich grasses can be fed along with legumes as they contain high amount of calcium. It is reported that alfalfa has the ratio of calcium to oxalate 1.5:1 which is very safe to the animals.

Fundamental Management Practices and Common Diseases in Rainbow Trout Fish (Oncorhynchus mykiss) Farming

Nishant Verma[1], Pankaj Kumar Singh[1], Rakesh Kumar[1], Ramender Das[1] and Vineeth M.R[2]

[1]*PhD Scholar, DCB Division, NDRI, Karnal, Haryana, 132001*
[2]*M.V.Sc Scholar, DCB Division, NDRI, Karnal, Haryana, 132001*

Trout fish farming is an ideal option for sustainable use of water resources in mountainous regions because here both surface and underground waters are suitable for this purpose. In regions where income-generating and employment opportunities are scarce, trout farming could help to ensure employment and steady incomes. Among trout fish species, brook trout, brown trout, lake trout, sea trout and rainbow trout are the most widely known species Rainbow trout (*Oncorhynchus mykiss*) is native to the cold water rivers and lakes of the Pacific coasts of North America and Asia. It has been introduced to about 82 countries, practically everywhere the conditions are favorable for its culture, because rainbow trout tolerates a wide range of environmental and production conditions better than other trout species. Rainbow trout is a highly commercial sport and market fish. A normal adult rainbow trout weighs about 2–3 kg. Rainbow trout lives in the upper, cold water sections of rivers and seas. The habitat and food of rainbow trout determine both their actual color and shape. The rainbow trout has many local strains, which have developed in the different river systems. The widely cultured commercial strains have been improved from those original rainbow trout populations that possessed advantageous qualities, such as hardiness, fast growth, resistance to diseases and reliable reproduction under farm conditions.

OPTIMUM CONDITIONS FOR RAINBOW TROUT FISH FARMING

Temperature range

Rainbow trout are classified as cold-water fish as their Standard Environmental Temperature is 15°C (59°F). There is a range of water temperature (about 7–18°C), where the appetite of rainbow trout is optimal. Outside of this range, at lower and higher water temperature, fish lose appetite. Finally, at too low or too high water temperature, fish stop feeding. Feeding (feed intake) of rainbow trout intensifies as the water temperature increases. However, this behavior continues only up to about 18°C. Above this temperature, the appetite of and feed intake by the fish sharply decreases and stops. For each degree C above or below the SET, there is an 8.5% reduction in metabolic

rate, which can be translated into a comparable decrease in weight gain or growth.

Water Quality

Keen eyesight is crucial for the efficient feeding of trout. Water should sustain Dissolved Oxygen in high concentrations, in order to ensure smooth respiration. Waters containing high levels of certain types of suspended/ settle able solids can create impairment of oxygen uptake by causing an inflammatory response in the gill lamellar tissues. In addition, certain plant pollens can cause similar problems in gill tissues. The net results are often a reduction of growth rate and an increase in feed-conversion ratio. In order to ensure the replacement of used water in the rearing devices, a continuous supply of fresh, clean and oxygen-rich water is essential. The necessary quantities of water supplied depend on the age and actual quantity of the developing fish. The quantity of eggs, fry and growing fish per unit area of rearing device is determined by the oxygen content of supplied water. In colder water, the metabolism and, hence, respiration slows, while in warmer water they intensify. Accordingly, the actual quantity of water needed for the same number of developing embryos, fry and fish will be different. At low water temperature, the quantity of water supplied may be less but at higher water temperature it should be more. Water supply is expressed by the flow rate, which is the quantity of water needed for 10 000 or 1 000 specimens of eggs, fry or fish. It is expressed either in litres per second (litre/s) or litres per minute (litres/min). Frequency of water exchange is another way to specify the quantity of supplied water. The water supply in concrete or lined tanks can be more intensive than in earth ponds, hence the density of fish can also be higher in these devices.

pH of Water

Water should be free of harmful solid and harmful gaseous waste materials produced during metabolism and respiration. Rainbow trout tolerates unfavorable pH conditions differently during the various development phases of the fish. The optimal and acceptable ranges of pH of rearing water also differ. For developing embryos and fry, the range of optimal pH is narrow, and varies between 6.5 and 8, but the range of acceptable pH is also narrow. For older fish, both the optimal and acceptable ranges of pH are wider.

Feeding Habits

The actual natural food of rainbow trout depends on the age and size of fish, on the size of food item and on the habitat occupied. Rainbow trout are aggressive and greedy in feeding. They are opportunistic feeders that grab and eat almost anything. Terrestrial insects are also consumed when they fall into the water. These insects are adult beetle, flies, ants and larvae of Lepidoptera. The earthworm and fish meal is also given to feed them in form of pellets.

Site selection

When selecting the production site, it is important to check the quality and quantity of available water, as well as the suitability of the site where the new fish farm is planned to be constructed. A rule of thumb

is that about 10 litres /sec (600 litres/min) of water source should be calculated for each 1 ton of rainbow trout produced. In general, both cold surface and underground waters are good for trout farming. In the case of surface water, the daily (day and night) fluctuation in temperature may be a few degrees (2–4 °C), while the seasonal i.e. summer and winter changes of water temperature may be as much as 5–15 °C. The temperature of springs and underground waters has no daily fluctuation and the differences between winter and summer are minimal if any. The availability (quantity) of water may change considerably according to seasons, especially in the case of surface waters and springs. In dry seasons, the water supply may drastically reduce while heavy rains often cause floods and sudden increases in the water quantity of springs. Therefore, the production capacity of a trout farm has to be planned according to the safe minimum quantity of water available. However, the protection of the farms against floods should be designed on the basis of the highest flood ever experienced. In order to avoid flooding, the farm should be constructed in a location higher than the flood-affected areas. This can be done if water is taken and conveyed to the fish farm through a service canal.

FISH DISEASES AND COMMON SIGNS OF DISEASED

Fish diseases

Rainbow Trout may suffer from different types of diseases and among those the most commonly occurring ones are listed below.

a) Viral diseases

- Viral haemorrhagic septicaemia
- Infectious pancreatic necrosis (IPN),
- Infectious haematopoietic necrosis (IHN)

b) Bacterial Diseases

- Furunculousis
- Enteric Red-mouth Disease (ERM)
- Columnaris disease
- Flavobacterium septicaemia (cold water disease)

c) Fungal Diseases

- Saprolegnia

d) Parasitic Diseases

- Protozoa (*Ichthyobodo necator*, *Ichthyophthyrius multifiliis*, *Trichodina* sp.,*Chilodonella* sp.)
- Whirling disease

e) Environmental diseases

- Acute and permanent oxygen shortage
- Gas bubble disease
- Poisoning: Nitrogenous wastes (ammonia, nitrite, nitrate), extreme pH, pesticides, heavy metals.
- Stress

f) Nutritional diseases

- Fusariosis
- Vitamin and mineral deficiency: Approximately 15 different vitamins are known to be important for fish. Fish also require minerals for different metabolic processes, such as haemoglobin synthesis, as well as for enzyme/hormone functions.
- Fatty feed: There is too much fat in the feed of the fish.

Signs of Diseased fish

The more intensive the trout production is, the more the reared fish are exposed to stresses, which increase the chances of falling prey to dangerous pathogens (viruses, bacteria, fungi or parasites) and contracting environmental or nutritional diseases. Therefore, it is important to observe the behavior of fish. The most obvious signs of disease are as under:

- Unusual/abnormal behavior
- Loss of appetite
- Gathering at the water inflow
- Gasping for air at the surface
- Staggering, whirling or floating on the water surface with forced movements or trembling.
- Unreflecting and stiff eyes
- Wounds, blisters, lost scales, bloody or discolored areas on the body.
- Reduced or excess quantity of mucous on the surface of the body.

CONCLUSION

Trout fish farming is practiced in cold temperate regions with favorable climatic conditions. The site selection is very important aspect of trout farming. The site should be less susceptible to natural calamities. The environment temperature, quality and quantity of water are very fundamental factors, which should be never compromised. Also, the trout fish suffers from very large number of diseases and therefore needs the expert advice on regular basis.

Various Techniques For Preservation of Meat

*Alok Kumar Yadav[1], Jitendra Singh[2] and Rakesh Kumar[1]

1-Ph.D. Scholar, DCB, Division, ICAR-NDRI Karnal-132001
2- Veterinary Officer, Department of Animal Husbandry, (U.P.)
**Corresponding author: - alokvet1000 @gmail.com*

Meat is an important perishable food commodity as all the nutrients required for the growth of bacteria, yeast and mold (especially water, proteins and minerals) are abundantly available in fresh meat. Several techniques have been adopted for the preservation of the meat by controlling microbial contamination and autolytic changes caused by enzymes action at cellular level. Various techniques for preservation of meat include.

I. DRYING

The oldest method of meat preservation. Drying reduces the water activity thereby-

i. Enzymatic processes within the cell become slow which retard autolytic changes.
ii. Reduced moisture in the meat is unfavorable for bacterial growth.

Drying may be achieved by-

a. Sun drying: Most common and cheap method.

Disadvantages:

- Development of rancidity due to oxidation of fat.
- Meat is unhygienic.
- Sometimes meat becomes hard.
- Rehydration is poor.

b. Mechanical drying: in this method, drying of meat is done under hygienic condition in a controlled environment. It may be achieved either in vacuum or adiabetic dryer.

c. Freeze drying

It is also known as lyophilization or cryophilization. It is a modern technique which effectively preserves both cooked and raw meat. First of all, meat is freezed, now water present in the form of ice crystal is sublimated from meat in vacuum chambers maintained at a pressure of 1-1.5mm Hg. Moisture content of freeze dried product generally less than 2%. During freeze drying the structure of meat remain unchanged. After rehydration such meat regains its natural colour and flavour.

II. COLD PRESERVATION

Preservation by cold is usually carried out at two different temperature ranges.

1. Preservation by chilling/ refrigeration

In strict sense temperature ranging between 5-15^{0}C is chilling temperature whereas temperature ranging between 0 - 4^0 C is refrigeration. However later is popularly known as chilling temperature. Preservation of meat by chilling can be achieved by two methods-

i. By Ice: Meat is kept in a mixture of ice and salt in insulated cabinets or vats.

Disadvantage

- Lowering of temperature is very low
- Surface of meat becomes moist and unattractive. Excessive salting may result in discoloration.
- Meat may absorb moisture from ice.

Generally this method of chilling is not recommended

ii. Mechanical chilling or refrigeration: It is rapid method of chilling. In this method, meat is kept in a chamber or chilling room and cold air (-3^{0}C) is constantly blown in the room on meat resulting in lowering of temperature. Relative humidity of chamber should be maintained at 88-92%. A shrinkage take place as compared to 8% in ice chilling.

2. Preservation by freezing

Excellent method for preservation of meat for longer duration. It results in very few undesirable changes in qualitative and organoleptic properties of meat as compared to other method of preservation. Most of the nutritive value of meat remains intact during frozen storage. Freezing is of two types

i. Slow freezing

Time required for freezing of meat is more which tales 3-72 hours depending on the size of carcass. This method of freezing is not preferred as it may lead to the development of certain undesirable changes on thawing.

ii. Quick freezing

A temperature of 20^{0}C may be achieved within 30 minutes. This is the excellent method for preservation of meat as it can preserve meat for longer duration with least undesirable effect.

Methods of freezing: Several methods are utilized for freezing meat in meat industry such as-

i. **Still air freezing**

In still air freezing, air is the heat transferring medium. Meat freezes very slowly. Same principle is also used in home freezer. Temperature in commercial still air freezing ranges from – 10°C to – 30°C.

ii. **Plate freezing**

In this method, heat transferring medium is metal rather than air. Products are placed directly in contact with metal freezer plate or shelves. Plate temperature ranges from – 10°C to – 30°C.

iii. **Blast freezing**

Most commonly used commercial method for freezing meat products. Cold air is blasted in the freezing room or cabinet with the help of fans to provide rapid air movement. Air velocity ranges from 30 to 1070 meters/minutes (mpm) and temperature ranges from – 10°C to – 40°C. However, air velocity of about 760 mpm and temperature of –30°C is most practical and economical in meat industry. Meat should be packaged properly before freezing otherwise dehydration and freezer burn may occur.

iv. **Liquid immersion and liquid sprays**:

Commercially used for poultry freezing. Products after placing in plastic bags are either immersed in freezing liquid or cold liquid is constantly sprayed on product surface. Liquids utilized for freezing include sodium chloride brine, glycerol and glycols.

v. **Cryogenic freezing**

It is a very low temperature freezing with condensed or liquid gases. It may be done either by direct immersion, liquid spray or

circulation of cryogenic agents vapours over products to be frozen. Most commonly used cryogenic agents include liquid nitrogen and carbon dioxide.

III. HEAT PROCESSING OR THERMAL PRESERVATION

Heat is used to kill spoilage and potentially toxic mirco-organisms in meat and meat products as well as to inactivate the endogenous enzymes. Two levels of heat processing are employed in meat preservation-

i. **Pasteurization**

Moderate heating, most common method for preparation of cooked meat products. Core temperature of the product reaches 58-75°C. Such products need refrigeration for storage.

ii. **Sterilization**

Extensive heating above 100°C. Used to prepare commercially sterile meat products. Sterility is achieved in large metal drums known as retorts. Sealed cans are placed in retorts, which are then closed, sealed and heated to reach an internal temperature of 121°C or more. such products can be stored at room temperature for one or more years.

IV. Irradiation preservation :

Radiation may be defined as emission and propagation of energy through space or material medium. For meat preservation electromagnetic radiations are utilized. Radiations having shorter wave length are more damaging to micro-organisms. Radiations utilized for food preservation include microwaves, ultraviolet rays, X rays and gamma rays.

Ionizing radiation: These radiations have a wave length of 2000 A° or less and frequently utilized for food preservation. These radiations have enough energy and ionize the molecules which come in their path without appreciably raising the temperature of food thus the process is called as **cold sterilization.**

Ultra violet rays: A powerful bactericidal agent, nonionizing, most effective wavelength is 2600 A°, have poor penetration power which limits its use in food preservation. It is utilized for the preservation of food surface only. On the surface of meat, it may catalyze oxidative changes leading to rancidity, discoloration and other undesirable reaction.

β rays: It is a stream of electrons emitted from radioactive substances. Poor penetration power of β rays limits its use in food.

γ rays: These rays are produced by the bombardment of heavy metal targets with high velocity electrons (cathode rays) within an evacuated tube. X rays have excellent penetration power.

Microwaves: These are electromagnetic waves having frequency between infra red and radio waves. Two frequencies of microwaves which have been frequently used in food preservation include 915 and 2450 megacycles. 915 megacycles means oscillation of molecules about 915 million times/second. Oscillation of molecules produces heat which causes destruction of microbes.

V. CHEMICAL PRESERVATION

Curing: Curing is the application of salt, nitrite or nitrate, seasonings and other additives to meat. Curing impat flavor and

colour to the meat as well as it inhibits the microorganisms.

Method of curing:

i. **Dry cure**: Curing ingredients are rubbed on meat surface.
ii. **Pickle cure**: Meat cuts are immersed in curing solution.
iii. **injecto cure**: Concentrated solution of curing ingredients is injected into meat either by artery or needles at multiple sites in intramuscular tissue.
iv. **Direct cure or addition**: Curing agents are added directly to finely ground meat as in sausage mixture.

In pickling 10% solution or curing ingredients is used whereas in injecto cure 25% solution of curing ingredients is used.

Composition of cure –

Salt - 501bs
Sugar - 51bs
Nitrate -21bs
Nitrite -11b

Salt: Most essential constituent of curing ingredients and has been utilized from ancient time in preservation. For preservative action it should be used at a concentration of 15% or above but in meat products it is usually used at 1-2% concentration to impart flavour. Salt exerts its preservative action by-

i. Dehydration and alteration of osmotic pressure which inhibit growth of spoilage bacteria.
ii. Slow down the action of proteolytic enzymes in meat.

Sugar: Sugar is used as a curing ingredient to improve flavour and to mask the harshening effect of salt. Sugar at much higher concentration can be utilized as a preservative by causing plasmolysis of microbes.

Nitrite and nitrate: These are used in curing as colour fixatives, to impart cured meat flavour and as a preservative. They have strong antibacterial activity especially against Clostridium botulinum. Hence this effect is also known as Antibotulinum effect. Nitrate reacts with secondary amines and yield Nitrosamine which is carcinogenic in nature hence in most meat processing units nitrate has been replaced by nitrite. Amount of nitrite permitted in finished meat products is 200 ppm but in bacon 120 ppm.

Smoking: It is a procedure in which meat products are exposed to smoke generated by slow burning of hard wood (sesame wood) or saw dust. Smoke contains a large number of compounds such as aldehyde (formaldehyde), phenols, ketones and organic acids which is responsible for bacteriostatic property of smoke. Phenol acts as a bacteriostatic whereas formaldehyde acts as main bactericidal compound. Nowadays liquid smoke is used as it does not contain carcinogenic polycyclic hydrocarbon compounds such as benzpyrene.

Acids: Certain acids have bacteriostatic effect. Acids which can be utilized in meat products as a preservative include lactic, acetic, citric, propionic, sorbic, benzoic etc. These acids also impart flavour to the meat products.

Antioxidants: These are used to prevent development of rancidity particularly in fatty foods. They also possess some antimicrobial activity eg. Butylated hydroxy anisole (BHA). Butylated hydroxy

toluene (BHT), t Butyl hydroxyl quinoline (TBHQ), Ascorbic acid, Tocopherol, Lecithin, Tartaric acid etc.

Antibiotics

Antibiotics are the excellent preservative for enhancing the shelf life of meat but their use has been discouraged as it may cause hypersensitivity, drug resistance etc. Antibiotics of particular importance in food preservation are nisin, natamycin, tetracycline, subtilin, tylosin etc.

Common Poisonings and Their Treatment: An Overview

*Alok Kumar Yadav[1], Jitendra Singh[2] and Rakesh Kumar[1]

[1]Ph.D. Scholar, DCB, Division, ICAR-NDRI Karnal-132001
[2]Veterinary Officer, Department of Animal Husbandry, (U.P.)
*Corresponding author: - alokvet1000 @gmail.com

Poisonings is usually accidental and very rarely malicious. Detailed enquiry and circumstantial considerations are important. Must rule out a specific infectious disease of per acute nature, electric shock and snake bite in case of history of sudden death. Some of the important considerations are as under:-

1. No. of animals show symptoms of varying intensity simultaneously if the toxicity is of food origin.
2. Enquire about history of recent spraying of some insecticide or pesticide, painting of sheds, access to industrial waste water etc. Consider the possibility of residual insecticide toxicity in fodders also.
3. Accidental over-dosing with some poisonous drug.
4. History of access to jowar or linseed field (HCN poisoning).
5. Use of rat poisons, skin application, skin application in case of pets.

GENERAL SYMPTOMS OF POISONING

1. Usually a febrile (exception is chlorinated hydrocarbons) Temp. is usually subnormal depending on the stage.
2. Pupilar responses either absent or weak. Pupils usually dilated. (Exception-organophosphorous poisoning).
3. Respiration and heart beats arrhythmic.
4. Convulsions, spasms, tremors, paddling, champing of jaw and such other uncontrolled movements. Rule out Rabies.
5. Bloating, frothing of mouth, regurgitation, diarrhoea.
6. Vomiting very common in dogs.
7. Depressed consciousness and coma.

GENERAL PRINCIPAL OF TREATMENT

1. Stop further ingestion/absorption of poison, in detected or suspected. Stop giving suspected feed.
2. Removal of residual poison from alimentary tract/skin (by giving emetics where indicated, gastric lavage, purgatives, washing of skin with plenty of water) For Dogs: 5 ml Hydrogen peroxide or one teaspoonful salt in little luke warm water given orally induces vomiting. Inj. Apomorphine 20 microgram/1b iv. Preserve vomitus for detection of poison).
3. Neutralization of residual poison.

Oxidizing Agents-Tannic acid which precipitates alkaloids.

Milk Eggs- In irritant and corrosive poisons.

Chemical Antidotes-which render poison insoluble or harmless.

Calcium-In most poisonings as universal antidote.

Activated Charcoal-Adsorbs the poison in stomach. (5 teaspoonful in 100 ml water as slurry given by stomach tube followed by 20g Sod. Sulph after one hour. In ruminants emetics are of no use and hence activated charcoal @ 1-3 g/kg body wt. (300-500 g as average dose) should be administered and repeated if necessary. It absorbs hydrocarbons, organ phosphorous, compound, mycotoxins, plant alkaloids. This should be followed by a saline or oily purgative after about an hour.

4. Supportive Therapy-Fluids in dehydration, demulcents in gastroenteritis, sedatives in excitement, stimulants in CNS depression.

Steps for Confirmation of Poisons:

Conduct post mortem examination whenever possible and make a detailed note of gross abnormalities.

Collect-Stomach contents, (ruminal and abomasal contents separately in ruminants); Liver (about 500g). Kidney (one) and intestine (about 12'' long piece) ligate at both ends. Pack separately in sterile airtight containers. Send preferably on ice or use saturated salt solution as a preservative. In suspected HCN or Nitrate poisoning send about 500g rumen contents preserved with about 5 ml chloroform in airtight container. Send a piece of long bone in suspected arsenic poisoning. Also send blood and muscles on ice. One per cent solution of mercuric chloride is very ideal for preserving viscera in case of suspected HCN positioning. Also send feed and fodder sample. (Mention the preservative used in all cases.). Forensic labs accepts material only from medicolegal cases.

Common Poisoning and their Treatment

LEAD

Ruminants are commonly affected. Poisoning through licking oil paints, lubricants, ingestion of metallic lead (car-batteries, lead shots).

Clinical Symptoms

Staggering, spasms, bellowing, convulsions, pupils dilated, blindness, mania, hyperesthesia, initially ruminal atony and constipation, later diarrhoea and signs of acute colic.

Treatment

Mag. Sulph. Orally Calcium Versant (Ca EDTA) 70 mg/kg as 12.5% sol. I/V in two divided doses along with dextrose. For dogs: @ 25 mg /kg subcutaneously in repeated doses for 4 -5 days. Sedation with Largactil or Siquil to control hyperaesthesia and excitement.

ARSENIC

Poisoning through dipping and spraying of animals for ectoprasite-control, arsenic weed killer, insect-killers, over dose of arsenical drugs etc.

Clinical Symptoms

Severe gastro-enteritis manifested by acute abdominal colic, grinding of teeth. Vomiting even in cattle, foetid diarrhoea. In dogs vomitus has a garlic-like odour, Cynosis, week pulse, shock and collapse.

Treatment

Sodium Thisoluphate 15-30mg in 200 ml I/V followed by oral doses of 30-60 g BAL (2.3 dimercaptopropanol) 2-3 mg/kg I/M (BAL-Inj. 100 mg. available (Boots).

HYDROCYANIC ACID (HCN)

Common in ruminants due to ingestion of jowar (Sorghum) plants at certain stage. New sprouts which appear after untimely rains in recently harvested field of jowar are commonly a cause of poisoning when animals graze in such fields. Linseed and certain other cyanogenic plants (Hiwar pods) can also cause poisoning.

Clinical Symptoms

Always acute and death occurring within 1-2 hours. Severe dyspnoea, restlessness, bloat, convulsions and opisthotonous, pupils dilated, m.m bright red. Blood is bright red. Rumen contents have a bitter-almond smell. The rumen contents can be tested by an easy picrate paper test. Mix 0.5 gm picric acid and 5 gm Sod carbonate in 100ml water. Filter paper strips are dipped in this soln. and air dried in dark place. A drop of rumen fluid is placed on this test paper. A red discoloration is a positive test for free HCN acid.

Treatment

Sod. Nitrite 3g
Sod. Thiosulphate. 5g
Dist. Water 200ml

Inject by I/V route. Repeat after one hour if necessary. Feed Sod. Thisulphate 30-60 gm. orally at hourly interval 4-5 times. Inj. Calcium borogluconate, dextrose saline and antihistaminic as intensive supportive therapy

NITRATE AND NITRITE

Plants grown on soils heavily fertilized with nitrates. Accidentals ingestion of Amm. Nitrate and used as fertilizer, water from deep wells etc. are the causes.

Clinical Symptoms

Salivation, abdominal pain and anoxia, muscle tremors, staging, subnormal temperature. Acute gastroenteritis on p.m. Blood dark red or coffee brown coloured.

STRYCHNINE

Once upon a time Strychnine was the most commonly used poison for killing stray dogs by municipal authorities. Dogs are highly susceptible for strychnine. Poisoning not common in farm animals.

Accidental poisoning is possible in dogs

Clinical Symptoms

Dyspnoea, cyanosis, severe tonic and spasms with opisthotonus, death due to respiratory paralysis.

Treatment

Evacuation of stomach contents by giving emetics (Apomorphine 20 microgram iv). Anaesthetize the patient by pentobarbital or I/V Intraval sodium (Rhone P.) 0.5 g in 20 mil. Distilled water @ 30 mg/kg bwt Gstric lavage after anaesthetization. (Do not use caffeine, opiate and synthetic narotics.)

ZINC PHOSPHIDE

It is a common rat poison and common accidental poison to dogs.

Clinical Symptoms

Vomiting and diarrhoea. Acute dyspnoea, pulmonary oeadema, tonic convulsions.

Treatment

Gastric lavage with potassium permanganate solution 1:2000, Oxygen, dextrose I/V unless pulmonary oedema has developed. Caffeine sod. Benzoate 0.05 g I/M.

CHLORINATED HYDROCARBONS

(D.D.T. Gammexane (BHC), Aldrein, Endrine)

Commonly used insecticides and pesticides in agricultural operations usually absorbed through skin and by ingestion of sprayed grass.

Clinical Symptoms

Initially stimulation of CNS, excitement, muscle tremors, tetany, grinding of teeth, dyspnoea, inco-ordination of movements and fever.

Treatment

Wash the skin thoroughly with soap water emetics and gastric lavage in dogs if possibly of ingestin. No specific antidote, sedation with Pentobarbital I/V calborol 200 ml of cattle. Calcium Sandoz 5-10 ml I/V for dogs. Nikethamide for supporting circulation reduce body temperature by cold water packs.

ORGANOPHOSPHORUS COMPUNDS

(Malathion, Sumithion, Neguvan)

Commonly used insecticides and pesticides. Also used for spraying over animal body in sheds for ectoparasitic control.

Clinical Symptoms

Salivation, dyspnoea, diarrhoea, muscle stiffness and staggering. Constriction of pupils, tremors of head, bloat, collapse and death. They inactivate enzyme cholinesterase and cause increase in acetylcholine in the tissues.

Treatment

Atropine sulphate 0.25 mg/kg body wt for cattle and 1.0 mg/kg for sheep. (available as 0.6 mg ampoules and 10 mg. vial. Average total dose for cattle is 50 mg Half of should be given by slow I/V route and half by I/M route.) repeat at 4-5 hourly interval. Calborol 200 ml I/V.

For Dogs: 0.02 mg/lb (av. Dose 1ml). atropine sulphate given by I/V route and repeated by subcutaneous route if necessary. Calcium Sandoz 5-10 ml I/V Sedation with barbiturates if excessive excitement and convulsions. Dextrose saline I/V.

UREA

Urea is the most common fertilizer extensively used by farmers. Accidental ingestion by cattle due to carelessness is one possibility. Urea is also used as a cheap source of protein in the cattle feed. If urea is to be fed as a protein supplement, it must be given in very small amount commencing from 0.5% increased to maximum 2% gradually. Adequate proportion of carbohydrates like maize, molasses etc. must be available in the feed if urea is to be added. Sudden addition and overdose usually results in poisoning. 100 gm. Of urea can be poisonous for average size cattle if the animals are not accustomed.

Clinical Symptoms

Severe colicy pain. Incoordination, tremors, bloat, dyspnoea, violent struggling and bellowing. The animal may die within 3-4 hours. There is a strong smell of ammonia to the breath and death is due to respiratory arrest.

Treatment

Not likely to be successful. Oral administration of weak acids (5% acetic, acid, 3-4 lt) may be effective in very early stage. Evacuation of rumen contents by quick rumenotomy. Large volume of intravenous dextrose saline will help recovery.

FLUORINE

Is a chronic condition due to continuous consumption of fluorine through water or feed. Some area are found to have high fluorine content in soil and water (area around Ramtek in Nagpur district parts of Chandrapur, district for examples.) Some industrial waste waters containing residual fluorides can contaminate the grazing land the deep soil waters in the adjacent areas. Rock phosphors in minerals supplements contain high conc. of fluorine.

Fluorine is deposited in bones and teeth. It fixed the tissue calcium by forming calcium fluoride. The rumen microflora is disturbed and chronic indigestion results. Mottling and pigmentation of incisor teeth which show spots and horizontal bands; teeth become brittle, get eroded and are painful, animals become lame due to osteofluorosis, joints and bones are enlarged and painful, easily get fractured.

Diagnosis

By estimation of fluorine levels in blood and urine. Soil and water samples must be also be analyzed. There is considerable increase in serum alkaline phosphate.

Treatment

Is not practicable in case where large animal population in involved. Calcium injections to replace the precipitated calcium, glucose, injections and other supportive theraphy is the only possible treatment. Aluminum sulphate @ 30 g daily may be tied as it reduce toxic effects of fluorine. Additions of slaked lime to water @ 500-1000 mg/kg water allowed to settle for 6 days.

OXALATE

This poisoning has attracted attention recently. Oxalates in the form of potassium oxalate are present in some plants and grasses. Some fungi like *Aspergillus niger* (black fungus) are capable of producing oxalates and the stored fodders infected with fungus due to humidity, act as potential source of oxalates to animals. There is a fairly high level of tolerance in cattle but continuous feeding on fungus-infected fodder over a prolonged period can cause oxalate poisoning in cattle who are not a accustomed to consumption of oxalates in low doses.

Mode of Action: Oxalates themselves cause gastrointestinal irritation. In rumen the oxalates combine with calcium and form calcium oxalate which is insoluble and is immobilized in blood, the oxalates chelate the blood calcium and produce hypocalcaemia. The acute syndrome is therefore like severe, hypocalcaemia, continuous ingestion of soluble oxalates cause renal damage due to oxalate crystals in the renal tubules, and injure blood vessels (causing edematous swellings at perineal region).

Symptoms

Acute poisoning-Muscular tremors, staggering, recumbency and coma.

Subacute Poisoning

Muscular weakness, ruminal atony, bloat, incoordination of gait, hematuria, oedematous swelling on perineum and around the genitals.

Confirmation

Suspected fodder or grasses should be analyzed for oxalate contents.

Treatment- Inj. Calcium borogluconate 25% sol I/V in the dose of 200-300 ml.

Or inj. Calcium levulinate (Rikckelvit-J.P.) 30ml./ I/M.

Feeding lime water along with feed, dextrose soln. for energy. The fungus infested fodder should be sun-dried and treated with lime water before feeding.

AFLATOXICOSIS

Is a type of fungal toxicosis due to some strain of Aspergillus flavus which produce a potent hepatotoxin (Aflatoxin-B). the fungus grows on grains, groundnut, maize, jowar, grains become mouldy due to humid conditions of storage. Acute poisoning may cause death in young calves. The symptoms appear slowly if the toxic feed is consumed in small quantities over along period. Affected animals suffer a chronic indigestion, nervous signs like inco-ordination, blindness, grinding of teeth and diarrhoea. Milk production is decreased and causes considerable economic losses. Aflatoxicosis may occur in other animals like poultry and rabbits.

Diagnosis

By analysis of suspected feed for presence of aflatoxin-B1 (levels above 100 mg/kg. feed are considered poisonous for cattle.)

Treatment

Not specific. Evacaution of rumen in case of obstinate rumen indigestion, intravenous dextrose, calcium and liver tonics may help in some cases. Careful and vigilant observation of feed ingredients and proper storage can prevent the conditions.

SNAKE BITE

Clinical Symptoms

Depend on the type and species of snake. Look for the bite marks on lower extremities, head and muzzle. Local swelling and pain, excitement, salivation, hyperaesthesia, tetany, recumbency and paralysis. Death due to asphyxia in 1-10 hrs in dogs upto 48 hours in cattle and horses.

Treatment

Tourniquet above the bite, give a deep incision at the site of bite to drain blood for some time. Polyvalent antiserum available at Haffkin Institute (Freeze dried) give 2 ampoules I/V as initial dose and repeat till clinical recovery. *Polyvalent serum should always be stocked in dispensary*.

Broiler Goat Farming For Marginal Farmers

[1]Pankaj Kumar Singh, [2]Nishant Verma, [2]Rakesh Kumar, [1]Vipin Kr Upadhyay and [3]Subhash Chandra

[1]Ph.D. Scholar, LPM, ICAR-NDRI Karnal, Haryana
[2]Ph.D. Scholar DCB, ICAR-NRDI Karnal, Haryana
[3]M.V.Sc. Scholar, LPM, ICAR-NDRI, Karnal, Haryana

Goat is a multifunctional animal and plays a significant role in the economy and nutrition of landless, small and marginal farmers in the country. Goat rearing is an enterprise which has been practiced by a large section of population in rural areas. Goats can efficiently survive on available shrubs and trees in adverse harsh environment in low fertility lands where no other crop can be grown. In pastoral and agricultural subsistence societies in India, goats are kept as a source of additional income and as an insurance against disaster. Goats are also used in ceremonial feastings and for the payment of social dues. Around 80% of global goat population is in developing countries. Among them India contains second largest population of Goat. From this, we can understand the importance of goat farming in India. In a country, where human population is very high and land available for farming very less, Goat farming is the suitable option for small scale farmers. Goat farming is one of the main source of revenue for thousands of small scale farmers in India. There are some specific advantages of goat farming which makes it economically important for small scale farmers.

MAIN ATTRACTIONS OF GOAT FARMING

- High fertility rate: They give birth every 6 months
- Wide adaptability
- High feed conversion efficiency
- Require low investment and Management skills
- Land requirements are less.
- Disease resistance high.
- Wide and sustainable market.
- Well established local market
- Low risk involved.

ECONOMIC IMPORTANCE OF GOAT FARMING

- It possesses major role in employment generation in India.
- Majority of farmers in rural area associated with Goat farming.
- Goat farming helps farmers in rural area to recover from losses occur from crop failure.
- Goat milk is a suitable alternative for cow milk.
- Goat Meat plays major role in Indian Meat Industry.
- Other supporting Industries like skin, ornamental usage etc are well developed in India.

Broiler goat production is highly suitable technology in areas where green fodder is not available or due to lack of grazing land. It is one of the techniques to improve the economy of rural farming community. Broiler goat rearing has been

found to be highly remunerative compare to rearing other farm animals and it has been advocated as a better substitute of livelihood for the rural farmer. Broiler goat has been evolved to enhance goat meat production in areas were land availability is scarce and fodder become dear. The browsing character of goats destroys the crops. Eventually goat rearing became very problematic. At this situation the new technology to grow goats in goat houses abandoning grazing, feeding high tech feed by reducing FCR to 2.5 and total removal of fodder fibre from the became a new innovation in animal industry.

WHAT ARE BROILER GOAT KIDS?

As far as broiler goat raring is concerned, we don't have any specific breed for this purpose. The kids produced from goats (whatever breed available in your area) can be used for broiler goat rearing (both male as well as female kids).

SELECTION OF KIDS

The goat kids about 15 days to 1 month old *i.e* before starting to eat green leaves and are having higher birth weight and not used for further breeding can be selected for broiler goat rearing. The selected kids will not be allowed to feed on green fodder/grazing green grasses in open spaces.

FEEDING

The selected kids are reared intensively by providing concentrate feed (goat feed) @ 5 g mixed with equal quantity of rice gruel (broken boiled rice) initially i.e. at start (15-30 days). Then gradually increase the amount day by day as per feed intake (eg. 7g, 10 g, 15 g like that). Apart from these you can add, coconut cake, rice bran or ground cake with minimum level (1-2 g/day/kid to maximum of 150-200/day) pure water also should be available at all times (24 hours). Liver tonic (Tefroli/Livol etc.) and Fish oil should be given twice in a week @ 2.5 ml/animal per day initially and increase upto 5-10ml/kid/day. The young kids should be allowed for mother's milk twice or thrice in a day.

It was a common knowledge that ruminant animals could not survive without consuming forages and fibre. Goats a small ruminant also could not be exempted. Why the ruminants eat forage was a technical question that resulted in the development of broiler goat. It is a fact that economics of feeding was the vital factor for feeding forage to ruminant animals. The unique capability of those animals to convert non edible fibre by virtue of rumen fermentation to digestible nutrients like

microbial biomass and volatile fatty acids was the bottom line. When land availability became zero for such forage cultivation the technologists were encouraged to delve into the feed technology.

Table 1. Kid starter grain mix

Ingredients	Percentage
Cracked corn	29.00
Crushed oats	29.00
Wheat bran	29.00
Soybean meal	11.50
Trace mineral salt	0.50
Dicalcium phosphate	0.50
Vitamins ADE	0.50
Protein	15-16
Fibre minimum	10.00

The advent of bypass nutrient technology paved the way to evolve new feeding system. It was proved that the dietary nutrients saved from rumen fermentation will reduce the nutrient losses in animal system. If dietary protein is fermented in rumen the availability of protein through microbial route at the lower tract would be less than 20%. However, if it could be bypassed it may yield around 60%. It is true for glucose and fatty acids. The above parameter was considered FCR and through practical trials it was found that broiler goat can achieve FCR 2.5 against 8 noticed in ruminant animals.

BROILER GOAT FEED

Based on the new technology the special feed- a complement feed was developed. The feed production is done in modern feed plants. Pelletisation is an important process in production. The raw ingredients are selected to meet the nutritional specification of broiler goat feed such as amino acids, glucose and fatty acids. Furthermore the balancing of macronutrients with micronutrients is necessary to accomplish better and faster growth rate.

Table 2. Grower ration

Ingredients	Percentage
Corn	50.00
Alfalfa meal	15.00
Oats	17.00
Soybean meal	12.00
Molasses	3.00
Trace mineral salt	1.00
Dicalcium phosphate	0.50
Vitamins ADE	1.00
Limestone	0.50
Protein	15-16

Along with the special goat feed sweet lick blocks and sugar syrup supplements are also evolved. The small farmers who are interested to try the new practice the availability of right feed is a problem.

HOUSING

Low cost housing should be constructed in such a way in a raised platform (about 1 meter height from ground level) by using bamboo/wooden poles or 'pakka' building by establishing concrete pillars. Floor and side walls may be made of wooden material. Roof may be thatched with coconut leaves, grass or asbestos sheets. . Average floor space per kid is 0.75 to 1 sq. metre. Floor should have atleast 1 cm space between bamboos/wooden planks to allow

passage of dung and urine down to the ground.

NEED FOR THE FUTURE

Every animal husbandry practices is developed by the advanced countries. Broiler chicken has become widely adopted is an example. However broiler goat is not an interested proposition for advanced countries where there is no land shortages. Moreover goat meat is not their choice of food. But developing the broiler goat would benefit Asian, African countries very much. The population there also relish chevon (goat meat). But no development agencies like FAO or worldbank look into such projects in the third world.

Multi-Dimensional Uses of Guttiferae Members

V. B. Shinde[1] and M. G. Bhoyar[2]

[1]*Ph.D. Horti. (Fruit Science) Scholar, Dept. of Horti.,COA, JAU, Junagadh-362001 (GJ).*
[2]*Ph.D. Fruit Science Scholar, Dept. of Fruit Science, Dr.YSPUHF, Solan-173230 (HP).*
vinayakshinde73@gmail.com

The trees or shrubs of members of Guttiferae (Clusiaceae) family are usually with milky or coloured sap, comprising about 37 genera and 1610 species. The leaves are simple and are opposite, whorled, or rarely alternate. Stipules are absent. The flowers are actinomorphic and are functionally unisexual. The fruit is usually a capsule or berry. They are found throughout the tropics, but especially in the Paleotropics. The best known of these species is a tropical fruit is Mangosteen (*Garcinia mangostana*). Some of the major species of this category includes, Asam Gelugur (*Garcinia atroviridis*), Malbar Tamarind (*Garcinia cambogia*), Bitter Kola (*Garcinia cowa*), Mundu (*Garcinia dulsis*), Mundar (*Garcinia forbesii*), Bacupari *(Garcinia gardneriana*), Hatrack Fruit (*Garcinia humilis*), Kokum Butter Tree (*Garcinia indica*), Lemon Drop Mangosteen (*Garcinia intermedia*), Imbe *(Garcinia livingstonei)*, Gamboge *(Garcinia morella*), Bar Thekera (*Garcinia pedunculata*), Cherapu (*Garcinia prainiana*) and Mammee apple (*Mammea americana*).

Asam Gelugur (*Garcinia atroviridis*): Also known as, asam gelugo or asam keping in Malay, is a large rainforest tree native to peninsular Malaysia. The Asam geluger tree grows to a height of more than 20 m and has a long trunk, smooth grey bark and drooping branches. The leaves are dark green, shiny, long and narrow with a pointed tip and upturned edges. The flowers are dark red. The round fruits are borne singly on twig ends about 7–10 cm in diameter. The ripe fruits are bright orange yellow, which are sliced, dried and used in curries or stewed in plenty of sugar to be eaten. The fruit contains citric acid, tartaric acid, malic acid and ascorbic acid, hydroxycitric acid, andflavonoids. Sun-dried slices of the fruits, are commercially available and are popularly used as a vegetable salad and is considered extremely sour. The fruit is sliced, dried then stewed and used as a common ingredient in Asian dishes such as curries and soups.

Malbar Tamarind (*Garcinia cambogia*): A tropical fruit also known as the 'gummi-gutta', is a popular weight-loss supplement. People say it blocks your body's ability to make fat and it puts the brakes on your appetite. It could help keep blood sugar and cholesterol levels in check, too.

Bitter Kola (*Garcinia cowa*): Is a tree that grows in the rain forests of West Africa. In India it is kown as 'Cowphal'. The fruit, seeds, nuts and bark of the plant have been used for centuries in folk

medicine to treat ailments from coughs to fever. Garcinia cowa has been used for centuries to treat chest colds in traditional medicine. It also benefits lung properties, which attributed to its high antioxidant content.

Mundu (*Garcinia dulsis*): Is a small evergreen tree, native of the area from India to Malaysia; also known as 'Rata'. It has widely spreading branches, even sometimes drooping; milky latex is exuded from the broken parts. The fruit is edible, but sour and make a good jam. The pounded seeds are applied to cure swellings. The bark can be used to dye mats.

Mundar (*Garcinia forbesii*): Mundar is native to Malaysia. It is strictly a tropical species, adapted to a hot, wet and humid climate; also known as 'Kandis'. It occurs as an evergreen tree, which tolerates heavy shade and thrives in well drained organic matter rich soils. A white, good-flavoured, acid-sweet, melting flesh is edible. The rind is dried and used as acidic flavouring for various cuisines. It is recognized as a rich source of xanthone and xanthonoid natural products with high pharmaceutical potential. The compounds pyranojacareubin and 1,3,7-trihydroxy-2-(3-methylbut-2-enyl)-xanthone were isolated from the branches of G. forbesii. A caged natural product forbesione, a modified xanthone was also found to be isolated from various parts of the tree.

Bacupari (*Garcinia gardneriana*): Is an evergreen, dioecious species of the genus *Garcinia*. It is distributed throughout South America's Amazon Basin and produces fruit with edible arils. In Brazil there is currently research to use this fruit as a source to combat cancer.

Hatrack Fruit (*Garcinia humilis*): It is a small, prolifically-fruiting tree related to the mangosteen; also known as 'Achacha'. It is grown traditionally in Bolivia, but recently has been planted on a commercial scale in Burdekin and Australia. Rich in vitamin C, Riboflavin, potassium, and also folate - achachas make a useful dietary aid to pregnant women, particularly as they are also lighter in sugar than many other fruits. Not only the flesh, but the skin is also packed with useful nutrients.

Kokum Butter Tree (*Garcinia indica*): Kokum butter tree is native to evergreen forests of Western ghats region of India. The sugary pulp known as 'amrit kokum' extracted from the rind to make sherbet. The dried product 'amsul' is used as a condiment for curries. Though the seeds contain 23-26% of fat, it can be used as a substitute for cocoa butter and to flavor curries. The leaves are used as a remedy for dysentery. A free radical scavenger, garcinol found to be extracted from the rind.

Lemon Drop Mangosteen (*Garcinia intermedia*): Lemon drop mangosteen is a tree species of tropical America, produces tasty fruit. It is primarily consumed fresh, but can also be used to make juices, jams and jellies. The wood is resistant to termites, and is used to make posts and tool handles. The tree is an attractive ornamental, especially when in fruit.

Imbe (*Garcinia livingstonei*): It is an evergreen small tree, growing in Tropical Africa to 6-18 m tall. The leaves are borne in opposite pairs or

whorls of 3-4, each leaf blue-green, oval, 6-11 cm long and 3-5.5 cm broad. The flowers are produced in clusters on the stems. The fruit is a small, bright, orange, thin-skinned berry 1-4 cm diameter, with one single large seed; the small yield of edible fruit is pleasantly sweet, yet acidic, but also containing a latex that some people find unpleasant. It is mainly grown as an ornamental fruit, but is sometimes eaten. The juice is known for staining very badly. Mostly eaten fresh, it is also used in drinks. It can be grown in southern Florida, also known as 'African Mangosteen'.

Mangosteen (*Garcinia mangostana*): Handsome tropical tree of guttiferae family, native to Southeast Asia is highly valued for its juicy, delicate texture and slightly astringent flavor. The fruit ripens on the tree and have shorter shelf life. Mangosteen usually produce good crop only in alternate years, but found to possesses antioxidant, anti-inflammatory, anticancer and antihistamine properties.

Gamboge (*Garcinia morella*): Gamboge is found in India, Sri Lanka and southern Philippines. Trees are up to 12 m tall. Bark is smooth, and dark brown in color; blaze white. Flowers show inflorescence and are dioecious; male flowers in fascicles, axillary; female flowers larger than male, solitary, axillary. Ripe fruits can be eaten but they are very acidic. The fruit can be preserved by slicing into thin pieces and then drying under sun. It can be made into pickles. Bodos cook the unripe fruit as vegetable with fish. A chutney can be made by boiling the fruit. In Assam, dried and preserved slices are added to black green pulses to make a popular slightly acidic curry. Dried up fruit slices are valued as a traditional remedy for dysentery.

Bar Thekera (*Garcinia pedunculata*): Is an evergreen tree, endemic to the south-eastern regions of Asia such as parts of Myanmar and north-eastern parts of India. The tree has a fluted trunk with short spreading branches. The roundish fruit with a diameter ranging between 8 to 12 cm. It has a juicy interior with edible arils. The ripe fruit is eaten cooked or raw. Usually the ripe or raw fruits are sliced, sun-dried and preserved. In the state of Assam, such slices are much valued and used for preparing delicacies like 'tenga diya masor jol' meaning Assamese sour fish curry. It can also be prepared with other vegetables, especially fritters made with lentils.

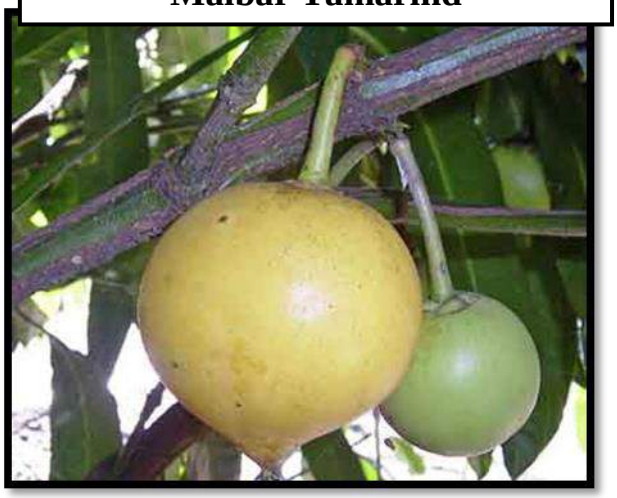
Cherapu (*Garcinia prainiana*): Also known as the 'button mangosteen'. It has a flavor similar to, but distinct from, its cousin, the purple mangosteen, with an interesting taste some have compared to a tangerine, but unlike its cousin, it has a tissue-thin skin rather than a hard rind, making it much easier to eat out-of-hand. Also unlike the purple mangosteen, it can be grown in a container.

Mammee Apple (*Mammea americana*): Is a large, primarily West Indian tree of the guttiferae family. The bitter rind encloses a sweet, aromatic flesh, which is eaten raw and also used for preserves. The rough seeds possessing bitterness and resinous, so that they can also be used as an anti-worming agent. An aromatic liqueur found to be distilled from its flowers. The acrid, resinous gum has been used traditionally for destroying skin-infesting chigoe fleas.

Asam Gelugur

Malbar Tamarind

Bitter Kola



Mundu

Mundar

Bacupari

Hatrack Fruit

Kokum Butter Tree

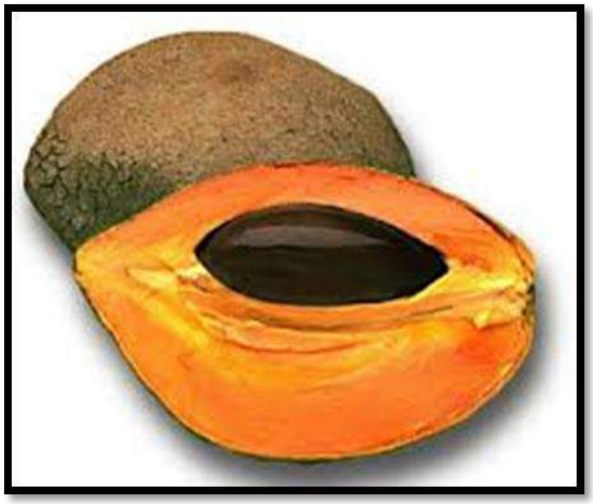
Lemon Drop Mangosteen

Imbe

Mangosteen

Bar Thekera

Cherapu



Mammee Apple

Gamboge

Drip Irrigation For High Density Orchards And Its Economics

S.S. Wandre[1] and V.B. Shinde[2]

[1] Ph.D. Scholar, Dept. of Soil & Water Conservation, CEAT;
[2] Ph.D. Horti. (Fruit Science) Scholar, Dept. of Horticulture, COA;
Junagadh Agricultural University, Junagadh-362001 (Gujarat).
sarikawandre@gmail.com

Establishing Drip Irrigation

Drip irrigation is the slow localized application of water drop by drop, at a point or grid of points on or just below the soil surface. Water is delivered to the plants via a set of plastic lateral tubes laid along the ground or buried just beneath it for protection. The lateral lines are connected to a buried main line that receives water from a head source. The trickling rate, generally in the range of 4-8 liters/hour per emitter, must not exceed the soils in filterability if run off is to be avoided.

Irrigation improves plant establishment, nutrient use, bearing area and plant health. It also improves fruit size and quality.

Drip irrigation is based on the concept of preventing rather relieving moisture stress. The crop response to this approach is positive. Some advantages of drip irrigation include:

- Easily automated,
- Water can be applied on windy days or during spraying operations,
- Foliage is not wetted- reduces disease problems and does not remove crop protection materials from leaf canopy or maturing fruit,
- Water does not come into contact with the produce and therefore the food safety risk associated with lower quality water is reduced,
- Well suited for fertigation (uniform water distribution).

HOW IT WORKS

A drip irrigation system supplies a small amount of water (0.5 – 2 US gal/hr [28 L/hr]) near the base of each tree. (Figure:1) The system components can be downsized because water is delivered on a more continuous basis (usually on a daily basis when needed) and only the rooting areas are watered (not between the rows). As compared to an overhead irrigation system, the pumps are smaller, less power is required, less energy is used and the water conveyance lines are smaller.

In a high density orchard one to two lines of drip hose (Figure 2) will supply each row of trees. The emitters (equivalent to sprinklers in other systems) may be evenly spaced along the lines or clustered near each tree. Drip systems require filtration

units to provide clean water and avoid emitter plugging (Figure 4). Systems also require pressure regulators at the head of each submain or other appropriate location.

A drip irrigation system supplies a small amount of near the base of each tree

Compared to an overhead irrigation system, the water conveyance lines are smaller.

Design

A high level of design is imperative for this system to operate properly, especially on rolling terrain. Seek a professional drip irrigation designer.

Choose high quality drip hose (not thin walled tape) with a minimum expected performance of 15 years. Choose a product where the manufacturer's coefficient of variation (CV) for the emitter type is less than 0.07. A CV of less than 0.03 is excellent. Choose an emitter with a low x exponent of 0 to 0.5 (x=0 is a fully pressure compensating emitter). The cost of pressure compensating emitters (lowest x exponent) is higher than non-pressure compensating. A system using emitters with higher x exponent (such as 0.5) may be satisfactorily offset by a skilled system designer.

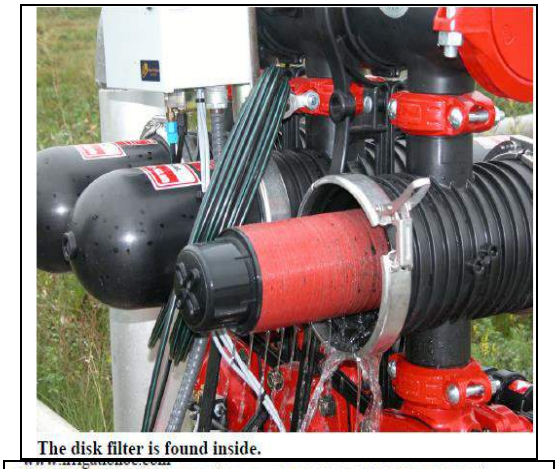
Filters

There are three main types of filters: screen, disk (Figure 3) and sand. The choice of filter type should be made in consultation with the irrigation designer and is based on the irrigation water quality and the emitter orifice size. Filters must be back flushed to keep them clean and operating properly – this is preferably automated and based on both a schedule and a pressure differential trigger. Filters are classed by the size of the openings of their mesh, which is called "mesh equivalent". A minimum of 80 mesh screen must be used for any drip irrigation system.(Figure:4).

Maintenance

Flush lateral lines at the beginning and end of the irrigation season. Begin by flushing one lateral to observe the amount of debris that has accumulated. If the water runs dirty for 5 seconds or more, all the laterals should be flushed. Emitter plugging can be

monitored by measuring the flow rate for each zone.



The disk filter is found inside.

A minimum of 80 mesh screen must be used for any drip irrigation system.

If the flow rate begins to decrease over the season, the emitters may be starting to plug. Inspect emitters and make a note if the clogging is caused by a buildup of organic material or chemical precipitate. Begin at the end of the lines as these emitters are generally the first to experience plugging. Also check that the filtration system is operating correctly as this may be the reason for the reduced flow rate.

Scheduling

A crop's water requirement can be expressed as evapotranspiration (ET). This is the amount of water transpired by the plant and evaporated from the soil surface. ET may be expressed as mm of water used per day and is affected by temperature, light intensity, wind, humidity, crop cover and crop growth stage. For optimum crop production, the water use (ET) must be replenished by irrigation or rainfall. With a drip irrigation system, irrigation (water use replenishment) should be done daily, on alternating days or every third day (as needed). An irrigation schedule (the daily amount of water to apply) may be developed by tracking water entering and leaving the root zone – this is called a water budget. By measuring or calculating the ET and measuring the rainfall the water deficit (or irrigation demand) can be determined. Soil moisture levels can be monitored and used as the primary method of scheduling irrigation or as a periodic verification of the water budgeting method.

ECONOMICS OF DRIP IRRIGATION

Land and water are the basic needs of agriculture and economic development of any country. Water is recognized as a vital resource for life forms on earth and human/societal development and human sustainability depends on this natural resource. Although the per capita availability of this resource in India is much less as compared to many other countries the demand is continuously on the rise. The availability of water for irrigation has always been a constraint in crop production in many regions of the world in general and India in particular. The vagaries of the monsoon render agriculture

an uncertainty. In vast country like India with geographical area of 328 million hectors, less than 53 per cent of the area cultivated. Out of cultivated area only 65 million hectares (37%) gets irrigation. Even after harnessing the entire potential of water resources, not more than 60 per cent of cultivated land is irrigated while ground water is declining very fast due to over-exploitation of water resources through increased bore wells and inefficient use of water due to adoption of age old practices in irrigation system. The selection of irrigation appropriate technology is of utmost importance for efficient utilization of scarce natural water

Drip irrigation, also known as trickle irrigation or micro irrigation is an irrigation method that applies water slowly to the roots of plants, by depositing the water either on the soil surface or directly to the root zone, through a network of valves, pipes, tubing, and emitters, with the goal of minimizing water and fertilizer usage. Drip irrigation has been used since ancient times when buried clay pots were filled with water and the water gradually seeped into the soil. Micro-irrigation is adopted only in about 6 lakh ha as compared to more than 30 lakh ha in the world though irrigated area in India is more than one third of total irrigated area in the world. The task force on micro-irrigation has identified the potential areas for drip irrigation in India as 10.5 million ha.

Drip irrigation in India is promoted under the Government sponsored schemeXSSMI (centrally sponsored scheme-micro irrigation)". Central government giving 40 per cent subsidy, 10 per cent subsidy is given by state government and remaining 50 per cent borne by the farmers. It has been assessed that there is the potential of bringing around 42 million ha under drip and sprinkler in the country (Raman 2010). The drip with a potential of around 12 million ha under cotton, sugar cane, fruits and vegetables, spices and condiments; and some pulse crops like red gram, etc. The percentage of actual area against the potential estimated under drip irrigation in different states varied between nil in Nagaland to as much as 49.74% in Andhra Pradesh followed by Maharashtra (43.22%) and Tamil Nadu with 24.14%. Compared to the potential of 42.23 million ha in the country, the present area under MI accounts for 3.87 million ha (1.42 million ha under drip). Unlike conventional method of irrigation, since water is supplied directly at the root zone of the crop using pipe network under drip method of irrigation, it increased the water used use efficiency up to 90 percent against the conventional method of irrigation. Besides saving water, it also increases productivity of crops, reduces cost of cultivation and energy (electricity) used to lift the water from well/tube well. The adoption of drip irrigation technology has increased the net sown area, net irrigated area and thereby has helped in achieving higher cropping intensity and irrigation intensity. Thus, our policy focus may be tilted towards the promotion of drip irrigation in those regions where scarcity of water and labour is alarming and where

shift towards wider spaced crops is taking place. Investment on drip irrigation was found to sound and economically viable. Therefore, cultivators are advised to make use of drip sets. The government should initiate promotion of better water management practices,

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Dry Cow Management

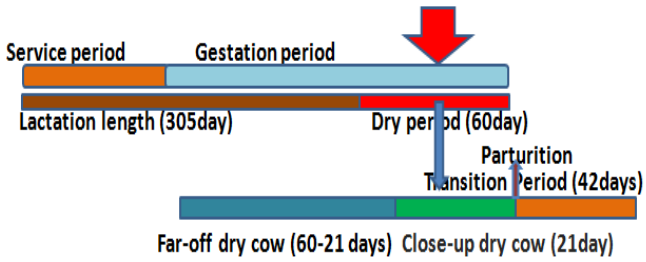
Subhash Chandra[1], P. S. Oberoi[1], Mukesh Bhakat, Pankaj Kumar Singh[1], Rakesh Kumar[2] and Narender kumar[1]

[1]LPM, ICAR-NDRI, Karanl, Haryana
[2]DCB, ICAR-NDRI, Karnal, Haryana
National Dairy Research Institute, Karnal Haryana-132001
**corresponding author- subhashchandra20july@gmail.com*

Dry cow management is critical for obtaining maximum dry matter intake, good health, increase reproductive efficiency and optimum milk production in the following lactation. These can be achieved by feeding balanced diets which will aid in avoiding metabolic disorders and maintaining improved disease resistance. Dry period is important for the rest and regeneration of tissues in the udder, when short or absent dry period reduces the number of secretary cell in the udder, and therefore, subsequent reduce the milk production. Dry cow is fed a high-fiber roughage diet, which helps restore the muscle tone of the rumen and allows time for any lesions in the liver to shrink.

DRY COW

A cow that is not lactating or secreting milk after it has completed a lactation period following calving.



Calving interval = Service period + Gestation period

Calving interval = Lactation length + Dry Period

Dry period = Far-off dry period + Close-up dry period

Transition period = Close- up dry period +21day after parturient

Why necessary for a cow to dry off:-

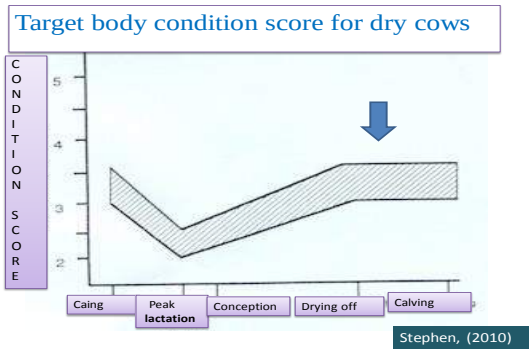
1. The mammary gland functions incessantly (without interruption) during the entire lactation period which results in wear and tear in the secretary cell of the udder.
2. Cow loose body condition during lactation.
3. Proper care, feeding and management of the dairy cow can help improve milk production and health of the dairy cow during the next lactation

Importance of the dry period;-

1. Prepare the mammary gland for the next lactation
2. Prepare the digestive tract for next lactation
3. To properly nourish the developing calf
4. To maintain optimum body condition

5. To minimize digestive, metabolic and infectious diseases

HOW TO DRY OFF



Abrupt cessation of milking:-

- Abrupt cessation of milking causes built up of pressure in the udder which no immediate permanent effect on the rate of secretion so drying off for few day
- Abrupt cessation method is the better one for low yielders, especially not for high yielders

Incomplete milking:-

- Emptying smaller and smaller quantities of milk from the udder spread over a week
- Incomplete milking is the best method of drying for high yielder cow otherwise may cause swelling and pen in the udder

Intermittent milking:-

- Milking once every second or third day
- This method is preferred for cows already having mastitis

A cow producing more than 40 pounds of milk daily dry- off by reducing feed intake by 50 to70 % will drastically reduce the supply of nutrient available to the udder causing milk synthesis to decrease and milking less frequently. Ideally, concentrate should be eliminated about 1-2 weeks before the dry off days. Separate dry cows from the milking herd, and allow them to get plenty of exercise.

DRY PERIOD LENGTH

The cow should be dry for 45-60 days. The date to begin the dry period is calculated back from the projected date of calving. Dry period length of cow is less than 40 day, the cow produce less milk in the next lactation compared to cow given a 45-60-days dry period. Dry period length of cow 70-days or longer dry period may have a slightly higher milk production, but it can not be economically justified. Dry period depends on the parity status: cow, 45-60 days and first calf heifer-60-70 days. If a cow is not dry off at all, the next lactation may be lower Production by as much as 25-30%.

BODY CONDITION SCORE

Body condition score is an indication of the amount of stored energy reserves held by the cow. It changes with stage of lactation. Body condition is a method of evaluating fatness or thinness in cows according to a five-point scale, a scale of 0 denotes a very thin cow while 5 denotes an excessively fat cow. Condition score 3, is the most desirable for the cow at drying off and calving.

Over conditioning or fatness, (BCS > 3.5), may cause the dry cow to have difficulty at calving, be more susceptible to metabolic disorders and infections. When milk production decreased and prolonged dry period. In contrast, under condition, or

thinness (BCS < 2.5), in the dry cow can frequently lower milk production; reduce the persistency of the cow's lactation. Thin cows often do not show heat or conceive until they start to regain or maintain bodyweight.

DRY PERIOD NUTRITION

Dry matter intake (DMI) tends to decrease during the latter part of the dry period due to increase in the calf size on reduction in rumen size. Due to this change in DMI, the diet nutrient density must be adjusted in the last 2 weeks to maintain nutrient intake. If this is not done, then actual quantities of nutrient intake will be decrease

Dry matter intake

Ingredient	**Far-off dry cow**	**Close-up dry cow**	**Milking cow**
Dry matter intake (%body weight)	**1.9-2.0**	1.6-1.8	2.5-4.0
NE(Mcal/lb DM)	0.57-0.62	0.63-0.72	0.75-0.78
Crude protein (%)	2	14-15	16-19

Source-: Pre-calving care equals post calving profitability (Amaral, 2007)

CONTROLLING ENERGY INTAKE DURING DRY PERIOD

Controlling energy intake during dry period might lead to better transition success (Dann *et al*., 2006; Douglas *et al*., 2006; Loor *et al.,* 2006). Controlling energy intake during the dry period is desirable (Holcomb *et al*., 2001; Agenas *et al*., 2003). Dry matter intakes remain more constant as cows approach calving when fed the high-straw, low energy diets than in cow fed high-energy close-up diets (Dann *et a*l., 2006; Janovick Guretzky *et al*., 2006). Common practices to feed ration of higher energy and nutrient density during the close-up period. This approach was designed in an effort to adopt the rumen microbial population and rumen papillae to higher nutrient diets fed after calving

A survey data collection in 277 herds (over 27000 Cow) in the United Kingdom, Ireland France and Sweden, changing to the high-straw, low energy TMR system decreased (Beever D.E, Richard Keenan and Co., Borris).

Complication	**Decreased by**
Assisted calving	53
Milk fever	76
Retained placenta	57
Displaced abomasums	85
Ketosis	75

PROTEIN REQUIREMENTS DURING DRY PERIOD

The protein requirement of the developing calf increases in the last 60 days of gestation. The optimum CP requirement for early dry period should be 12-13 CP%. Protein excess must be avoided which is associated with downer cow syndrome (Rick, 2008). Incidence of metabolic disorders in cows fed different level of CP during dry period.

Incidence	CP -8%	CP-15%
Number of cows	27	26
Downer cows	0	8
Abortions	0	3
Parturient paresis (milk fever)	2	4
Displaced Abomasum	0	3
Deaths	1	6

(Kjulien *et al*., 1997)

VACCINATION

Advantages of Vaccines at drying off:-

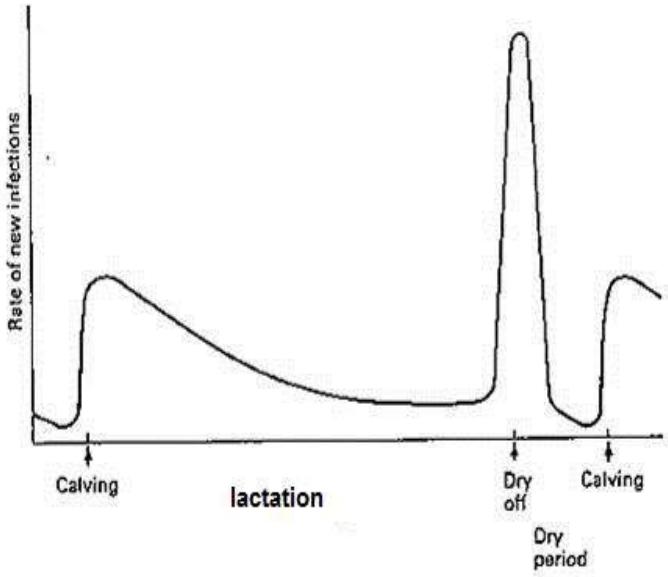
1. It should produce protective antibodies for calving time and early lactation.
2. Vaccination during the dry period results in protective antibodies in colostrum for passive protection of the calf.
3. Vaccine boosters for calf protection should be given three weeks prior to calving for maximum colostral antibodies.

DRY COW THERAPY

The risk of new intramammary infection is greatest during the early and latter portions of the dry period. The most effective time to treat udder infections is at drying off.

- The cure rate is higher than that achieved by treatment during lactation.
- A much higher dose of antibiotic can be used safely.
- Retention time of the antibiotic in the udder is longer.
- Tissue damaged by mastitis may be regenerated before freshening.

Timing of infection in udder



(Williamson et al., 1995)

CONCLUSION

Ensure sufficient body condition to provide reserve energy to meet requirements for milk production and reproduction in early lactation. Strengthen the cows' immune systems and body defences by ration balancing and supplementation of vitamins and minerals. Dry cow therapy is recommended for all cows that have had contagious mastitis and herds with high infection rate during lactation

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