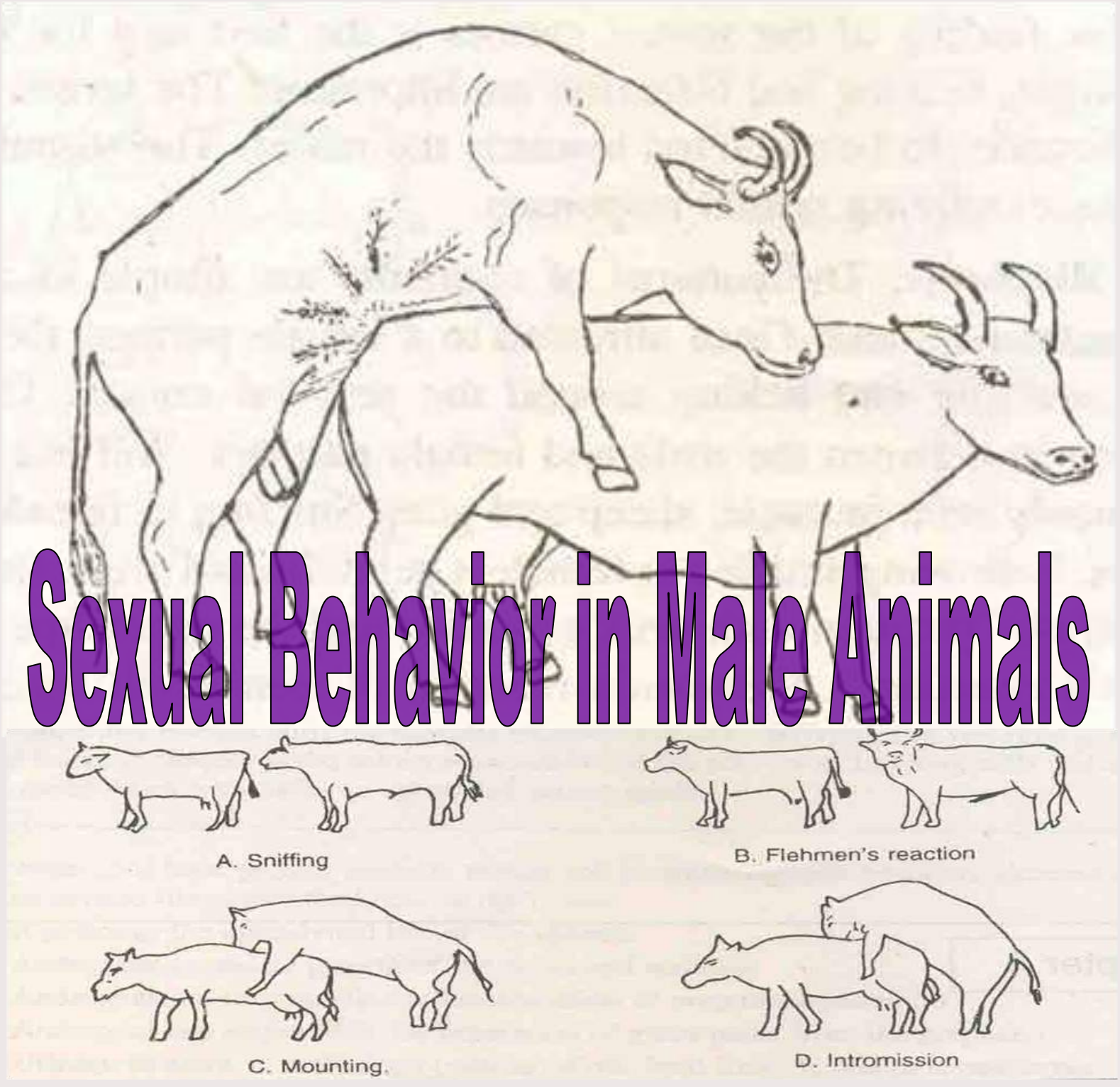
Indian Farmer

ISSN 2394-1227

A Monthly Magazine

Volume: 3 | Issue-5 | May- 2016 | Pages - 74



Sexual Behavior in Male Animals

www.indianfarmer.net

INDIAN FARMER

A Monthly Magazine

Volume: 3, Issue-5 May -2016

Newly Recognised Breeds in India

***Lalit[1], D.S. Dalal[3], S.P. Dahiya[3], Ankit Magotra[2], C.S. Patil[2] and Kapil Dev[1]**

[1]Ph.D. Scholar, LUVAS, Hisar, [2]Assistant Professor, [3] Professor, Department of Animal Genetics and Breeding LUVAS, Hisar
Corresponding Author: drlalit78@ gmail.com

India is having rich domestic animal biodiversity which has originated due to years of evolution within specific ecological environment. The domestic animals are supporting the country's economy by providing milk, meat, egg, draught power, fibre, manure, etc. as well as generating rural employment. Interaction of some of the conditions like human needs, environmental condition, species adaptability, selection and practices of animal husbandry give rise to the evolution of new breeds. National Bureau of Animal Genetic Resources (NBAGR) situated at karnal, Haryana is the nodal agency for the registration of newly identified breeds of the livestock and poultry of the country. National Bureau of Animal Genetic Resources has registered eleven new breeds of livestock species which include three breeds of cattle, three breeds of buffalo, two breeds each of goat and pig and one breed of donkey. These newly identified breeds are well adapted to the local climate. They have better survival in adverse environmental conditions and also in scarcity of feed and fodder. Our indigenous breeds have been found to have certain unique characteristics like indigenous cattle possess some specific milk protein type which is more beneficial for human health than milk from exotic and crossbred cattle. It is supposed that these new breeds may also have certain unique traits which more research efforts are required. A brief description of these new breeds of domestic livestock species along with their peculiar qualities is given here under for the welfare of the farmers.

NEW BUFFALO BREEDS

Kalahandi

Origin: Orissa

Characteristic features: Animals are medium sized; having long, strong, half circled horns with broad base and are excellent in heat and drought tolerance.

Use: Kalahandi buffaloes are dual type; used for milk and draught purpose in Kalahandi and Rayagada districts of Orissa.

Chilika

Origin: Orissa
Characteristics features: Only breed able to feed on vegetation in the lake, very low maintenance and require no additional feed or shelter, except that provided by trees at the lakeside, low mortality, milk production is 2kg/day.
Use: Milk is used for curd or yoghurt making because it can remain fresh for a week without refrigerartion (because of buffaloes' saline diet.

Bunni

Origin: Gujrat
Characteristics features: Breed is heavy size with typical coiling of the horns. The breed is very hardy, well adapted to harsh climatic conditions.
Use: These are trained to typical grazing on bunni grass land during night and come to the villages in the morning for giving milk.

NEW CATTLE BREEDS

Pulikulam

Origin: Tamilnadu
Characteristics features: Breed is more resistance to communicable and parasitic diseases as compared to crossbreds under hot and wet conditions. Cattle are maintained in large migratory herds in Madurai and nearby region of Tamilnadu.
Use: These cattle are used in games like bull riding (Jallikattu) in local area. Utility is draught and manure.

Kosali

Origin: Chhattisgarh
Characteristics features: Kosali is small sized, draft purpose cattle breed of Chhattisgarh. Animals are known for very efficient working ability and high disease resistance.
Use: Farmers prefer bullocks of this breed for cleaning of weeds from paddy field.

Malnad Gidda

Origin: Karnataka

Characteristics features: Malnad Gidda is a short statured cattle breed from Western Ghat of Karnataka. Animal have excellent endurance power and resistance to diseases.

Use: Breed is reared for milk and manure purpose.

NEW GOAT BREEDS

Konkal Kanyal

Origin: Maharashtra

Characteristics features: Animals have typical white bands on black face and black ear with white margin. Well adapted to high rainfall and hot and humid climate of Konkan region of Maharasthra.

Use:Konkal Kanyal goat is meat type breed.

Berari

Origin: Maharashtra

Characteristics features: As a unique feature, animals have light to dark strips on lateral sides from horn base to nostrils of face.

Use: Berari goat is reared mainly for meat purpose in Vidarbh region of Maharashtra.

NEW PIG BREEDS

Ghoongroo

Origin: West Bengal

Characteristics features: These pigs are black coloured and have upwardly curved snout and large heart shaped ears.

Use: Ghoongroo pig is reared for pork in Darjeeling and nearby Tarai area of West Bengal.

Niang Megha

Origin: Meghalaya

Characteristics features: The animals have typical wild look with erect bristles on dorsal midline and small erect ears extended vertically.

Use: Niang Megha pig breed from Garo, Khasi and Jaintia hills of Meghalaya is reared for pork and bristle purpose.

NEW DONKEY BREEDS

Spiti

Origin: Himachal Pardesh

Characteristics features: These animals can survive well in scarcity of feed and fodder during harsh winter months when the area is completely snow bound.

Use: The breed is utilized for transportation at high altitude area with low level of environmental oxygen found in Lahaul and Spiti region of Himachal Pradesh.

Important Use and Management of Poultry Farm Waste

Kuladip Prakash Shinde and *Shailesh Kumar Gupta

Divison of Livestock Production and Management
National Dairy Research Institute, Karnal, Haryana-132001.
**Corresponding author: sgshailesh786@gmail.com*

The scientific management of poultry waste is important for farm management and profit. The poultry sector experience is favourable to increase profit in poultry industry (Oyebanjo, 2011). Poultry manure is the organic waste material from poultry consisting of animal faeces and urine. The growth of poultry sector in relation to its high level of energy and protein, which are advantages of poultry over other livestock (Mokwunye, 2000). Poultry litter refers to the manure mixed with some of the bedding material or litter (wood shavings or sawdust). Poultry waste also includes feather and dead birds. The two types of waste are – Solid and liquid waste. The rate of litter production from a farm affected by type and amount of bedding materials, stocking density, number of flock reared, feed types, litter management strategy, and ventilation (Kelleher *et al*., 2002). The solid waste consists of bedding material, excreta (manure), feed, feathers, hatchery waste (empty shells, infertile eggs, dead embryos and late hatchlings), shells, sludge, abattoir waste like offal's, blood, feathers and condemned carcasses) The wastewater results from washing and disinfection of chicken houses and abattoir**.**

Importance of poultry Waste management

- To maintain acceptable environmental standards.
- If poultry wastes are not properly handled, they can pollute surface water and groundwater and cause air pollution.
- Coliform bacteria and nitrate nitrogen that can contaminate water supplies.
- Bacteria and other microorganisms in stored manure produce gases these gases include odourless methane and hydrogen sulphide.
- Pathogenic bacteria that can cause disease in humans and livestock.
- Phosphorus that can promote algae-growth, which can use up oxygen in streams and kill fish.

Composting and Vermiculture and biodegradable plastic practices

Composting is a natural aerobic biological process to break-down organic matter, which provides a practical and economically feasible method for stabilizing poultry manure and litter before land

application**.** Robinson. and Beauchamp (1982) reported that the approximate percentage of nutrient intake excreted by poultry are; Nitrogen (65.5%), Phosphorus (68.5%) and Potassium (83.5%). Correctly managed composting effectively binds nutrients such as nitrogen and phosphorus in organic forms. Poultry manure contains high phosphorus which has positive effect on the growth of crops (Mokwunye, 2000). Traditionally, the vermiculture process has primarily been adapted to produce vermicast, a recognized valuable organic fertiliser. However, the production and processing of earthworms into vermimeal has been becoming an increasingly viable component. Poultry feathers are also converted into biodegradable plastics by a process called polymerization. In this process, feathers which contain keratin protein are pulverized into fine dust. These thermoplastics can be popularized to manufacture all kinds of products, from plastic cups and plates to furniture**.**

Stacking and apply to fields

Proper stacking of poultry litter will minimize problems with nutrient loss and potential environmental contamination and will provide sufficient heating to reduce potential disease causing organism. Stacked litter can be further protected by covering it with plastic. A windbreak of some sort near the stack could help prevent damage to the plastic This reduces labor, expense and potential environmental problems. Grasses, pasture and hey crops are efficient users of nitrogen and respond well to applications of poultry litter.

Production of biofules, methane and electricity generation

The biogas can be used as an on-farm energy source for heat or as a fuel for various engines that generate electricity. Poultry manure and litter contain organic matter that can be converted into bioenergy under certain processing technologies. One of the most common approaches for poultry excrement managed by water is anaerobic digestion, which yields biogas, a gas mixture with varying concentrations of combustible methane. Gasification technology is a way of producing bio-energy this process involves incomplete combustion in a limited-oxygen environment. Anaerobic digestion could degrade and stabilize a wide range of organic poultry wastes including litter, producing potentially saleable methane and digestate.

Organic matter+H2O→CH4+CO2+New biomass+NH3+H2S+heat.

Methane could be captured after digestion, the gas then cleaned and then used as renewable energy, while the digestate could be utilized as a soil improving agent with potentially good fertiliser attributes.

The poultry litter energetic potential is high. Anaerobic digestion and biomethanation of poultry litter results in methane (biogas) production which are used to run turbine to generate Power.. The calorific value of the poultry litter depends on the humidity level, however, for air dried samples, this value is in the range of 9 to 13.5 MJ/Kg (about half the coal calorific value). Blood and bone meal produced methane rapidly. The methane production of offal need more time probably due to long-chain fatty acid inhibition. Poultry

offal, blood, and bone meal which is rich in proteins and lipids, showed high methane yields at different concentrations of volatile solids. combined thermal and enzymatic pre-treatments resulted in increased methane yield by 37 to 51%.

Treatment of heavy metal and contaminated water

Utilization of poultry litter as a precursor material to manufacture activated carbon for treating heavy metal, contaminated water . Poultry litter-based activated carbon possesses a significantly higher adsorption affinity and capacity for heavy metals than commercial activated carbons derived from bituminous coal and coconut shell and does not pose secondary water contamination risks.

Utilization of dead bird and poultry feather

Chicken feathers contain nutrients approximately 91% protein (keratin), 1% lipids, and 8% water. Serine (16%) is the most abundant amino acid in chicken feathers. Feathers are also converted to feather meal with usage as animal feed, organic fertilizers and feed supplements. For disposal of dead birds deep pit with inside framing and a tight-fitting cover can be constructed. Incineration is the probably the most biologically safe method of disposal. Composting of dead birds are environmentally safe disposal alternative. Preservation by freezing is one of the initial preservation methods tried to transport the contents to a rendering facility. Preservation by lactic acid fermentation - up to three months before rendering can also be used.

Rendering and animal refeeding

Rendering refers to different heating applications to remove fat from meat. Rendering at 133°C for a minimum of 20 min or an alternative heat treatment is required for high-risk materials used for animal feed. Rendering produces meat-bone-meal, which can be used in animal feed or fertilizer or further processed via anaerobic digestion or composting. The amino acid nitrogen of cage layer waste ranges from 37 to 40% of total nitrogen and that about 40 to 60% of total nitrogen in poultry excreta is present in the form of non-protein nitrogen (NPN). Litter may make up over 70% of the ration for pregnant beef cows. In finishing cattle the level may be only 20 to25%. In the feeding of lactating dairy cows up to 17% poultry excreta had no effect on dry matter intake, fat-corrected milk yield or milk fat.

REFERENCES

Kelleher, B.P., Leahy, J.J., Henihan, A.M., O'Dwyer, T.F., Sutton, D., Leahy, M.J. (2002) Advances in poultry litter disposal technology - a review. Bioresources Tech; 83:27-36.

Mokwunye, U., (2000) Meeting the phosphorus Needs of the soils and crops of West Africa: The Role of Indigenous Phosphate rocks Benin Republic, October 9-12.

Oyebanjo, O. and Abiodun O. O. (2011) Profit Efficiency and Waste Management in Poultry Farming: The Case of Egba Division, Ogun State, Nigeria. International Journal of Poultry Science 10 (2): 137-142.

Robinson, J. and E. Beauchamp (1982). The Resource conservation Ethic Applied to Manure Management. In: The Manure Management Handbook, Ontario soil and crop Improvement Association, Ontario Ministry of Agriculture and Food, Ontario Agricultural College, Canada, pp: B1-1 to B1-2.

Grazing and Pasture Management In Small Ruminants

Sasmita Panda*, Kuldeep Kumar Panigrahy, Satyaranjan Barik[1], Dayanidhi behera, Lakshman Kumar Babu, Arun Kumar Panda[2] and Kumaresh Behera

Department of Livestock Production and Management, OUAT
[1]M.V.Sc, Department of Animal Nutrition,OUAT
[2]Principal scientist,Central institute of women in agriculture,BBSR
Corresponding Author: smileysas555@gmail.com

Abstract

Small farming operations are becoming more popular as the amount of land available for large livestock enterprises and row crops is reduced by urban sprawl. Small ruminant livestock systems such as goats and sheep fit well with small farm operations. Forages, whether are grazed or hayed, supply the major source of nutrition and a critical component to small farm enterprises to maintain sustainability. Many of these small farm owners are either newcomers to farming or people living in urban areas and see them as "hobby" farms. There is a critical need to educate them on the basic agricultural practices and forage utilization for this type of livestock management. The grazing habits of sheep and goats differ from traditional livestock production and they can be incorporated into the grazing systems for cattle and horses. Goats tend to browse more while sheep tend to graze. Goats are efficiently used in pasture utilization controlling brush and weed, but they need higher quality forage than cattle because they cannot digest cellulose.Grazing can either promote or reduce weed abundance at a particular site. By itself, grazing will rarely, if ever, completely eradicate invasive plants. However, when grazing treatments are combined with other control techniques, such as herbicides or biocontrol, severe infestations can be reduced and small infestations may be eliminated. Animals can also be used as part of a restoration program by breaking up the soil and incorporating in seeds of desirable native plants. When not properly controlled, however, grazing or other actions of grazing animals (wallowing, pawing up soil) can cause significant damage to a system, and promote the spread and survival of invasive weeds. Overgrazing can reduce native plant cover, disturb soils, weaken native communities, and allow exotic weeds to invade.

Seven rules for pasture management in small ruminants:

1. Graze at the correct stage of growth:
2. Vary grazing interval:

3. Aim for good utilization:
4. Graze quickly:
5. Do not over-graze, particularly just prior to winter:
6. Recognize surpluses early and conserve:
7. Harvest before fibre content gets too high:

TYPES OF PASTURE

Clean pasture- It is the pasture free from infection in the sense that susceptible animals grazing on it will not become a source of contamination and if worm free animals are put on such pasture it will remain safe for the rest of the season (Waller,1997; Barger,1998).the clean can be prepared by:

- Cultivation of new pasture
- Pasture not grazed by small ruminants for past 6 to 12 month
- Pasture grazed by cattle/Buffalo in the previous year
- Grassland used for conservation in the previous year, Burnt pasture

Safe pasture- It is not sufficiently heavily infested to effect the production of susceptible animals grazing on it but such animals will become a source of contamination. Safe pastures are those which are grazed only by young animal during summer. Pasture that has been grazed by other species for a grazing season or longer period are also consider safe, because only a small amount of cross infection between species occur (Waller,1997; Barger,1998).

Dangerous pasture- These are liable to carry an infestation sufficient to impair the production of susceptible animals (Waller,1997; Barger,1998)

Practices of pasture management

Pasture rotation system: it is a grazing management technique involving sub divisions of pasture in which each paddock is grazed for a short time &then rested for a relatively much longer time. The resting time should be framed in such a way to cause death of larva.

Advantages

- Reduced use of anthelmintics
- Better pasture productivity & its utilization.

Limitations

- Initial higher capital investment
- Require larger pasture area. labour intensive

Safe pasture system

It is suitable in combined crop & livestock production system. The number of larvae in the pasture are reduced overtime by resting the pasture during the period when they are normally being re-contaminated or through growing & harvesting of crop of hay/silage(Cabaret et al.,2002)

Advantages

- Reduced use of anthelmintics, Better pasture utilization

Limitation

- If combined with the use of anthelmintics, it may increase the selection pressure. Poor performance of animals if turned out was not in the time.

Alternate grazing system

Two or more host species in any given environment do not share common parasite species, alteration between species can be successful tool of improving worm management. It is a less efficient in temperate climate. It involves grazing between different age groups of different

species taking advantage of higher resistance in older animals & between different animal species, where cattle and buffalo act as vacuum cleaner to pasture if grazed before or after sheep & goat.

Pasture resting

This requires preventing of animals from grazing in the same paddock for longer time. the resting period varied from 2 to 6 months. The studies conducted in semi-arid regions of Rajasthan revealed that sheep grazed during monsoon on spring contaminated, summer ungrazed pasture had very low faecal counts, pasture larval burden and worm counts compared to those on continuously grazed contaminated pasture.(Singh et al.,1997).

Pasture management in sheep

When selecting a pasture, plant requirements need to be considered, including: growth requirements; seasonality and fluctuations in production; and nutrient quality.Requirements of the sheep also need to be considered including: expectedperformance; nutrient intake levels; forage quality; and forage palatability.Ensure sheep have access to fresh clean water and minerals. Sheep need from 7.5 to 10 litres of water per day.Sheep may walk from three to five kilometres for water (depending on topography).The distance they have to travel has a significant influence on production. The greater the distance to water, the more energy and time is needed to satisfy the sheep's requirements.

- Sheep need access to some form of shelter (e.g. trees, sheds).
- Livestock seek shade and cool locations during hot summer periods, which may result in excessive grazing under trees and in riparian areas.
- Stocking rate – the number of animals per unit of land – also needs to be considered.

Stocking rate guidelines

It depends pasture quality, production, rainfall, pasture species, soil fertility and type of grazing management.

Pasture type	Cow	Sheep	Goat	Cow + Goat
Excellent pasture Brushy pasture	1 1	5-6 6-7	6-8 9-11	1+1-2 1+2-4
Brush Eradication Sustainable browse mgmt.			8-12 /acre 1-3 /acre	5+6-8

(Table no.1-Stocking density guidelines in small ruminants)

Grazing management in sheep

Several different grazing management systems can be employed to ensure sufficient pasture in a stage suitable to graze at all times throughout the grazing season.

Continuous grazing means putting animals out on a pasture and leaving them there for the majority of the season.

- The number of animals the pasture can support is determined by the forage yield during the period of poorest pasture productivity.
- In most cases, stocking rate needs to be very low or the sheep will lose weight during the summer.
- Individual animals can do well under this type of grazing management if stocking rates are low enough.
- Drawbacks of continuous grazing include:

° Meat or milk product per hectare is very low.
° Spring-produced forage is wasted.Animals selective graze and can cause the pasture to become less productiveover time.
• **Controlled grazing** is when sheep stay in an area for a long time, but the size of thearea is adjusted by moving fences.
• The grazing area can be increased when forage growth is slow or it can be decreasedwhen forage growth is fast.
• Forage growth is measured by taking the height of the pasture.
• Controlled grazing requires the manager to check pasture growth daily and have additional land for pasture.
• Advantages of controlled grazing include:
° More produced forage is used.
° Higher number of animals can be supported.
° More meat/milk is produced per unit of land.
° Pasture remains productive for a longer period of time.
• **Rotational grazing** involves dividing a pasture into several small paddocksusing fencing. Livestock graze paddocks in sequence, moving to a new paddock when forage isready to be grazed.
• Generally, livestock are put into a paddock when the forage is 25 to 30 cm tall and
removed when the pasture has been grazed down to 8 cm and paddocks are rested.
• **Strip grazing** is when animals are given just enough pasture to supply half to one day's requirements.Fences are moved once or twice daily to provide fresh forage.
• This is the most labour-intensive method of grazing.
• Strip grazing also results in the highest quality of feed and the least waste.
• **Forward grazing** is where the pasture is grazed by two groups of animals.
The first group to enter the pasture is those with higher nutritional needs (e.g. eweswith lambs) and grazes the top of the plants.The second group, with lower nutrient requirements (e.g. dry ewes), grazes what isleft by the first group.
• **Mob grazing** is a form of rotational grazing where large numbers of sheep graze thepasture until forage is grazed down evenly and closely. This is normally used to clean up pastures with coarse, mature forage.
• **Mixed grazing** is when different types of livestock graze different plants.
Two or more types of animals graze the paddock at the same time, or follow one another through the pasture.
• Do not graze sheep with horses.Sheep, goats and cattle do not have the same grazing habits – this can be veryhelpful in pasture management.Sheep are more selective than cattle and tend to prefer grazing on forbs(broadleaved plants).Cattle and sheep will complement each other if grazed on pasture with a highproportion of forbs and browse.Multi-species grazing can benefit the producer with better economic gains (differentmarkets), predator protection, and improved range health.
Creep grazing is a form of grazing in which smaller animals are allowed to go (creep) from one pasture to another through openings in a fence.
Creep grazing can be used to access lambs quality pasture while restricting adult

sheep to inferior pasture. The rationale for creep grazing is based on the fact that
(1) different ages and sizes of livestock have different nutritional requirements
(2) the quantity and quality of forage are not uniform during the pasture season

Stockpiling

• Stockpiling is also known as fall-saved pasture or deferred grazing.It is the practice of saving certain hay or pasture grown during the spring and summerfor grazing in the fall and winter.Forage may be stockpiled following an early hay/silage harvest or grazing. It can extend the grazing season into the late fall by several weeks.

PASTURE MANAGEMENT FOR GOATS

Intensive grazing of goats on high-investment pastures is usually not cost effective. Ideal way to utilize goats is to graze them with cattle in large pasturesbecause in such situations they can be quite effective in controlling weeds. They are effective in eliminating many troublesome plant species that cattle do not consume such as willow, pigweed, thistles, stinging nettle and curly dock. Goats also consume seed heads of grasses that are often ignored by cattle. Some pasture weeds such as sicklepod, bitterweed, and dogfennel are avoided by goats. On most farms, supplemental pasture species will likely be needed to supply adequate forage for meat goats during at least part of the year. It is important to supply a higher level of nutrition including 14 percent protein in diets to does in late pregnancy and early lactation. As far as forage grasses, goats like to forage on bahiagrassand pearl millet but find bermudagrass to be less palatable. Rye, wheat, and annual ryegrass are suitable, but clovers are often ignored. Poisonous plants are usually not a problem for goats with an adequate feed supply.Parasites are a major problem with goats in the more humid climate such as ourarea when they are confined to small areas of pasture at a high stocking rate.

They can particularly become a serious problem in closely grazed pastures of species such as bahiagrass. Taller growing species or forages that are less closely grazed allow for less contact between the animal and the ground during grazing. The best line of defense against a parasite infestation is using an appropriate stocking rate and rotational stocking which allows pastures to rest between grazing periods. Implementing a sound deworming program is a second line of defense against parasites. Predators such as coyotes can be particularly harmful to goats but feral dogs or neighborhood dogs can also cause problems with kids and even adult animals. Penning goats up at night is one option; however, donkeys also make good guardians and will keep predators out of the area. Electric fencing is also helpful. Goats are intelligent animals. They can be trained to electric fences by placing them in a small pasture enclosed by a five or six foot wire fence with the bottom wires 6 inches apart and the top one at 4 feet. Once they are trained, goats can be easily contained by three-wire electric fences placed at 10, 20 and 36 inches apart.

GRAZING MANAGEMENT FOR GOATS

Goats selectively graze unwanted vegetation in pastures and forests, thus

providing biological controlwhich will reduce dependence on certain pesticides.Goats consume only the most nutritiousparts of a wide range of grasses, legumes,and browse plants. Browse plants includebrambles, shrubs, trees, and vines with
woody stems. The quality of feed on offerwill depend on many things, but it is
usually most directly related to the age or stage of growth. Goats are very active foragers, able tocover a wide area in search of scarce plantmaterials. Their small mouths and splitupper lips enable them to pick smallleaves, flowers, fruits and other plant parts,thus choosing only the most nutritiousavailable feed. The ability to utilize browse species, whichoften have thorns and an upright growthhabit with small leaves tucked amongwoody stems, is a unique characteristic ofthe goat compared to heavier, less agileruminants. Goats have been observed tostand on their hind legs and stretch up tobrowse tree leaves or throw their bodies against
saplings to bring the tops withinreach.The feeding strategy of goats appears to be
to select grasses when the protein contentand digestibility are high, but to switch tobrowse when the latter overall nutritivevalue may be higher. This ability is best utilized under conditions where there is abroad range in the digestibility of the available feeds, giving an advantage to ananimal which is able to select highly digestible parts and reject those materialswhich are low in quality.

Grazing goats have been observed to:

- Select grass over clover.
- Prefer browsing over grazing pastures
- Prefer foraging on rough and steep landover fiat, smooth land.
- Graze along fence lines before grazing the centerof a pasture.
- Graze the top of pasture canopy fairly uniformlybefore grazing close to the soil level.

Because of their inquisitive nature and tolerance of"bitter" or high tannin material, goats may eatunpalatable weeds and wild shrubs that may bepoisonous, such as cherry or milkweed. The absenceor the severity of poisoning is related to the quantity ofmaterial consumed, the portion and age of the planteaten, the season of the year, the age and size of theanimal, and other factors. In addition, severalornamental plants that are grown outdoors or indoorsare highly toxic. In a pasture situation goats are "top down" grazers.This behavior results in uniform grazing and favors afirst grazer-last grazer system. This might consist ofusing a goat herd as the first group and cattle as thelast group. This management is most appropriate withlactating does or growing kids.Goats naturally seek shelter when it is available.Goats seem to be less tolerant of wet cold conditionsthan sheep and cattle because of a thinnersubcutaneous fat layer. A wet goat can easily becomesick. Therefore, it is advisable to provide artificial shelters, such as open sheds.

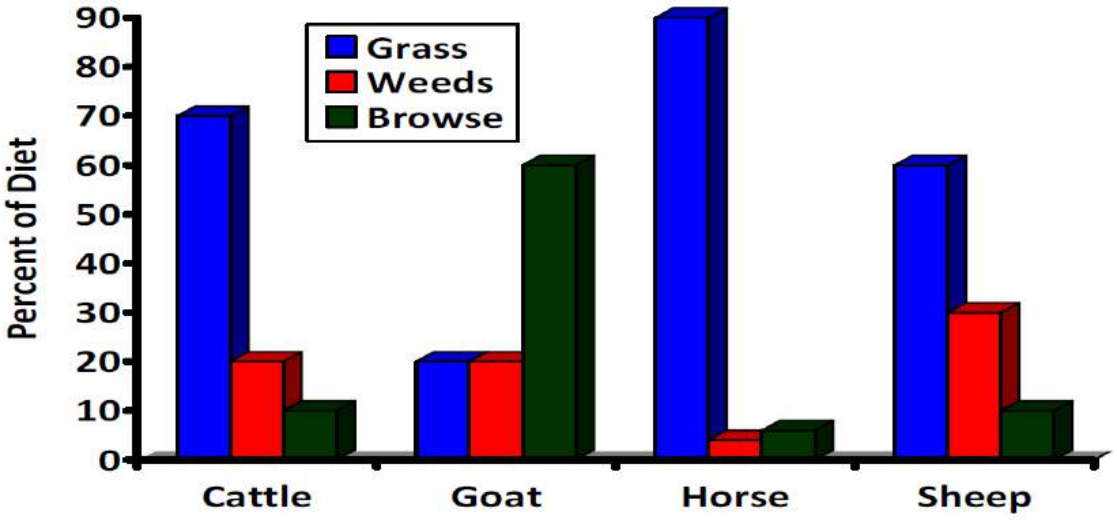


Figure 1. Dietary preference of different livestock species. Source: AnPeischel, 2005.

Grazing systems in small ruminants

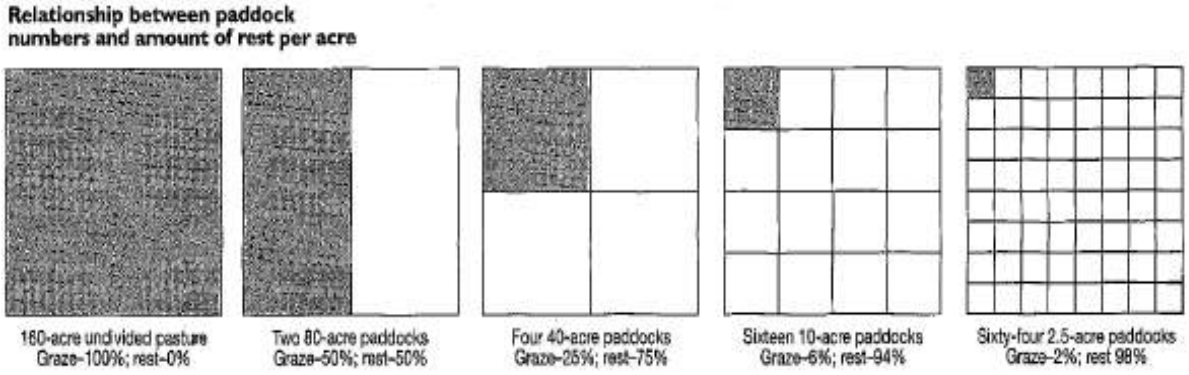
There is no single "best" number of paddocks for a managed grazing system. Any number of paddocks is better than one big pasture continuously grazed the entire season. Deciding on the number of paddocks depends on:

- Existing fences
- Cross-fencing
- Topography
- Forage type

Soil type Initially the number of paddocks will be determined by any of the factors listed above. Startingout with anywhere from two to eight paddocks will increase

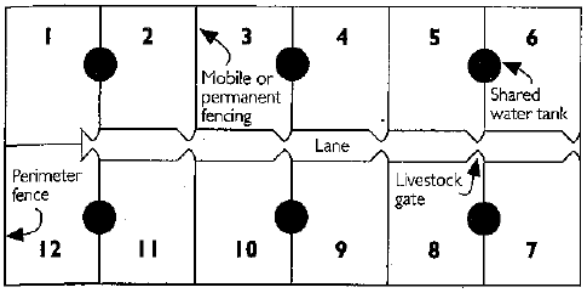
Fig.1- Temporary Electric FenceFig.2- Dividing A Large Pasture Into Two Paddock

both pasture condition and animalperformance over a continuously grazed pasture. Using temporary fencing, electrictape or flexible net fencing, works well to divide pastures into paddocks. Both types are visibleand easily moved. This allows you to adjust the size of your paddocks based on production eachyear. The more paddocks a larger pasture is divided into, the more rest plants will get and the healthier. More paddocks tend to be better than fewer, for both the plants and the animals.



Paddock Layout

When planning the layout of paddocks, remember that the easiest way to put up fencing aroundpastures is to make square or rectangular pastures of roughly the same size. This allows easiersubdivision of larger pastures into smaller paddocks with movable, electric fences. Square paddocksalso use the least amount of fence, maximizing their area and encouraging more even grazingand manure distribution. Long rectangular pastu



1 Fig.3- Square Paddock

res and strip grazing using moveable electric fencing help keep sheep andgoats in the area scheduled for grazing

Paddock Design - Divide larger pastures into smallerpaddocks. Keep in mind:

- Topography
- Forage Type
- Soil Type

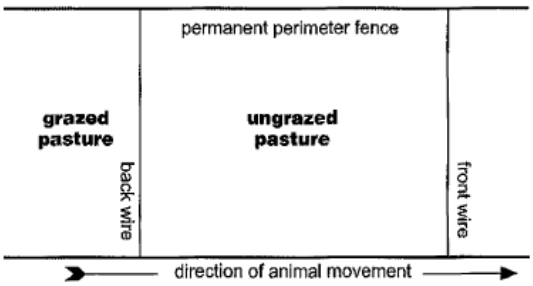


Fig.4- Rectangular Pasture Divided Into Square Paddock For Strip Grazing

- Sensitive Areas
- Shade

Alleys and Gates (Fig.5)-Keep lanes as short and narrow as possible. The forage found in the lanes will betrampled, less palatable; keep the waste to a minimum.Lanes which are about 12 feet wide work well for smaller flocks (350 sheep) but if youhave a larger one you may need to increase their width to 20 or 30 feet.Gates should be located in the corner of the pasture nearest to the alley.

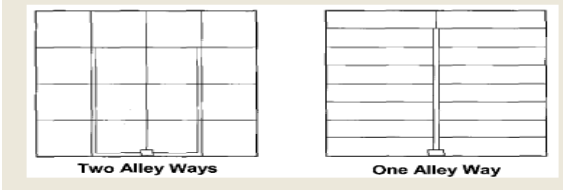


Fig.-5 Fencing

PERMANENT FENCING

Woven wire fencing is used for sheep and goats. It requires a lot of labour to

install,but provides a nearly predator-proof exterior fence for your small livestock.

Many producers are now using **high tensile electric fencing** when building new

permanent fences. It is relatively inexpensive, long-lasting, and very effective. It alsocan be built so that some, or all, of the strands can be electrified if needed. You can use four to five strands of smooth electrified wire as perimeter fencing. Thespace between the wires will vary from six to eight inches near the ground and eightto twelve at the top. The fence should be at least 42 inches high (6-9).

Fig.6- Woven wire fence

Fig.7- Temporary electric fences

Movable or Mobile Electric Fencing

Mobile electric fencing lets you easily change the size of your paddocks to deal with changing conditions. Temporary electric fences are light weight, easy to install and very adaptable to your operation. A pasture divided into temporary paddocks. Electric netting or three strands of hot wire or electric tape are generally needed when you are building these interior electric fences.

Designing a Simple Managed Grazing Plan General Tips

- Put what you know about your operation to use.
- Try to keep costs low at the start. Use as much of your existing resources (water sources, fences, buildings, etc.) as possible.
- Make sure your flock or herd has access to a reliable source of clean water and a trace mineral mixture in each paddock.
- Make sure you keep assessing the state of your pastures and flock or herd during the grazing season.
- Starting out with a simple managed grazing plan can help you manage the risks associated with a new system. If possible, use temporary electric fencing for your internal fences. You can use this first year to build your knowledge and confidence with new grazing management techniques.
- Be sure to have a back-up plan in case of drought or poor pasture production.

This means haying one of your paddocks or purchasing feed from off-farm.

Management of gastrointestinal nematodosis by grazing management

Arthru le Feuvre principle states that “if one cannot or do not measuresomething, onecan not manage it and if one do not

manage it, one cannot control it." The management of gastrointestinal nematodes through a system should incorporate:

- Measurement of worm level.
- Measure the efficiency of available anthelmintics.
- Application of efficacious drench.
- Ensure reduction in pasture contamination.
- Use of worm hostile climate.
- Use of non chemical strategies.

REFERENCES

Abaye, A. O., et al. 1994. Influence of grazing cattle and sheep together and separately on animal performance and forage quality. Journal of Animal Science. April. p. 1013– 1022.

Boyazoglu, J., 1982. The animal as food resource for man. Invited paper, Proc. 3rd International Conference on Goat Production & Disease. Tucson (USA), 15-19 pp.

Etchepare, John. 1985. Cattle and sheep in the Intermountain region. In: Proceedings of a conference on multispecies grazing. Winrock International, Morrilton, AR. June 25–28. p. 178–187.

Esmail, S.H.M. 1991. Multispecies grazing by cattle and sheep. Rangelands. February. p. 35–37.

Forbes, T.D.A., and J. Hodgson. 1985. The reaction of grazing sheep and cattle to the presence of dung from the same or the other species. Grass and Forage Science. June.p. 177–182.

Hart, Steve. 2000. Sustainable brush control. In: Proceedings of the 15th Annual Goat Field Day. Langston University, Langston, OK. p. 32–35.

Luginbuhl, J.M., et al. 2000. Use of goats to manage vegetation in cattle pastures in the Appalachian region of North Carolina. Sheep and Goat Research Journal, Vol. 16, No. 3. p. 124–130.

Malacheck, J.C., 1982. Grazing management of goats in extensive rangeland production systems. Proc. 3rd Int. Conf. on Goat Prod. and Disease. Tucson (USA), 404-408 pp.

Meyer, Howard H., and T. G. Harvey. 1985. Multispecies Livestock Systems in New Zealand. In: Proceedings of a conference on multispecies grazing. June 25-28, 1985.Winrock International, Morrilton, AR. p. 84–92.

Rutherford, Burt. 1994. Sheep–Cattle bonding experiments prove successful in New Mexico research. Ranch Magazine. May. p. 26–27.

Taylor, C.A., and M.H. Ralphs. 1992. Reducing livestock losses from poisonous plants through grazing management. Journal of Range Management. January. p. 9–12.

Taylor, Charles A. 1985. Multispecies Grazing Research Overview (Texas). In: Proceedings of a conference on multispecies grazing. June 25-28, 1985, Winrock International, Morrilton, AR. p. 65–83.

Umberger, S. H., et al. 1985. Adding sheep to cattle for increased profits. In:

Proceedings of a conference on multispecies grazing.Winrock International, Morrilton, AR. p. 212–214.

Vallentine, J. F. 2001. *Grazing* Management. 2nd Edition.Academic Press, London.

Waller, P.J. (1997). Sustainable helminth control of ruminants in developing countries. Vet. Parasitol., 71 : 195 – 207

Zweede-Tucker, Yvonne. 1997. How to hotwire a goat. Cashmirror. December.p. 19–21.

Effect of Phytase Enzyme on Performance of Broilers Nutrition

G. Jayaprakash*[1], M. Sathiyabarathi[2], M. Arokiarobert[1], T. Tamilmani[4], T. Chandrasekar[4] and R. Dhinesh Kumar[5]

[1]*MVSc Scholar, Kerala Veterinary and Animal Sciences University, Thrissur, Kerala- 680651.*
[2]*MVSc scholar, SRS, NDRI, Bengaluru, India- 560030.*
[4]*MVSc Scholar, IVRI, Izatnagar, Bareilly, India- 243122.*
[4]*PhD Scholar, NDRI, Karnal, India- 132001.*
[5]*PhD Scholar, SRS, NDRI, Bengaluru, India- 560030.*
**Corresponding author email: drgjayaprakash@gmail.com*

Abstract

Phosphorus (P) is a macro mineral in poultry nutrition. Monogastric animals lack endogenous phytase, so phytate decreases the nutrient availability at the intestinal level in poultry. The addition of phytase enzymes to diets increased P availability from 42 to 95 percent. Phytase could ensure the economical poultry production by the exploitation of the inherent nutritional potential of feedstuffs.

Key words: *Broiler, Growth, Phytase*

The primary ingredients of diet for poultry and swine are grains, pulses and oil seeds meals. In above these ingredients, phosphorous in the form of phytate phosphorus, which represents nearly 60 to 80 per cent of the total phosphorous (Ravindran*et al*., 1995; Kirby and Nelson, 1988).In cereals, legumes and oilseeds contain phytate in varies level depending upon cultivators, soil types, climatic, irrigation conditions, processing, and locations. Non-ruminants lack the endogenous enzyme for the hydrolysis of phytate, so there is a need for supplementation of inorganic P (di-calcium phosphate, DCP) to overcome the P deficiency (Sebastian *et al*. 1998). Monogastric animals like especially swine and poultry are poorly utilized for phytate dueto lack of phytase enzyme that hydrolyzes these compounds in the digestiv e tract. (Perney*et al*., 1993) In addition monogatric animals, phytic acid to bind minerals isreduces the digestion and absorption of phosphorus, calcium, magnesium and zinc from plant-derived (Ravindran*et al*., 1999b; Viveros*et al*., 2002). The main objective of this current review, therefore, is to evaluate the effect of

dietary phytase feed additives on the broiler performance.

The substrate: Phytate

Three terminologies, namely phytate, phytin and phytic acid, are used in the literatureto describe the substrate for phytase enzymes. The most commonly used term, phytate,refers to the mixed salt of phytic acid (myoinositol hexaphosphate; IP6). The term, phytin, specifically refers to the deposited complex of IP6 with potassium, magnesium, and calcium as it occurs in plants, whereas phytic acid is the free form of IP6.

Source, action and activity of phytases

Sebastian *et al*. (1998) reported four possible sources for phytase:

1. Intestinal phytase found in digestive secretions (animal origin)

Lieber*et al*. (1993) observed that the phytase activity of crop, stomach and small intestine of chicken is negligible. Kornegay (1999) stated that the significance of phytase produced by microorganism residing in the intestinal tract is negligible.

2. Phytase originating from microbes in the digestive tract

(e.g. as in ruminants)

3. Endogenous phytase from plant feed-stuffs

Endogenous phytase activity variable in different feed stuffs. The highest activities are observed in rye, wheat and wheat bran (Ravindran*et al*., 1995).

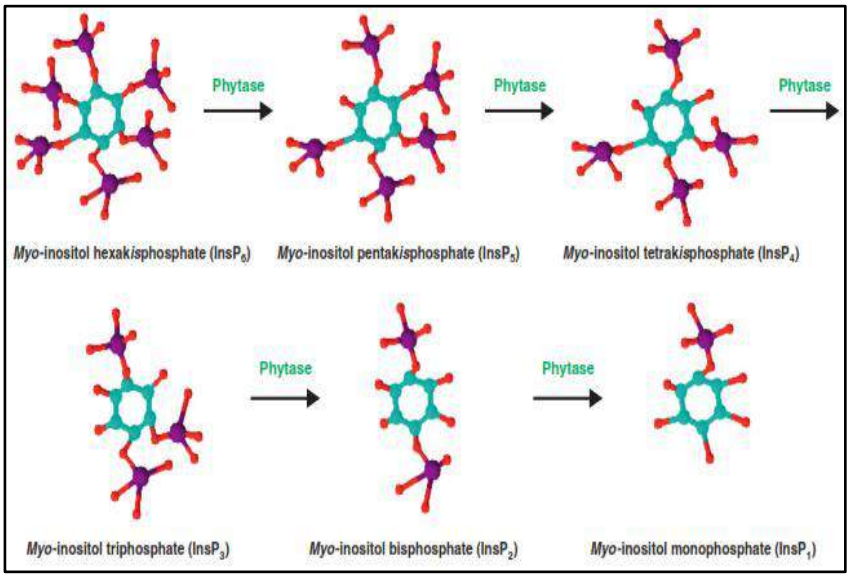
4. Phytase produced by exogenous microorganisms

Microbial sources are considered to be more widely used for commercial phytase production. *Aspergillus sp.* is commonlyused, particularly the strains *A. niger*and *A. ficuum*, by commercial producers. Microbial phytase can be found in many bacteria, yeast, and fungi. *Aspergillus* is the most commercial production of microbial phytase. The inclusion of fungal phytase in diets for poultry and swine has resulted in considerable improvement in phosphorus retention. Phosphorus retention by broilers was improved from 50 to 60 percent by supplementing diets with a fungal phytase.

Two types of commercial phytase products are available:

1. One is derived from **submerged liquid fermentation** that uses genetically manipulated organisms to achieve maximum enzyme production.

2. The other type of product is based on **Solid-state fermentation** that uses normal organisms for enzyme production.



Mechanism of Action (Adopted from Kebreab*et al*., 2012)

In theory, enzymic hydrolysis of phytate generates a series of lower myo-inositol phosphates esters (IP6⇒IP5⇒IP4⇒IP3⇒IP2⇒IP1), via a progression of step-wise dephosphorylation reactions, to yield inositol and six inorganic P moieties. Consequently, hydrolysis of phytate by phytase is more likely to yield myo-inositol monophosphate (IP1) and five inorganic P moieties. At last due to the presence of phytase with water at pH 5.0 myo-inositol hexaphosphate is converted into free myo-inositol and onorganic orthophosphate is liberated from the phytate structure.

Table 1:Phytate phosphorus concentration in various feed ingredients

Ingredients	Total P (%)	Phytic P (%)	Phytate P (as % of total P)
Cereals and by-products			
Wheat	0.33	0.18	55
Corn	0.25	0.17	73
Rice	0.12	0.08	65
Sorghum	0.26	0.17	66
Rice polishing	1.57	1.13	72
Wheat bran	0.92	0.63	69
Oilseed and by-products			
Cotton seed	0.64	0.49	77
Soyabean meal	0.57	0.37	65
Cotton meal	1.34	0.84	63
Pam oil meal	0.51	0.29	57
Coconut meal	0.43	0.24	56
Brewery meal	1.22	0.30	24

(Adopted from Godoy et al., 2015 and Selle&Ravindran, 2007.)

Phytase supplementation on broilers

Some researchers have found phytase supplementation on broiler an improvement in feed efficiency ratios (Broz, 1994). Also, others did notobserved any improvement in feed efficiency (Huyghebaert, 1996). Phytase supplementation increased the body weight gain ($p<0.05$) and improve the weight of liver ($p<0.05$) (Wang *et al*. 2013). Also, others did not influence phytase supplementation had no significant effect on carcass cuts and dressing percent compared to low P diet. Also, results of this investigation showed that phytase enzyme increased the digestibility of dry matter, crude protein, ash (Jamal *et al*., 2009). Some researchers, however, have found no effect on iron availability (Biehl, 1997)

Table 2: The effect of phytase supplementation (0–12,000 FTU kg−1) on growth performance of broiler chicks.

Phytase (FTU kg−1)	Growth Performance		
	Weight Gain (g/bird)	Feed Intake (g/bird)	FCR (g/g)
0	287	381	1.32
375	399	490	1.23
750	424	505	1.19
1500	459	548	1.19
6000	494	580	1.17
12000	515	595	1.15

(Adapted from Shirley *and* Edwards, 2003; Selle&Ravindran, 2007)

CONCLUSION

This review suggests that supplementation of phytase in broiler had some positive effect on the growth performance, feed efficiency, protein/amino acid digestibility,

energy utilization, mineral retention and bone growth of broilers during the entire whole growth period.

REFERENCES

Biehl, R.R. (1997). Iron bioavailability in soybean meal as affected by supplemental phytase and 1a - hydroxycholecalciferol. Poult. Sci., 76, 1424-1427.

Godoy, S., Chicco, C., Meschy, F. and Requena, F.(2005).Phytic phosphorus and phytase activity of animal feed ingredients. Interciencia, 30, 24–28.

Huyghebaert, G. (1996). Effects of dietary calcium, phosphorus, Ca/P-ratio and phytase on zootechnical performances and mineralisation in broiler chicks. Arch. Geflugelk, 61, 53-61.

Jamal, M., Omar, A and Sabha, R (2009). Effects of phytase on broilers performance and body status of phosphorous. Hebron Univ. Res. J., 4(1), 55-66.

Kebreab, K., Hansen, A.V., Strathe, A.B. (2012). Animal production for efficient phosphate utilisation: from optimized feed to high efficiency livestock. Current Opinion in Biotechnology. 23, 872-877.

Kirby L.K and Nelson T.S (1988) Total and phytate phosphorus content of some feed ingredients derived from grains. Nutr. Rep. Int. 37, 277-280.

Kornegay, E.T., Zhang, Z., Denbow, D.M. (1999). Influence of microbial phytase supplementation of a low protein/amino acid diet on performance, ileal digestibility of protein and amino acids, and carcass measurements of finishing broilers. In: Phytase in Animal Nutrition and Waste Management, second revised ed. BASF Corporation, Mount Olive, NJ, pp. 557–572.

Liebert, F., Wecke, C., Schoner, F.J. (1993). Phytase activities in different gut contents of chickens as dependent on level of phosphorus and phytase supplementations. In: Proceedings of 1st European Symposium Enzymes in Animal Nutrition, pp. 202–205.

Perney K.M., Cantor A.H., Straw M.L. and Herkelman K.L. (1993). The effect of dietary phytase on growth performance and phosphorus utilization of broiler chicks. Poult. Sci., 72, 2106-2114.

Ravindran, V., Bryden, W.L. and Kornegay, E.T. (1995) Phytases: occurrence, bioavailability and implications in poultry nutrition. Poult. Avian Biol. Rev. (6), 125–143.

Ravindran, V., Selle, P.H., Bryden, W.L., (1999b). Effects of phytase supplementation, individually and in combination, on the nutritive value of wheat and barley. Poult. Sci., (78), 1588–1595.

Sebastian S., Touch Burn S.P. and Chavez E.R. (1998). Implications of phytic acid and supplemented microbial phytase in poultry nutrition: a review. W. Poult. Sci., 54, 27-47.

Selle P.H., Ravindran V., Ravindran G. and Bryden W.L. (2007). Effect of

dietary lysine and microbial phytase on growth performance and nutrient utilization of broiler chickens. Asi. Aust. J. Anim. Sci., 20, 1100-1107.

Shirley, R.B. & Edwards, H.M., 2003. Graded levels of phytase past industry standards improve broiler performance. Poult. Sci., 82, 671–680.

Viveros A., Centeno C., Brenes A., Canales R. and Lozano A. (2000). Phytase and acid phosphatase activities in plant feedstuffs. J. Agric. Food Chem., 48, 4009-4013.

Wang, W., Wang, W., Yang, H., Cao, Y., Zhu, X. and Zhoa, Y. (2013). Effects of phytase supplementation on growth performance, slaughter performance, growth of internal organs and small intestine, and serum biochemical parameters of broilers, 3(3), 236-241.

Environment Enrichment for Dairy Cows

Girish Panchbhai and Ankaj Thakur

Ph.D. Scholar LPM, ICAR-NDRI, Karnal
Corresponding author: girishpanchbhai384@gmail.com

In recent years formaximizing the milk productions in dairy animals the husbandry practices has shifted from extensive to intensive farming. Under such confined conditions the welfare of animals is often neglected which leads in development of abnormal behavior and results in lowered production and reproduction performances of animal.

Environment enrichment is a technique to improve biological functioning of an animal via modifying its environment. It enhances the physical and social environment of an animal by adding one or more objects to an animal's enclosure rather than specifying the desired endpoints of these changes. The endpoint of enrichment should be to improve the biological functioning of the animal.

APPLICATIONS

- Used to enhance social interactions in animals in intensive environment
- Reduces undesirable and abnormal behavior
- To emphasize the functionality and adaptiveness of behavior in specific environments
- Used for refining environment of animals used in research
- To avoid boredom of animals lacking complexity in physical environment

Environment enrichment has wide-ranging physiological and behavioral effects on a variety of species of animals. It may reduce the frequency or severity of abnormal behaviors, or even prevent them from developing in the first place.

Goals of enrichment program:

The environment enrichment is aimed to enhance barren environment and providing the environment which meets species relevant behavior pattern,this involves:

- Increasing the number and range of normal behaviours shown by the animal
- Preventing the development of abnormal behaviours or reducing their frequency or severity
- Increasing positive utilization of the environment(e.g., use of space)
- Increasing the animal's ability to cope with behavioural and physiological challenges such as, exposure to humans, expérimental manipulation, or environnemental variation

- Besides above, observation of animal behavior, health and performance are important components of enrichment progrmamme

TYPES OF ENRICHMENT

Social enrichment

Direct (tactile) or indirect contact (visual, olfactory, auditory cues) with conspecifics (companion animals of same species)or humans.

Occupational enrichment:

Both psychological enrichment (e.g., devices that provide animals with control or challenges) and enrichment that encourages exercise.

Physical enrichment:

Involve altering the size or complexity of the animal's enclosure or adding accessories to the enclosure such as objects, substrate, or permanent structures (e.g., nest boxes).

Sensory enrichment:

Stimuli that are visual (e.g., television), auditory (music, vocalizations), or in other modalities (e.g., olfactory, tactile, taste).

Nutritional enrichment:

Involve either presenting varied or novel food types or changing the method of food delivery.

IMPLICATIONS

Social grouping

The group is an essential resource for gregarious animals. Positive social environment has beneficial short and long term effects on psychological and physiological health of animals. Group housing helps to decrease fear reaction, improves feed intake and increase rumination time. Stable relationship helps in minimizing social tensions and conflicts. Optimum group size and stocking density should be considered which help in minimizing agonistic interactions among animals

Lying area

Lameness and skin lesions which are welfare indicators are related to dairy cattle health. These are associated with the lying area provided to them, which also affects the rest; High producing animals requires more rest (12-14 Hrs). Cows spend most of time lying which aids their rumination. Providing comfortable litter material like straw increases the lying time indicates resting which is directly related to the production.

Grooming devices

Promotion of grooming in cattle reduces stress and boredom. Scratching or rubbing devices mimics the natural behavior of animal and help in improving coat condition. It also helps in reducing discomfort behaviors associated with itching. In lose-housed cattle grooming is increased when provided a mechanical brush.

Environment enrichment devices(EEDs)

The useof EEDs can facilitate entry of cattle in feedlot environment and can affect their weight gain. Use of these depends on the percentage of animals in pens and type of enrichment device used. Toys made of plastic hose pipe, pieces of tires or chains can increase activity and play behavior and decrease abnormal behavior pattern.

Exercise

The dairy animals, while exercising can reach their body parts which they cannot

reach in tied condition. Daily exercise reduces illnesses, hock injuries and requires less veterinary attention.

Music

The noise is a possible stressor to a dairy animal. A quiet environment is more important for dairy cattle, as they are more reactive to sound. Radio stimulation is a complex and variable, comprising of combination of acoustic elements, including the human voice and different genres of music which helps in increasing the milk yield in dairy cows.Music can also serve as a signal for synchronize attendance at an automatic milking machine.

Pastures

Access to pastures provides adequate exercise,social grooming, enhances roughage consumption and helps to stereotypicbehavior like tongue rolling in cattle. It also enhances theexpression of sexual behavior in dairy animals and reduces the chances of mastitis.

Mineral or salt blocks

Provision of proving the mineral or salt licks not only accomplish the nutritional requirement but can also use for playing.

Sprinkler or shower

This type of environment enrichment can help to improve dairy cow well-being by offering them behavioral opportunity to reduce stress naturally especially during summer season.

Human interaction

Regular pleasant contact with humans may result in desirable alterations in the physiology, behaviour, health and productivity of farm animals. On the contrary, animals that were subjected to aversive human contact were highly fearful of humans and their growth and reproductive performance could be compromised. Farm animals are particularly sensitive to human stimulation that occurs early in life, while many systems of the animals are still developing. This may have long-lasting impact and could possibly modify their genetic potential.Maintaining routine and confident actions could help in reducing sign of fear, resistance or distress. Appropriate and gentle contact (e.g. stroking body parts commonly groomed by other cattle such as the neck) with humans can improve human–animal interactions and reduces the fear of humans in animals.

General Considerations:

Type of enrichment may respond different in different animals due to genetic differences between breeds, lines, or strains etc. hence, an enrichment device should be made by considering following points.

- Facility design should not cause injury to animal and should be easy to clean
- Made of non toxic material
- Should not be broken or dismantledby the animal, and if so, the fragmentsor constituent parts should have a safety risk.
- Cost effective
- Species specific
- Ease of management
- Time involved in maintaining the enrichment program should also be considered

CONCLUSION

Enrichment programmes can help the dairy animals to cope up with the stressors in

their surroundings and increase the fulfillment of their behavior needs.Its physiological and behavioral effects can help in reducing the incidence or severity of the abnormal behaviors.

REFERENCES

Bloomsmith, M. A., L. Y. Brent, and S. J. Schapiro. 1991. Guidelines for developing and managing an environmental enrichment program for nonhuman primates. Lab. Anim. Sci. 41:372–377.

DeVries, T. J., M. Vankova, D. M. Veira, and M. A. G. von Keyserlingk. 2007. Short communication: Usage of mechanical brushes by lactating dairy cows. J. Dairy Sci. 90:2241–2245.

Evans A 1990. Moosic is for cows, too. Hoard's Dairymen 135, 721

Gustafson, G. M. 1993. Effects of daily exercise on the health of tied dairy-cows. Prev. Vet. Med. 17:209–223.

Hill, J. D., J. J. McGlone, S. D. Fullwood, and M. F. Miller. 1998. Environmental enrichment influences on pig behavior, performance and meat quality. Appl. Anim. Behav. Sci. 57:51–68.

Lanier, J. L., T. Grandin, R. D. Green, D. Avery, and K. McGee. 2000. The relationship between reaction to sudden, intermittent movements and sounds and temperament. J. Anim. Sci. 78:1467–1474.

Mason, G., R. Clubb, N. Latham, and S. Vickery. 2007. Why and how should we use environmental enrichment to tackle stereotyped behaviour? Appl. Anim. Behav. Sci. 102:163–188.

Newberry, R. C. 1995. Environmental enrichment: Increasing the biological relevance of captive environments. Appl. Anim. Behav. Sci. 44:229–243.

Schmied, C., X. Boivin, and S. Waiblinger. 2008. Stroking different body regions of dairy cows: Effects on avoidance and approach behavior toward humans. J. Dairy Sci. 91:596–605.

Uetake, K., J. F. Hurnik, and L. Johnson. 1997. Effect of music on voluntary approach of dairy cows to an automatic milking system. Appl. Anim. Behav. Sci. 53:175–182.

Washburn, S. P., S. L. White, J. T. Green, and G. A. Benson. 2002. Reproduction, mastitis, and body condition of seasonally calved Holstein and Jersey cows in confinement or pasture systems. J. Dairy Sci. 85:105–111.

Wisniewski, E W. 1997. Behavioral modifications of milking parlour entrance order in dairy cattle by operant conditioning method. Ph.D. Thesis. Purdue University, West Layfayette, IN, USA

Young, R. J. 2003. Environmental Enrichment for Captive Animals. UFAW Animal Welfare Series, Blackwell Publishers, UK.

Young, R. J. 2003. Environmental Enrichment for Captive Animals. UFAW Animal Welfare Series, Blackwell Publishers, UK.

Sexual Behavior in Male Animals: An overview

Shabir Ahmad Lone*, Narendra Kumar, Shailesh Kumar Gupta, Bilal Ahmad Ganie, Haneef Ahmad Rather, Sunil Kumar, Kuladip Prakash Shinde and Aasif Ahmad Sheikh

PhD Scholars, ICAR-National Dairy Research Institute, Karnal-132001, Haryana
**Corresponding Author's Email: drloneshabir@gmail.com*

The animals are mostly social ones and prefer living in herds. In each species there are certain rules for group survival, cohesion, defense and also for propagation. The basic patterns of male sexual behaviour appear to be innate in nature. Calves of both sexes are very often seen exhibiting sexual display during play and most commonly mounting is seen. Bulls reared in complete isolation show normal mating behaviour when exposed to estrous cows. In females the sexual rec eptivity is restricted to few hours or days near the estrous phase of the estrous cycle, while in males the sexual receptivity is grossly permanent. Gonadal steroid balance is responsible for physiological signals for arousal of sexual motivations. However, the secretion of gonadal steroids is not permanent. In males the androgen secretion is in the form of several peaks within 24 hours reflecting the pulsatile release of pituitary gonadotropins. However, the total amount of androgen in males is almost constant. The various components of copulatory patterns in male domestic animals can be presented as:

Sexual arousal→ Courtship (sexual display)

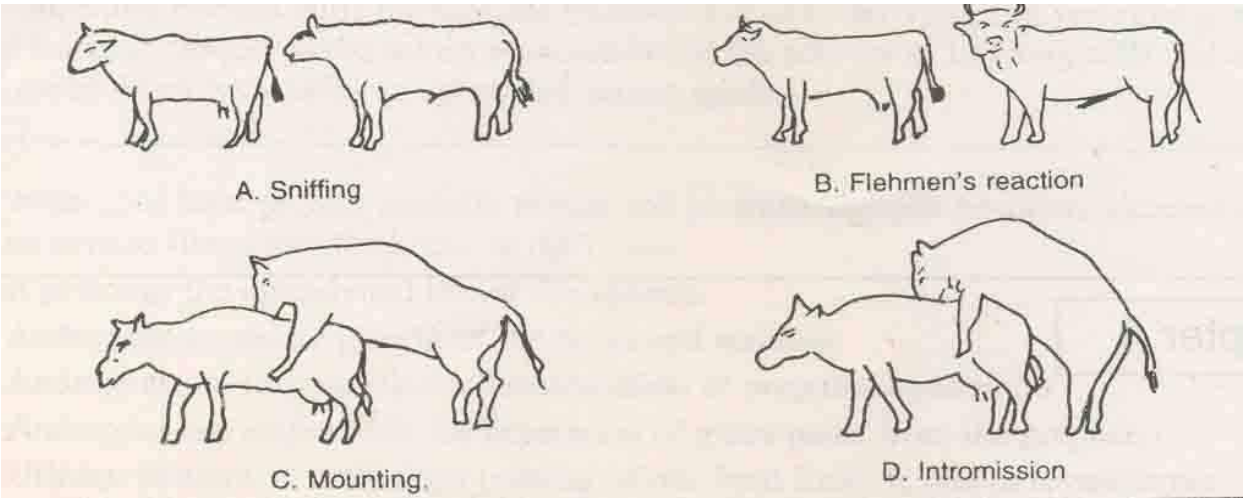


Figure 1 Sexual responses in cattle

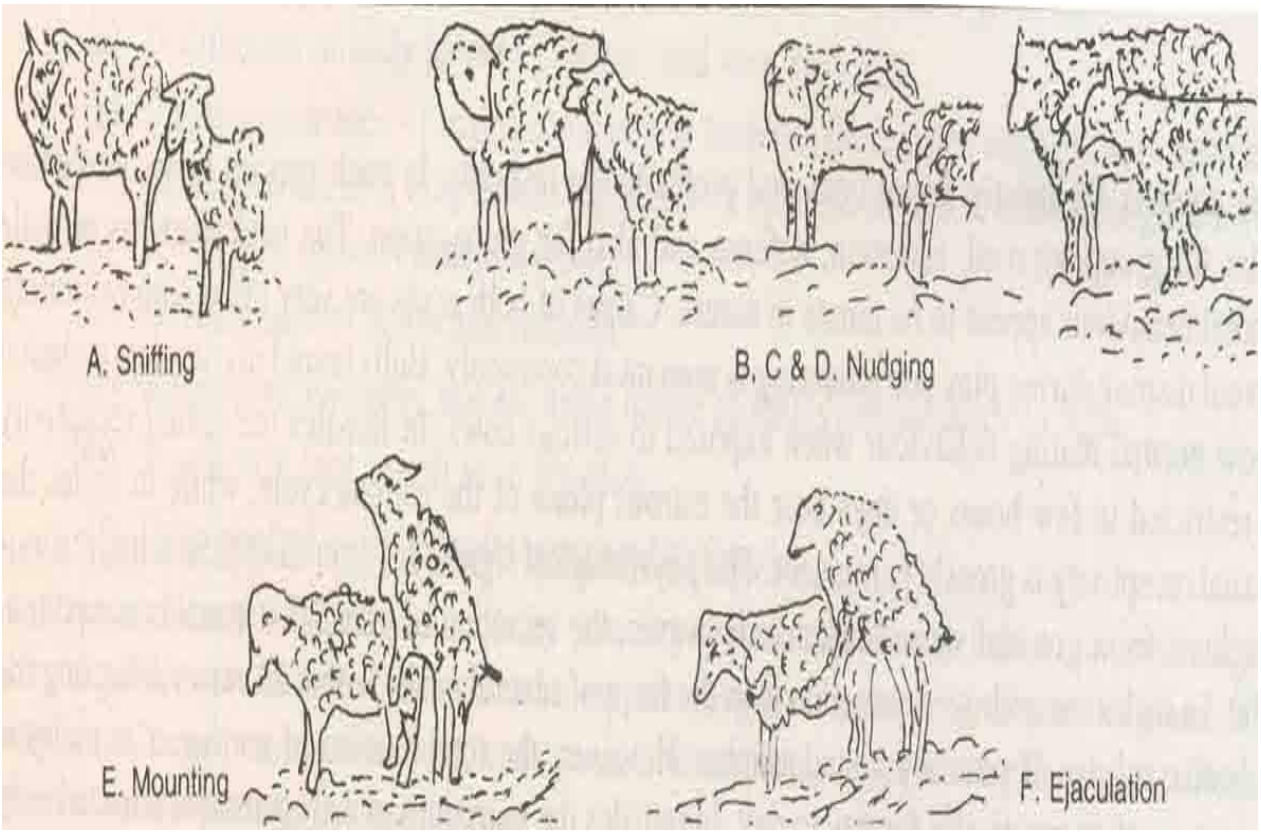


Figure 2: Sexual responses in sheep

→ Erection→ Penile protrusion→ Mounting→ Intromission→ Ejaculation→ Dismounting→ Refractoriness→Memory

Each response becomes a stimulus for next component of the copulatory pattern. Courtship and copulation events are shorter in cattle, sheep and goat (one second or so) and are longer in swine (about 5 minutes or even more) and horse (about 40 seconds). The sexual responses in cattle, sheep and goats are shown in Figs. 1, 2 and 3, respectively. The various components of copulatory patterns in male domestic animals are discussed as under:

1. Sexual arousal: First step for sexual arousal in male animals is the finding of the sexual partner and in that all the senses like sight, hearing and olfaction are important. The senses of sight, hearing and olfaction help estrous females to be attracted towards the males. The stimuli from males greatly influence the females for exhibiting sexual responses.

2. Courtship (Sexual display): The patterns of courtship are simple in domestic animals but species specific differences do occur. Once attracted to a female partner, the bull tests her receptivity by sniffing and licking around the perineal region. These actions indicate chemical communication in between the male and female partners. Sniffing to female's genitalia and urine is very commonly seen in cattle, sheep and goat. Sniffing to females head is commonly seen in swine and horses. Following sniffing to female's genitalia and urine, the male stands rigidly, makes the head in horizontal position with neck extended and the upper lips are curled upward to

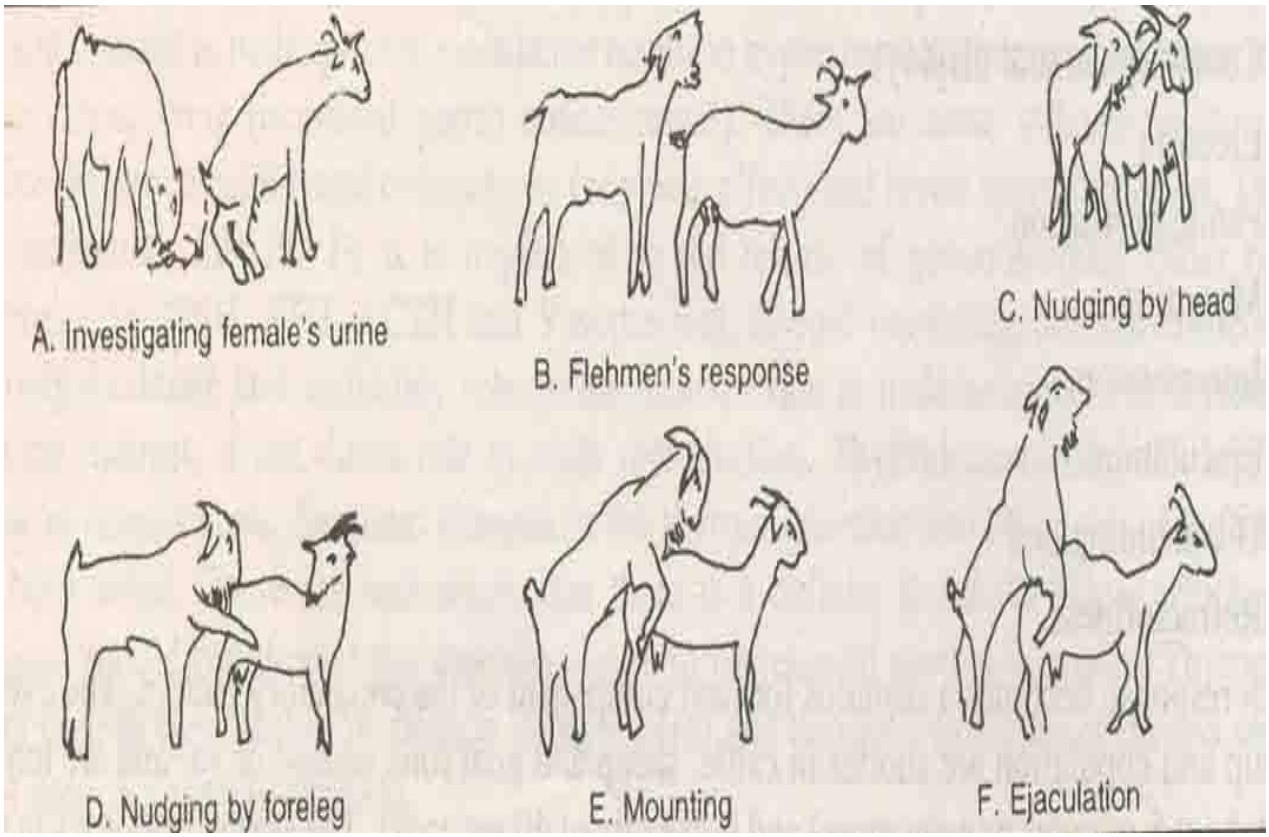


Figure 3: Sexual responses in goat

perform the "Flehmen's reaction". Flehmen's reaction is seen in all species except in swine**.** Characteristic odour does not appear to play role during courtship. However, species specific patterns of urination during courtship are noticed in some species. Stallion marks with urine the place where an estrous mare has urinated. There is rhythmic emission of urine during sexual activity. In goats, frequent micturation on forelegs is seen during sexual activity**.** In cattle and sheep, urination during sexual excitement has not been observed.

Vocalization

Species specific vocalization patterns are also observed in males during courtship. Courting bleats are noticed in male sheep and goat during sexual display. Courting grunts are observed in swine. Neighing is observed in horses during sexual excitement. In bulls no vocalization patterns are observed during sexual display.

Nudging

(Nudge = to push gently specially to draw attention) and licking of the females external genitalia and perineal region are noticed in cattle, sheep and goat. Nudging of the female through forelegs is commonly seen in sheep and goat. Nudging through nosing the flank area of the female is observed in swine. The stallion bites over the mare's back and neck and also licks the mare's body.

3. Erection and penile protrusion: The vascular penis in the stallion and dog erects slowly and there is foreplay before

copulation. The penis of bull, ram and boar is fibroelastic and the vascular tissue is much less and there is varying amount of foreplay in these species. The erection process is predominantly under the control of parasympathetic nervous system. Reflex stimulations from testicles, urethra, prostate or penis and specially the glans penis cause erection. The acts of erection and ejaculation are reflex with centers being located in the lumber region of the spinal cord and also involve cerebral cortex of the brain.

The penis of the sexually active male may erect partially and there may be to and fro penile movements before mounting. During this process dribbling of accessory fluid derived from bulbourethal glands may also be seen. The male rests his chin on female's body and the receptive female respond by standing quietly in order to allow mounting by the male.

4. Mounting

The sexually active male mounts the female. Some initial mounts may be un-successful. During this process the movements of bull's hind limbs and contractions of his abdominal muscles particularly the rectus abdomins muscle align the glans penis both horizontally and vertically to seek vulva for penetration. The male mounts, grasps the female by fixing forelegs around female's body. During this process rhythmic pelvic thrusts may be performed (Fig. 4). The mounting has been widely exploited in semen collection from bulls. Practically the greatest stimulus for bull to ejaculate is the female's rear quarter or something similar to it. Even male dummies are satisfactorily utilized for

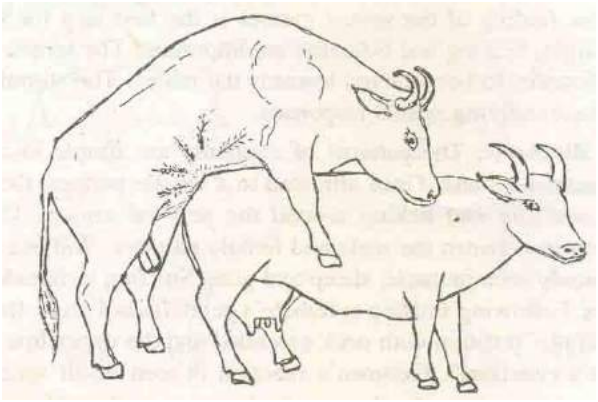


Figure 4: Mounting and intromission by bull. The male grasps the female's body by fixing forelegs around female's body and there is contraction of abdominal muscles, particularly the rectus abdominis muscle.

semen collection. However, the mounting object should be at appropriate height, should have adequate strength and should have immobility.

5. Intromission: In farm animals one Intromission takes places per copulation. At mounting, the male's pelvic region is brought in close apposition to the female's external genitalia. The movements of the male help the glans penis to seek vulva. The vulvar heat and moisture are detected by the superficial nerve endings of the glans penis and this sensation is the leading factor for proper Intromission. Stallion oscillates the penis several times which causes its engorgement with blood and thus making it rigid for intromission. Full intromission of the penis occurs after ejaculatory thrust. The duration of the intromission varies greatly in between different species. The intromission is instant in bull, ram and goat. Boars on average take 5 minutes per mating, however, they may maintain intromission up to 20 minutes. Horses maintain intromission on an average for 40 seconds.

6. Ejaculation*:* The ejaculation after intromission is dependent upon the nerve impulses from the dorsum of the free portion of the penis. Generalized muscular contractions especially of abdominal muscles take place at ejaculation. The process of ejaculation start from epididymis, travel along ductus deferens and at the same time accessory sex glands contract and their contents are forced into urethra. Oxytocin is released and causes transport of semen in the epididymis and ductus deferens. Rhythmic contractions of the urethral, ischiocavernosus and bulbospongiosus muscles cause release of semen from urethra. At ejaculation there is maximum lengthening of the penis so that the semen is ejaculated near os cervix in case of cattle, sheep and goat, in the ceryix and uterus in boar and in the uterus in horse. At ejaculation the bull leaps and the thrust is very strong. Bulls often coil the penis during ejaculation. Ejaculation in sheep and goat is characterized by backward movement of the male's head. The bull at ejaculation presses its head on female's back. The boar remains motionless during ejaculation, however, scrotal contractions are observed. During such period of immobility some thrusts at irregular intervals are seen in boar. In horses the male bites the femals neck.

7. Dismounting: After the ejaculation has taken place, the male dismounts and soon the penis is withdrawn into the prepuce. Postcoital display is rare in domestic animals. Postcoital reactions are generally not seen in cattle, swine and horse. The male goat licks the penis after ejaculation. The male sheep stretches its head and neck after ejaculation.

8. Refractoriness: Most of the males would not show sexual interest in females immediately following copulation and this is known as refractoriness. The period of refractoriness varies greatly in between individual males. Repeated and successive copulations greatly increase the period of refractoriness. The period of refractoriness is modified by environmental stimuli e.g. male to female ratio, cyclicity of the female, length of the breeding season and social interactions among animals. The presentation of new stimuli can revitalize sexual interest in males. Generally, approach of the male towards the female is selective in nature. The goat, boar and stallion reach exhaustion after smaller number of ejaculations than ram and bull**.** The pasture-mated bulls may perform 30-35 services per day provided stimulus is adequate. After long period of sexual rest, a ram may perform up to 50 services on first day but this frequency would greatly reduce on subsequent days.

Sahiwal Cattle: A Unique Genetic Resource Of India

Ankaj Thakur[1]and Anshuman Kumar[2]

[1]Ph.D Scholar LPM, [2]Ph.D Scholar AGB
ICAR-National Dairy Research Institute, Karnal, Haryana, India-132001
[1]Corresponding author: ankajthakur27@gmail.com

Cattle population of India is 190.1 million (Indian Livestock Census 2012). There are 39 breeds of cattle in India and about 59.4% of cattle population arenon-descript and only 9.4 % is indigenous pure breed (GOI). Milch breeds are Sahiwal, Red sindhi, Gir, Tharparkar, Rathi. Sahiwal cattle are considered the "best zebu milch breed in the tropics" (Maule, 1990). Going back to history of present Sahiwal cattle in India, it is known that the Maharaja of Bikaner invited Sahiwal breeders from Montogomery area about 200 years ago but, during the partition most of the breeders went to Pakistan but few remained in India. Due to its utility importance, efforts have been made from time to time to not only increase their number but also their production performance through establishment of some herds. First farm was established at ChakGanjaria, Uttar Pradesh in 1950 and next at Anjora, Durg, Madhya Pradesh (Present Chhattishgarh) in 1956. Climatic change is increasing its demand overseas (Australia, Brazil) as it is known for its resilient qualities such as tick resistance, heat tolerance and ability to utilize even low quality feeds

Synonyms

Synonyms of Sahiwal areLola (loose skin), Lambi Bar, Montgomery, Multani, Teli.

Origin

These animals are originated from Montgomery district in present Pakistan.

Breeding tract

Fazilka and Abohar towns of Ferozepur districts of Punjab

Dispersion

Sahiwal is an international trans-boundary breed and available in 29 countries across the globe (FAO). Both semen and cows of Sahiwal had been exported to countries like Mauritius, Kenya, Tanzania, Sierra-Leone, Malaysia, Phillipines, Vietnam, Thailand, Myanamar, Bangladesh, Sri

Lanka, Nepal, Brazil, Jamaica, Trinidad, Australia and New Zealanddue its better adaptability to and subtropical environment and reasonable dairy performance.Kenya is the third leading country with Sahiwal cattle genetic resources now mainly imported from India and Pakistan. Now, it serves as an important breeding stock for propagation, upgrading small East African zebu cattle and crossbreeding with temperate cattle breeds. This breed is involved in the development of cross-breed Karan-Swiss and Frieswal. Other breeds like Australian-Friesian Sahiwal (AFS), Australian Milking zebu (AMZ), Jamaica Hope, Mpwapwa (Indo-African zebu cattle breed), Malaysian Mafriwal,Taurindicus (New Zealand) also has Sahiwal inheritance.

Population dynamics

The Sahiwal population has been dwindling in the country due to crossbreeding with exotics such as Holstein and small population size. Population of Sahiwal in **Punjab** - 38446 (Livestock Census 2012). The situation is critical for Sahiwal, which can be put in category of threatened breeds.

Physical characteristics of the breed

- The colour is reddish dun or pale red, sometimes flashed with white patches
- Height : Male- 136 cm , Female- 120 cm
- Weight : Male- 400-500 kg(sometimes up to 1000 kg) , Female- 300-350 kg
- The Sahiwal is a heavy breed with symmetrical body and loose skin
- Animals are long, deep, fleshy and comparatively lethargic
- Horns are short and stumpy
- Dewlap is large and heavy. Hump in males is massive and frequently falls on one side
- Naval flap is loose and hanging. Sheath in males is also pendulous.
- Tail is long and fine with a black switch reaching almost to the ground
- The distinguishing feature between Sahiwal and Red Sindhi is the muzzle
- Red Sindhi has dark colour muzzle whereas Sahiwal has lighter colour muzzle. Sahiwal has also whitish ring along the eye. Muzzle and eye-lashes are of lighter colour
- Udder large and strong and occasionally have white patches

Productive and reproductive performance

Sahiwal is best India dairy breed and most economic milk producer. Milk yield varies from 2000 to 4000 kg per lactation, with fat content varying from 4% to 4.5%. Highest milk recorded from Sahiwal is 22.7 kg (National livestock championship in Punjab, 2015).Average incidence of culling in female calves was higher in crossbred and exotic cattle in comparison to Sahiwal cattle.

Estimates of culling rate up to AFC in Sahiwal cattle ranged from 7.10% to 19.93%. (Upadhyay 2013 and Shahi*et al* 2006).Whereas, in crossbred and exotic cattle breeds, average culling rate ranged from 11.57% for Frieswal to 31.05% for Holstein-Friesian, with the average being 18.08%.Average incidence of abnormal calving in exotic and crossbred cows was 8.65%, whereas, in Sahiwal cows average incidence was 4.70%(Upadhyay*et al.*2014).

Table: 1-

Parameters	Performance
Age at first calving (day)	879-1568 (Avg. 1268)
Weight at first calving (kg)	287-380 (Avg. 343)
Service period (day)	126-195.5 (Avg. 148.0)
Dry period (day)	120-183.5 (Avg. 156)
Calving Interval (day)	383.2-482.1 (Avg. 402.5)
Lactation milk yield (kg)	1928-2632 (Avg. 2064.6)
Lactation length (day)	270-300 (Avg. 285)
Peak yield (kg)	10.1-12.1 (Avg. 11.1)

Joshi and Singh (2005)

Adaptability to tropical and subtropical climate

Best milch breed of zebu cattle, known for its endurance and high resistance to parasites both internal and external. Moreover it is heat tolerant and drought resistance. Impact of climatic change due to global warming will negatively impact production. The decline in production and reproductive efficiency will be highest in exotic and cross bred cattle followed by buffaloes

Marketing strategies

Milk

- Indigenous breeds possess the milk having A2 allele beta-casein protein unlike exotic cows having A1 allele of milk. A2 allele is 100% available in high yielding milk breeds- Red Sindhi, Gir, Rathi, Sahiwal and Tharparker. A2 milk demand is rising in foreign countries due to consumer awareness as A1 milk can cause Type 1 Diabetes, Coronary heart disease, Autism, Schizophrenia.
- Sahiwal cows' milk is closer to human mothers' milk, due to its significantly lower soluble phosphate level, compared to the milk from Holstein cow and buffalo. It may be better alternative, than the Holstein cow or buffalo, for the preparation of infant formula (Mehta and Nautiyal 2004).

Therefore, promotion of A2 milk will help farmers shift to traditional breeds and will also make gaushalas economically viable. Selling of milk at higher price and subsidizing the feed costs can encourage more farmers in switching from crossbreds to desi cows

Panchagavya

Pachgavya (cow milk, gomutra, curd, ghee and cow dung) as ayurvedic medicines may be effective in many diseases like Psoriasis, neurological disorders, Diabetes, tuberculosis, arthritis

Urine

Sahiwal cows showed average concentration Zinc, Potassium, Calcium and Iron. Cow urine has been developed as bio-enhancer of anti-infective, anticancer agents and nutrients.

Biogas

It is an important green power which can be used in reducing carbon footprint

Need for Conservation

- Among the population of milch breeds, Sindhi and Sahiwal have significantly reduced
- Dilution of breeds due to intermixing
- Indiscriminate infusion of exotic germplasm for enhancing milk production

- Absence of specific strategies and programmes for conservation of indigenous breeds
- Loss of breeds due to geographical reorganization

Breeding Farms and Gaushala

- Cattle Breeding farm: Jagduar; Pachmile; Silchar, Assam
- Sabarmati Ashram Gaushala, Bidaj, Gujarat
- Government Livestock Farm, Hisar, Haryana
- National Dairy Research Institute, Karnal, Haryana
- Satguru Hari Singh Animal Breeding Farm, Sri Jiwan Nagar, Sirsa, Haryana
- Shri Gaushala Society (Regd.), Panipat, Haryana
- Government cattle Breeding Farm, BeliCharana, Jammu & Kashmir
- Cattle Breeding Farm, Anjora, Durg; Imlikhera, Chhattishgarh
- Government cattle Breeding Farm, Bod, Wadsa, Maharastra
- Government cattle Breeding Farm, Nabha, Punjab
- Pinjrapole Gaushala, Amritsar, Punjab
- Tamil Nadu Co-operative Milk producers'Federation Ltd., Udhagamandalam (TN)
- State Livestock-cum-Agricultural Farm, Chakganzaria, Uttar Pradesh
- Military farm, Meerut, Uttar Pradesh

Nivsarkar*et al.* (2013)

Rashtriya Gokul Mission

RashtriyaGokul Mission is a focused project under National Programme for Bovine Breeding and Dairy Development, with an outlay of Rs.500 crore during the 12th Five Year Plan. It aims at the development, preservation and conservation of indigenous cattle breeds "in a focused and scientific manner". Funds under the scheme will be allocated for establishment of integrated indigenous cattle centres – Gokul Gram- and strengthening of bull mother farms to conserve high genetic merit indigenous breeds.

REFERENCES

Maule, J. P. (1990)The Cattle of the Tropics. University of Edinburgh Centre for Tropical Veterinary Medicine, Edinburgh.

Mehta S and Nautiyal C S (2004) A method of distinguishing human and bovine milk samples based on soluble phosphate content. *Food control* 17(3): 180-82

Nivsarkar, A. E., Vij, P. K., and Tantia, M. S (2013) Animal Genetics Resources of India, Cattle and Buffalo.ICAR New Delhi publication. pp 144-49

Shahi, B.N. and Kumar, D. (2006) Factors affecting replacement rate and its components in Jersey-Sahiwal cattle. Indian J. Anim. Sci., 76: 855-856.

Upadhyay, A. (2013) Analysis of disposal patterns in Sahiwal cattle. MVSc Thesis.NDRI, Karnal, Haryana, India.

Upadhyay, A, Sadana DK, Gupta A K, Chakravarty A K, Dash K, Dash M K, Anushree M and Shivahre (2014)Age and lactation specific disposal pattern in Sahiwal cattle and influence of various genetic and non-genetic factors. *Veterinary World* 7(10): 842-47

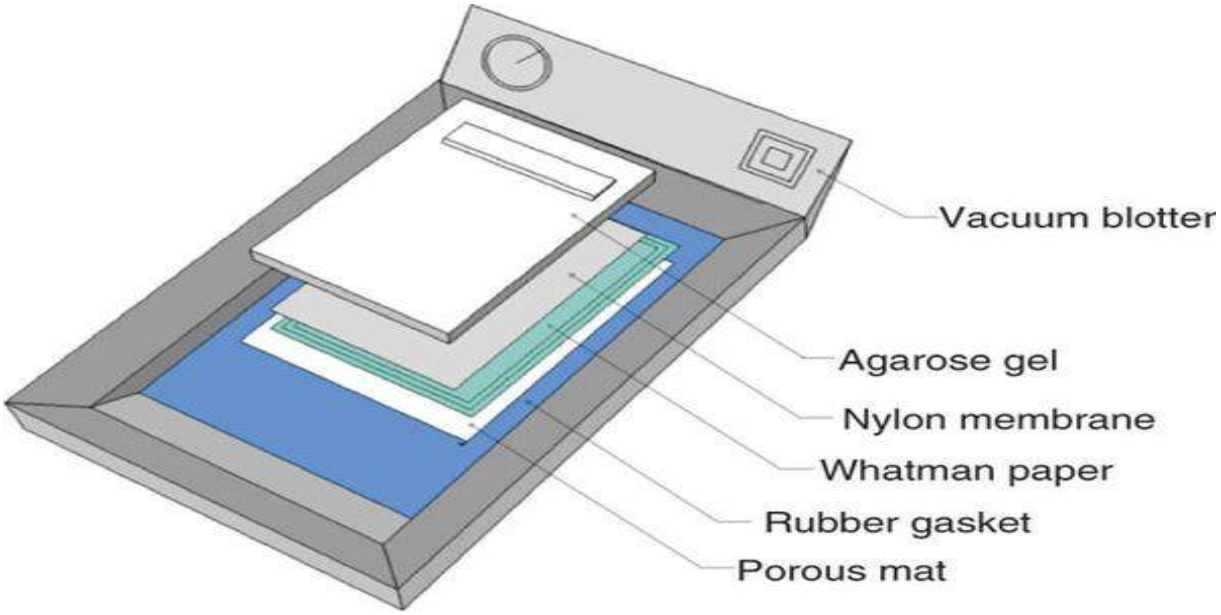
Southern Blotting:

A Molecular Technique for Detection of Specific DNA Sequence in Livestock Genome

[1*]Binoy Chandra Naha, [2]Prasanta Boro, [1]Lalrengpuii Sailo, [3]Chandra Prakash, [1]Atherajendra Prasad, [1]Rajni Chaudhary and [1]Om Prakash

ICAR- Indian Veterinary Research Institute, Izatnagar, Bareilly, U.P-243122
[1] PhD Scholar, Animal Genetics Division, ICAR-IVRI
[2]PhD Scholar, LPM Section, ICAR-IVRI
[3]MVSc Scholar, Animal Genetics Division, ICAR-IVRI
Corresponding Email: binoychandranaha@gmail.com

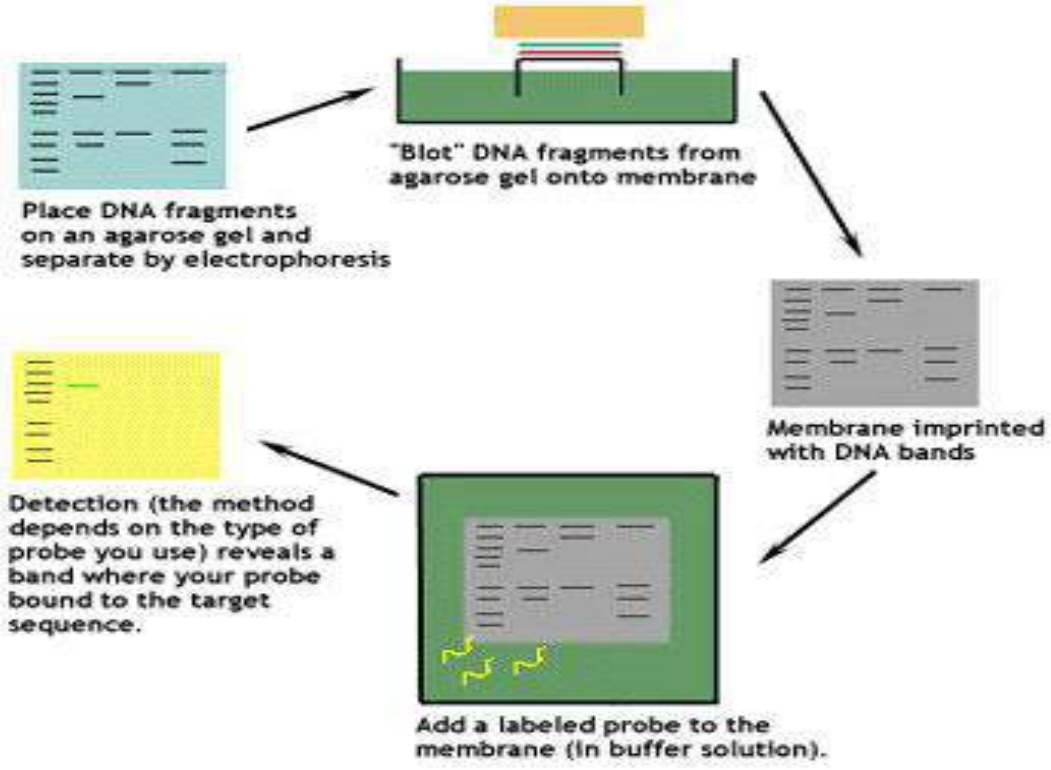
A Southern blot is a method used in molecular biology for detection of a specific DNA sequence in DNA samples. Southern blotting combines transfer of electrophoresis-separated DNA fragments to a filter membrane and subsequent fragment detection by hybridization. The method is named after its inventor, the British biologist Edwin Southern. Other blotting methods (i.e., western blot, northern blot, eastern blot, southwestern blot) that employ similar principles, but using RNA or protein, have later been named in reference to Edwin Southern's name. As the label is eponymous, Southern is capitalised, as is conventional for proper nouns. The names for other blotting methods may follow this convention, by analogy. Southern blotting is the transfer of DNA fragments from an electrophoresis gel to a membrane support. The transfer or a subsequent treatment results in immobilization of the DNA fragments, so the membrane carries a semipermanent reproduction of the banding pattern of the gel. After immobilization, the DNA can be subjected to hybridization analysis (*UNIT 2.10*), enabling bands with sequence similarity to a labeled probe to be identified. When setting up a Southern transfer, choices must be made between different types of membrane, transfer buffer, and transfer method. The most popular membranes are made of nitrocellulose, uncharged nylon, or positively charged nylon. Although these materials have different properties, the three types of membrane are virtually interchangeable for many applications. The main advantage of nylon membranes is that they are relatively robust and so can be reprobed ten or more times before falling apart. Nitrocellulose membranes are fragile and can rarely be reprobed more



than three times; however, these are still extensively used, as they give lower backgrounds with some types of hybridization probe. The properties and advantages of the different membranes are discussed more fully in the commentary. The basic protocol describes Southern blotting via upward capillary transfer of DNA from an agarose gel onto a nylon or nitrocellulose membrane, using a high-salt transfer buffer to promote binding of DNA to the membrane. With the high-salt buffer, the DNA becomes bound to the membrane during transfer but not permanently immobilized. Immobilization is achieved by UV irradiation (for nylon) or baking (for nitrocellulose). A support protocol describes how to calibrate a UV trans illuminator for optimal UV irradiation of a nylon membrane. The first alternate protocol details transfer using nylon membranes and an alkaline buffer, and is primarily used with positively charged nylon membranes. The advantage of this combination is that no post-transfer immobilization step is required, as the positivelycharged membrane binds DNA irreversibly under alkaline transfer conditions.

SOUTHERN BLOTTING MACHINE

The method can also be used with neutral nylon membranes but less DNA will be retained. The second alternate protocol describes a transfer method based on a different transferstack setup. The traditional method of upward capillary transfer of DNA from gel to membrane described in the first basic and alternate protocols has certain disadvantages, notably the fact that the gel can become crushed by the weighted filter papers and paper towels that are laid on top of it. This slows down the blotting process and may reduce the amount of DNA that can be transferred. The downward capillary method described in the second alternate protocol is therefore more rapid than the basic protocol and can result in more complete transfer. Although the ease and reliability of capillary transfer methods



makes this far and away the most popular system for Southern blotting with agarose gels, it unfortunately does not work with polyacrylamide gels, whose smaller pore size impedes the transverse movement of the DNA molecules. The third alternate protocol describes an electro blotting procedure that is currently the most reliable method for transfer of DNA from a polyacrylamide gel.

SOUTHERN BLOTTING OF GENOMIC DNA

1. Digest DNA:

- 1.5 µg DNA in a 25 µI reaction containing BSA
- 3 to 5 units for 5 to 3 hours (aim for 10-fold over digestion; remember many enzymes will not
- survive well for more than 3 hr).
- Also prepare molecular weight standard (Lambda plus HindIII); avoid plasmid-derived markers (1kb ladder, etc.) since it might cross-hybridize with the probe!

2. Run gel:

- Ioad samples onto agarose gel (typically 0.8 to 1.0% agarose in TBE, depending on desired size range).

SOUTHERN BLOTTING

- run gel at maximum rate of 5 volts per cm.
- run until the bromophenol blue has run ca. 9 cm (some DNA will run 1-2 cm below the dye).
- Using gloves, place in staining solution (0.5 to 1 µg/ml ethidium bromide in water, 20-40 min. Becareful not to break the gel.

3. Nicking of DNA (to improve transfer of high molecular weight DNA):

- Place the gel (on a plastic plate) in a UV oven.
- Irradiate ca. 1200 joules.
- Destain 10-30 minutes in water (optional) and photograph.

4. Transfer to nylon membrane:

- Wear gloves when handling blotting membrane, wicks, etc., since oils on skin will inhibit transfer. WASH OFF powder from gloves before use.
- Soak gel 20-40 minutes in denaturation solution (0.4 M NaOH, 0.8 M NaCI)
- Set up capillary blot apparatus (this is one of several transfer methods that can be used for transfer of DNA) as shown on the next page.
- Cut out wicks from Whatman 3 paper using the paper cutter. Setting up the blot will be easiest ifone dimension of the wick equals that of the gel. Soak the wick in denaturing solution. Place on plastic sheet suspended on a giasspyrex dish. Use a pipette to rub out any air bubbles.
- CAREFULLY turn over gel and place on top of wick apparatus (transfer is sometimes inhibited bythe hardened top surface of gels). Use plastic sheets to help turn over the gel. Use a wet, gloved finger to press out any air bubbies.
- Place a sheet of Hybond N+ membrane on the gel. Use a piece the same size as the gel. Do not prewet the membrane. Be careful to align the membrane with the gel. Use a pipette to rub out any bubbles.
- Cover with 2 wet sheets of Whatman paper, cut to exactly the same size as the nylon. Cover with2-4 sheets of dry paper.
- Add "short circuit" prevention device (to make sure that liquid will not bypass the gel and membrane). Use either saran wrap, nescofilm, etc. to cover parts of the wick that might later come into contact with the paper towels.
- Cover with a few inches of blue paper towels, followed by a piastic sheet and weight (1 kg for a 5x 10 inch gel).

5. Final preparation of membrane (post-blot treatment):

- Let the transfer proceed for 12-18 hr (do not let go longer as the quality of the biot will degrade with time.
- Remove the paper towels and whatman paper from the transfer apparatus, until the membrane isexposed.
- Use a clean blade to notch one side of the membrane to help orient it to the gel (I make a notch on the top of the gel by lane #1). Label the membrane using a pencil.
- Carefully remove the membrane and place, DNA side up, in a dish containing ca. 200 ml of 3X SSPE (20X SSPE is 3.6M NaCI, 0.2M sodium phosphate, 0.02M EDTA pH 7.7). Rock back and forth 10 seconds. Repeat two more times to neutralize the membrane (the alkali transfer covalently bonds the DNA to the membrane; baking or drying is not needed).
- Air dry in a clean and protected piace. Store at room temperature until needed for hybridization.

MAKING PROBES FOR DNA (or RNA) BLOTS

A. Labelling the DNA

The lab currently uses a kit from Amersham. Here is a brief protocol:

1. In screw-cap 1.5 ml tube, place 25 ng DNA in 30 µl water plus 5 µl primer/BSA mix.
2. Boil 5 min; place on ice.
3. Add 10 µl labelling mix.
4. Using a filter-tip pipette tip, add 5 µl (50 µCi) 32P-alpha-dCTP
5. Add 2 uIKlenow.
6. Close the tube. Mix gently by agitating with finger. Spin 10 seconds.
7. Incubate 37°C 10-30 minutes (for Megaprime kit).

B. Removing unincorporated label

- Make a minicolumn in a narrow-tipped plastic transfer pipette.
- Cut off the bulb (top)
- Plug the bottom using a small chunk of sterile, siliconized glass wool.
- Support the column in a 2 ml screw-cap tube.
- Add gel slurry (Biogel P-60 100-200 mesh in TE [10 mMTris 8.0, 1 mM EDTA]
- plus 0.2 % SDS).
- Add about 2 inch of 66% slurry for a typical column.
- Wait for the resin to settle and for the liquid to drain out; discard the liquid.
- To the DNA labelling reaction (50 µl) add about 20 µl of column loading buffer:50% glycerol 0.1% bromophenol blue (dark blue) 1% blue dextran (light blue-aquamarine)
- Store buffer at 4°C (aliquots can be kept at room temp for 2+ months)
- Load the reaction. For the greatest efficiency, try to squirt it down to the top of the resin, along the side of the column.
- Once the reaction has entered the resin, fill the column with TE-0.2% SDS.
- The labelled DNA will elute with the blue dextran. Just before the bromophenol blue elutes, remove the column. Cap the tube.
- On the geiger counter a "good" probe will register >2x105 cpm.

APPLICATIONS

Southern transfer may be used for homology-based cloning on the basis of amino acid sequence of the protein product of the target gene. Oligonucleotides are designed that are similar to the target sequence. The oligonucleotides are chemically synthesised, radiolabeled, and used to screen a DNA library, or other collections of cloned DNA fragments. Sequences that hybridise with the hybridisation probe are further analysed, for example, to obtain the full length sequence of the targeted gene. Second, Southern blotting can also be used to identify methylated sites in particular genes. Particularly useful are the restriction nucleases MspI and HpaII, both of which recognize and cleave within the same sequence. However, HpaII requires that a C within that site be methylated, whereas MspI cleaves only DNA unmethylated at that site. Therefore, any methylated sites within a sequence analyzed with a particular probe will be cleaved by the former, but not the latter, enzyme.

Aflatoxicosis/Groundnut Poisoning: A Foe to Poultry Farmers

Rakesh Kumar[1*], Rahul Katiyar[1*], Vikas Kausal[2], Sourabh Kant[2], Kunal Pandit[3], Manish Kharwal[2], Namit Mohan[2] and Akash Uniyal[2]

Ph.D. Scholars[1], MVSc scholars[2], ICAR-IVRI, Izatnagar, Bareilly, U.P. 243122; MVSc scholar, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

Corresponding Author: rakudoc@gmail.com

India being a humid and hot country, often there is a problem of storage and handling the feed. Due to the lack of processing and drying facilities at our villages many of cereals support mould formation and thereby production of toxins called as mycotoxins. These are basically toxic metabolites of fungus which are quite harmful to poultry as well as other animals and human beings. Groundnut cakes and maize are the most common sources of mycotoxins.

The most common mycotoxins of animal health concern are:

S. No.	Effect	Mycotoxin
1	Hepatotoxins	Aflatoxin, Phomopsin, Spordesmin
2	Nephrotoxins	Ochratoxin, Citrinin, Oosporein
3	Cardiotoxin	Moniliformin
4	Osteotoxin	Fusarochromanone
5	Osterogenic toxin	Zearalenone (F2 toxin)
6	Ergotism (SOD disease)	Ergotamine
7	Ulcerative stomatitis	Trichothecene (T2 toxin)

The most important and common among all the mycotoxins is aflatoxin. The disease caused by aflatoxins is called as aflatoxixosis/ groundnut poisoning. This disease is called as groundnut poisoning because it was firstly reported in dogs fed with contaminated groundnut meal. The existence of the mycotoxin was first reported in 1960s. This toxin if formed once, it cannot be destroyed at milling and storage. The production of aflatoxins by fungus requires tropical environment (more humid and 30-35 ^{0}C temperature). Important species leading to aflatoxicosis includes:

- *Aspergillus flavus*
- *Aspergillus parasiticus*
- *Aspergillus puberulum*

At least more than 17 different type aflatoxins exists. But the most important are B1, B2, G1, G2, M1 and M2. These shows structural resemblance with coumarin. Among all these toxins B1 is most potent and associated with most of the outbreaks. B1 metabolized to M1 and found to be excreted in milk. In poultry, aflatoxicosis, ochratoxicosis and trichothecosis are most commonly seen mycotoxicosis.

Susceptibility variation

i. Young birds are more susceptible than older ones.
ii. Male birds are more susceptible than females.
iii. Turkeys/ ducklings more susceptible than chicken.
iv. Rats are more susceptible than mice.
v. Horses are relatively resistant to aflatoxicosis.

Order of susceptibility in different birds:

Ducklings> Turkeys> Chickens (ducks 10 times more susceptible than chickens).

Mechanism of action:

- Aflatoxins inhibit nucleic acid and protein synthesis.
- Leads to immunosuppression as responsible for T cell function impairment (decrease CMI).
- Leads to mutation of p-53 gene, so, acts as carcinogen capable to cause liver cancer (Hepatoma, hepatocellular carcinoma and hepatic cell carcinoma).

In acute cases it leads to sub-normal temperature, hemorrhages in muscles, jaundice, increase LFTs, severe hepatic necrosis and edema of gall bladder.

Patterns of hepatic necrosis in different animal species	
Cattle/pigs/dogs/guinea pigs	Centrilobular necrosis
Birds/cats/rats	Periportal necrosis
Rabbits	Midzonal necrosis

In chronic cases most striking features seen are bile duct proliferation and periportal fibrosis. Sometimes there is occlusion of central vein by fibrous tissue so also called as **veno-occlusive disease.** Thus also concerned with alteration in coagulation mechanism and can lead to anemia in birds. This toxin also have effect on hatchability of eggs mainly in White Leghorns. As it can lead to inhibition of ova maturation and decline in sperm count.

The levels of aflatoxins the birds can resist:

Dose	**Effect**
>10 ppm	Lethal
>1	Decrease in FCR
>0.5	Decrease pigmentation
>0.2	Decrease hatchability

The detection of aflatoxins is to done by DOT ELISA, thin layer chromatography, flurotoxinometer and aflacord total test.

Prevention and Control:

i. Decrease the moisture level up to 10% in storage room.
ii. Provide proper ventilation in storage room.
iii. Dry gunny bags properly used for grain storage.
iv. Wash the floor with pentachlorophenol or sodium- pentachlorophenate.
v. Severity in birds can be reduced by providing more proteins and vitamins in diet.
vi. Treatment can be done with aureomycin.
vii. Gentian violet has recently been recommended as an excellent inhibitor of fungi as well as gram positive bacteria.

Because of immunosuppressive effect of this toxin the CMI get reduced, thereby other agents like *Salmonella, Coccidia*, MD virus and IBD virus get a chance to supervene. Vaccination failure is also one of the important outcome of aflatocosis.

Mammary Involution in Domestic Animals

Sabita Behera[1*], Dayanidhi Jena[2] and Shamik Polley[3]

[1]Divison of Veterinary Bacteriology and Mycology, IVRI, Izatnagar – 243122
2Department of Gynaecology and Obstetrics, Ranchi Veterinary College Ranchi, Birsa Agricultural University, Kanke, Ranchi-6
[3]Department of Veterinary Biochemistry, Ranchi Veterinary College, Birsa Agricultural University, Kanke, Ranchi-6
Corresponding author- sabitabehera1989@gmail.com

Abstract

Mammary gland plays a significant role in the female reproduction system and its complications affect milk productionwhichstrike severely to the backbone of farmer'seconomic condition. Dueto huge demand of milk and milk productsthe production capacity of the animal has been increased but increase productivity compel farm animals to several disorders.The normal physiological process by which the mammary gland undergoes various structural and functional changes is moderately understood but overall mechanism influencing structure and function of the mammary gland yet to be known. The apoptosis of mammary gland epithelial cells, the STAT$_3$ and STAT$_5$ proteins apart from the hormonal factors like estrogen and progesterone are considered as key factors to determine structure and function of mammary duct and alveolar system of mammary gland.

INTRODUCTION

Mammary glands of female mammals are organs for milk production. Mammary glands are composed of a branching networkof ducts formed by epithelial cells terminating in extensive lobulo-alveolarclusters that constitute the sites of milk synthesis, storageand secretion. During development the mammaryglands progress through a series of highly complex and complicated multistep process from puberty to pregnancy and further modification after the parturitionuntil reaching their ultimatefunction to synthesize and secrete milk. Change in mammary gland involves the spectacular lobulo-alveolar growth followed by the complete differentiation of the mammary epitheliumat the time of pregnancy to lactation andfinally dramatic switch from survival to death signalling takes place at weaning leading tomammaryglands involution. Involution is the course of action in which the lactating gland returns to a morphologically near pre-pregnant state. It occurs either in a steady fashion just after peak lactation orregular decrease in suckling or sometimes in an abrupt fashion after cessation of milking orsudden weaning of the young and

whole process to a large extent is regulated by environmental factors like milking or suckling.The entire process involves extensive tissue remodelling characterized by massive programmed cell death of epithelial cells. The switch between lactation and involution in the mammary gland requires the integration of different signalling pathways. All these processes are maintained by a delicate balance of a cascade of events involving physiological, hormonal and genetic level, many of which aresynergisticallydecide the fate of mammary gland.The primary factors affecting mammary gland function is hormones, including galactopoietic hormones such as growth hormone (GH) and suckling induced prolactin secretion generally stimulate milk secretion.

Mammary epithelial cells and its apoptosis:

The daily milk yield in a lactating cow follows a trajectory path which involves higher milk production after calving which is followed by the declining phase where the production levels slowly declines. Several factors affect the production level like the environmental and managemental, general health status, photoperiod and endocrine status of the animal. The variations in milk yield during lactation consequence from changes in the mammary secretory tissues that produce the milk. Milk yield outstandingly depends on the number and activity of mammary epithelial cells (MECs) as well as minimal mammary tissue remodelling. In early lactation, the proliferation rate of MECs is higher than the apoptosis rate, by this means increasing the number of MECs. Higher rate of secretory activity of MECs and very low level of tissue remodelling leads to a rapid increase in milk yield. During lactation period, the apoptosis rate in the mammary gland increases gradually until it becomes higher than the proliferation rate, which initiates the turn down ofmilkyield.

Rapid loss of MECs,boost of apoptosis and mammary tissue remodelling process point towards regression of alveolar tissues resulting turn downof milk production and finally initiation of mammary gland involution. Mammary gland involution is characterized by degradation of extracellular matrix by matrix metalloproteinases and disruption of epithelial tight junctions. This disruption is responsible for the loss of epithelium integrity and bidirectional passage of blood and milk components to vice versa.The milking frequency, accumulate milk in the udder and endocrine factors such as sex steroidsinfluence the integrity of mammary gland.Administration of exogenous estradiol in late-lactating cows induces a rapid drop in milk yieldwhich isdirectly associated with reduce a-lactalbumin, lactose and potassium concentrations and enhance lactoferrin and sodium concentration in the milk. Exogenous estradiol may be responsible for acceleration of normal involution with more leaky tight junctions. In the mammary gland of a late-lactating cow, the advance apoptosis rate and mammary tissue remodelling alter milk composition for mammary gland involution. The cessation of lactation is followed by regression of the secretory tissue and initiation of mammary gland involution. The early involution stage is characterized by reduce level of milk-specific protein concentration (a-lactalbumin, b-lactoglobulin and caseins)

which is inversely proportional to both blood protein (immunoglobulin and BSA) and mammary lactoferrin protein concentration. This may beassociated with slow down synthesis activity in mammary secretory tissue as well as tight junction disruption in the mammary epithelium.

STAT protein and glucocorticoid receptor:

Gene expression is well regulated by control activation of distinct transcription factors which directly interact with DNA and other transcriptional regulators. Among several transcription factors, two key transcription factorslinked with different processesinmammarygland development and involution are the glucocorticoid receptor (GR), and the signal transducers and activators of transcription (STATs).After translocation to the nucleus,activated GR modulates the expression of target genes by direct DNA binding as well as by protein-protein interaction. After Activation STAT moleculesdimerize and translocate to the nucleus and regulate gene transcription after binding to specific DNA elements. Previous studies have reported that different STAT family protein interact with GR both physically and functionallyand cross talk between both families of transcription factors has been found to be associated with regulation of cell proliferation, differentiation and survival in a tissue specific manner.For example, GR and STAT5 factors play antagonistic effects on cell death in hippocampal cells, whereas STAT3 behaves as a GR coactivator in hepatocytes and B cells.GR synergizes both lactogenic and survival activity of STAT5 in mammary gland,where STAT3 antagonizes those actions, initiates the cessation of lactation period followed by apoptosis induction of mammary secretory cells.The successful differentiation of the secretory epithelium as well as milk production is regulated by both Prolactin (PRL) and glucocorticoids. The circulating PRL activates its receptor which leads to tyrosine phosphorylation of STAT5A and STAT5B by JAK2.These two members of the STAT family share more than90%of their sequence identity and typicallytake part in redundant functions.It has been demonstrated that STAT5A is crucial for mammary gland lactogenic differentiation, while STAT5B is not involved in lactogenic differentiation.In contrast, GR participates as a survival signal in the mammary gland and also play very important role in maintaining the secretory phenotype by inducing milk protein gene expression in addition to milk secretion.The prolactin-inducible protein (*pip*) gene also acts as a target gene for PRL and GR which is mainly expressed in normal exocrine glands and in benign and malignant breast tumours also.PIP is an anti-apoptotic factor and also works as a sensitive and specific marker for monitoring and defining apocrine differentiation in breastcancer. Based on reversibility involution is classified into two phases.The first phase lasts for 48 hours and starts immediately after weaning and is predominantly regulated by local factors. The second phase instigates anytime between 48 and 72 hours after weaning and it is characterized by descendent levels of circulating hormones which induce massive apoptosis of epithelial cells and mammary gland remodelling.Milk stasis

at some point in first stage of involution induces expression and secretion of the proinflammatory cytokine leukemia inhibitory factor (LIF).LIF binds to the specific LIF receptor and forms a heterodimer by recruiting the glycoprotein 130 (Gp130) signal transducer subunit resultingactivationof the JAK/STAT3 signalling pathway.LIF-dependent activation of STAT3 induces mammary epithelial cell death which is accompanied by the quick decline of STAT5 expression and activation.STAT5 directly protects cells from the STAT3-mediated death and plays a vital in preventing mammary gland involution.STAT5-deficient mammary glands show high levels of apoptosis, in contrast overexpression and activation of STAT5 delays cell death.In addition, LIF treatment provokesoverexpression of phospho-STAT3 and lesser expression of phospho-STAT5in mammary epithelial cells.

REFERENCES

L. Yart , V. Lollivier , L. Finot , J. Dupont , S. Wiart , M. Boutinaud, P.G. Marnet and F.Dessauge.2013. Changes in mammary secretory tissue during lactation inovariectomizeddairy cows, Steroids,78 (2013) 973–981.

Ting-Chieh Yu, Shuen-Ei Chen, Tsung-HuaHo, Huo-Cheng Peh, Wen-Bor Liu,AttapolTiantong, Hajime Nagahat, Chai-Ju Chang.2012. Involvement of TNFα andMAPK pathway in the intramammaryMMP-9 release via degranulation of cow neutrophilsduring acutemammary gland involution.Veterinary Immunology andImmunopathology, 147 (2012) 161– 169.

Paola Y. Bertucci, Ana Quaglino, Andrea G. Pozzi, Edith C. Kordon,and AdaliPecci. 2010.Glucocorticoid-Induced Impairment of MammaryGland Involution Is Associated with STAT5 and STAT3Signaling Modulation,Endocrinology, 151(12):5730–5740.

P. Lacasse, V. Lollivier, F. Dessauge, R.M. Bruckmaier, S. Ollier and M. Boutinaud.2012.New developments on the galactopoietic role of prolactin in dairyruminants.Domestic Animal Endocrinology, 43 (2012) 154–160.

Timothy A. Reinhardt and John D. Lippolis.2009.Mammary gland involution is associated with rapid down regulation ofmajor mammary Ca^{2+}ATPases.Biochemical and Biophysical Research Communications 378 (2009) 99–102.

Nutrient Enrichment of Eggs by Dietary Manipulation

Rishikesh Jagzap*, Banakar P.S. and Srinivasan C.

Department of Animal Nutrition, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala – 680651.

Corresponding author e-mail id: rishikesh122@gmail.com

Poultry industry of India is one of the dynamic and fastest growing industry. India ranks 3rd in egg production and 4th in in poultry meat production.Production of broiler meat in the year 2012-2013 was 2.69 million metric tons. Growth of broiler from 2007 to 2013 was 10.56% and of egg is 5.95%, whereas that of milk is only 4.60%. Even then the demand is still increasing. Present Egg availability is 61.34/head/year but the requirement is 183/head/year which is three times more than that of present situation. Same is the situation of poultry meat of which present availability is 2.6 kg/head /year and the requirement is 11 kg /head/year.

Value Addition of Eggs

Consumers are always in search of newer products and never satisfied with the existing products. This consumers' attitude applies for the poultry products also. In case of poultry products, there are two types of value addition.

I. One is, value addition before the product is produced, i.e**.-slaughter or pre-oviposition value addition".** Products like, organic / designer **/** functional eggs and meat will come under this category.
II. The other category is **"post-slaughter or post-oviposition value addition"**, which is usually referred as **"post harvest technology"**.

The health conscious consumers are in need of **safe poultry products,** which are free from drug / pesticide residues and other harmful components. Moreover, the consumers are ready to pay a premium price for such products, which are safe and also promote their health; due to the presence of special health promoting components like n-3 fatty acids, anti-oxidants, extra vitamins, minerals and non-nutrient components. These types of value addition will be done mostly by combination of management and nutritional manipulations.

Organic and cage-free eggs are the earliest pre-oviposition value added eggs. According to the American Egg Board (AEB), organic eggs are those obtained from hens fed rations having ingredients that were grown without pesticides, fungicides, herbicides or commercial fertilizers. Moreover, these hens are reared

free from cages and fed organic feeds free from any performance enhancers like antibiotics, antimicrobials, coccidiostats and other drugs.

Egg is the best vehicle to incorporate several health-promoting components in it. The fatty acid composition of egg yolk could be modified by dietary manipulation. However, this technique was not utilized for more than 50 years. In the late 80s, Sim, Jiang and their associates in the University of Alberta, Canada, have blended these ideas together and developed a **Designer Egg**, rich in n-3 fatty acids and antioxidants. They have patented this egg as **Professor Sim's Designer Egg**. They have incorporated the n-3 PUFA in the egg yolk at the expense of saturated fatty acids, by feeding hens with diets having flax seeds. Since n-3 PUFA is highly unsaturated and unstable, the yolk fat will undergo rancidity quickly; leading to off odors. To overcome this problem, they are incorporated with natural antioxidants like vitamin E, selenium and carotenoid pigments that are usually free from residues of pesticides, drugs and other harmful chemicals.

Later in Australia, Farell (1998) enriched the eggs with **folic acid and iron**; which are good for anemic patients. In Canada, Leeson (2004) produced **lutein-enriched** eggs; which will act as a retinal tonic, by preventing Macular Degeneration and Retinitis Pigmentosa. In India, Narahari (2004) has developed **Herbal Enriched Designer Eggs (HEDE)**, which are not only rich in n-3 PUFA, vitamin E, selenium, carotenoids, certain B complex vitamins and trace minerals; but also rich in herbal active principles like, Allicin, Betaine, Euginol, Lumiflavin, Lutein, Sulforaphane, Taurine and many more active principles of the herbs, depending upon the herbs fed to the hens. Moreover, these eggs had about 25 % lesser cholesterol in their yolks, compared to ordinary eggs. Feeding such HEDE to human volunteers has resulted in significant reduction in their Triglycerides (TG) levels, increased the good HDL cholesterol, improved immunity and hematocrit.

Dietary manipulation is the major step in producing the **pre-oviposition/pre-slaughter value addedpoultry products**. Various nutritional manipulations to the chicken diet will be done to produce different types of value added products.The total fat content in the egg yolk cannot be altered; but its fatty acid composition can be altered, by changing the type of oil used in the hens' diet. Flax seed (linseed), marine algae, fish oil and rape seed oil are added to chicken feed to increase the omega - 3 fatty acid content in the egg yolk, at the expense of saturated fatty acids like palmitic and stearic acids.

It has been reported that decreasing ratio of N-6 / N-3 PUFA in designer eggs to 1.5, from as much as 20 in regular eggs,supplies about 50% of the daily requirement of N-3 PUFA to the consumers, without any change in the sensory quality of the egg. This n-3 PUFA in egg yolk decreased the serum Triglycerides and increased the serum HDL-Cholesterol levels in human volunteers, when consumed for a period of two months at two eggs per day.

Since the N-3 PUFA will undergo rancidity quickly, it is essential to prevent the rancidity of the designer egg yolk lipids, by

incorporating anti-oxidants in the hens' diet. Decreased susceptibility to lipid peroxidation, prevention of fishy odor to the product, preventing destruction of fat-soluble vitamins, preventing denaturation of natural fat-soluble pigments and promoting the overall health of the consumers are the advantagesof enrichment of the egg with anti-oxidants. For designer egg, vitamin E and organic selenium are added as anti-oxidants at levels of 200-400mg/kg and 0.1-0.3ppm, respectively.By manipulating the diet of chicken with these feed supplements, value added and health promoting chicken egg, can be made available to the consumers. This value addition involves higher cost to the extent of 50-300 %of the conventional foods. Hence, the producers of these products must conduct a market survey or find out the export potential, before starting the venture.

REFERENCES

Farrel, D.J.1998. Enrichment of hen eggs with n-3 long chain fatty acids and evaluation of
enriched eggs in humans. *American Journal of clinical Nutrition,* **68**: 538-544.

Jiang, Z. and Sim, J.S.1993. Consumption of n-3 polyunsaturated fatty acid enriched eggs and
changes in plasma lipids of human subjects. *Nutrition,* **9**: 513-518.

Leeson, S.,2004. Lutein enriched eggs: Transfer of lutein into eggs and health benefits. In: *The 3rd international symposium of Egg nutrition for health promotion, Banff, Alberta, Canada,* Program booklet p. 28.

Mandal.A.B. 2015.Poultry Feed Industry - Challenges in the Present Day Context. In*: XXXII Annual Conference if Indian Poultry Science Association & National Symposium:(IPSACON-2015)*;19th to 21th November, 2015.

Narahari.D. 2005. Nutrient manipulations for value added eggs and meat production. *XXIII Annual Conference of Indian Poultry Science Association and National Symposium*-2005*(IPSACON-2005). 2nd* to 5th February,2005.

Narahari, D., Kirubakaran, A. Ahmed, M. and Michealraj, P 2004. Improved Designed egg production using herbal enriched functional feeds. *In: XXII World's Poultry Congress, Istanbul,Turkey : p.847.*

Parthenium Hysterophorus:

A Noxious weed to effect the Agro-EcoSystem in India

Gaurav*[1], Rupesh Kumar Meena[2], V K Verma[3] and S K Verma[4]

[1,3]*Research scholar, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi – 221005*

[2]*Research scholar, Department of Agronomy, College of Agriculture, S.K.R.A.U., Bikaner- 334006*

[4]*Assistant Professor, Department of Agronomy, I. Ag. Sc., BHU, Varanasi-221005*

**Corresponding author Email: gauraviasbhu@gmail.com*

Weeds are unwanted plants playing a very significant role in different agro-eco systems and many of them cause direct and indirect losses. Weeds not only cause huge reduction in crop yields but also increase cost of cultivation, reduce input use efficiency, loss of potentially productive lands, loss of grazing areas and livestock production.*Parthenium hysterophorus* L. (Asteraceae), a noxious weed, inhabits many parts of the world, in addition to its native range in North and South America and the West Indies (Picman and Picman.,1984).Parthenium hysterophorus is found in Australia, Bangladesh, Ethiopia, India, Sri lanka, Kenya, Madagascar, Nepal, Pakistan, Papua New Guinea, Puerto Rico, South Africa, Swaziland, Taiwan, Vietnam and the United States.In India, it is locally known as 'Gajarghas'.*Parthenium*was introduced to India in seed form as a contaminant of food grains imported from Mexico. In India it has invaded almost all the states with a high level of spreading in Haryana, Punjab and U.P. It was first reported in India in 1880, but recognized as a threat in 1950s.It was first time reported from India in 1956, growing as stray plants at waste places in Pune (Maharashtra).It is a tall growing, deep rooted, much branched dicotyledonous weed species attaining a meter height at fully flowered stage. The weed bears numerous small white flowers aggregated together to form the Capitulum inflorescence. At maturity Capitulum is transformed into Cypsela type fruit which bears numerous seeds. It is mainly propagated through seeds. Within a decade it had spread so vigorously in the Plains of India that it became a problematic weed posing problem of its extermination.Now it has achieved the status of the countries "worst weed" owing to its allelopathic effects on crop production and harmful effects on people and animals.

CURRENT SPREAD OF PARTHENIUM WEED

Figure 2 Whole plant and inflorescence

Figure 1Crop infestation by P. hysterophorus

In India, it is locally known as "Congress Grass or Gajar Ghans". It was first introduced due to contaminated PL-480 wheat imported from the United States of America in 1950s, and is also called as 'Congress Grass'.India has become one of the most Parthenium affected countries in the world as this weed is occurring in all of her states and presenting a major problem in many those states that have large areas of non-cropped and pastures rain-fed land (Sushilkumar and Varsheny.,2010) (Sushilkumar.,2012). The spread of Parthenium has been reported from all states of India in varying intensity. In general, overall spread in terms of density and infestation level was highest in Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Haryana, Karnataka, Maharashtra, Madhya Pradesh, Punjab, Tamil Nadu and Uttar Pradesh; medium in Assam, Gujrat, Himachal Pradesh, Jharkhand, Jammu & Kashmir, Uttarakhand, Odisha, West Bengal and Rajasthan; low in Andaman & Nicobar, Arunachal Pradesh, Goa Kerala, Lakshadweep, Manipur, Mizoram, Meghalaya, Nagaland, Pondicherry and Sikkim (Sushilkumar.,2012).

HOW IT IS SPREADS

Parthenium seeds are mainly dispersed through water currents, animals and the movement of vehicles, machinery, livestock, grain. Parthenium weed has a short life cycle, grow very quickly and survive or grow under different habitats. Most of the long distance spread is through vehicles, farm machinery and flooding. The weed produce enormous number of seeds which are very small in size and also light in weight and can survive as seed bank in soil for years (Dogra *et al*.,2011). These some characteristics help toparthenium weed dispersal up-to long distances and result in their rapid spread in the invaded areas.

Figure 3: Seeds of P. hysterophorus

Seed dispersal by vehicles

- High reproductive potential
- Fast growth rate

- Allelopathic potential
- Unpalatable to animals

Figure 4: Causes of rapid spread

IMPACTS OF PARTHENIUM

Impact on crop production

Due to the invasive capacity and inhibitory role ofallelochemicals, phenolicsand sesquiterpene lactones, mainly parthenin, it inhibits the germination and growth of plants including pasture grasses, cereals, vegetables and other plant species (Veena*et al.,* 2012). In India Parthenium hysterophorus causes a yield decline of up to 40% in agricultural crops(Khosla and Sobti 1981).(Maharjan*et al*.,2007) showed that increase in concentration of extract was invariably associated with decrease in germination and seedling characteristics of the crops. The germination and growth of agricultural crops, like rice, wheat, maize, pigeonpea, blackgram, sorghum etc. are inhibited by its allelopathic effect. The weed affects nodulation in legumes due to inhibition of activity of nitrogen fixing and nitrifying bacteria, namely, Rhizobium, Actinomycetes, Azotobacter, and Azospirillum.

Impact on human and animal health

In India, this weed has been consideredas one of the greatest source of dermatitis, asthma, eye irritation, and sinusitis (hay fever) types of diseases. Pollens in contact with body causes swelling and itching of mouth & nose. Consumption of weed roots cause excessive water loss from the body (Oudhia andTripathy, 1998). Due to contact of *Parthenium hysterophorus*causes acute toxicity in cattle and milk becomes bitter tastingdue to the presence of parthenin compound, which is also hepatotoxic in nature. Due to Contact of this weed causes inflamed udder, fever and rushes in cows, allergic inflammation in the mouth of cattles. If it is present in animal diet then causes dermatitis with pronounced skin lesions and a significant amount (10–50%) of *Parthenium hysterophorus*in the diet can kill cattle and buffalo(Veena*et al*., 2012) (Ahmed *et al.,* 1988).

MANAGEMENT AND CONTROL

Mechanical

Manual uprooting of *Parthenium* before flowering and seed setting is the most effective method. This is easily done when the soil is wet.Uprooting should be done by using hand globs of leather, cloths or plastic to avoid direct close contact with the skin.

Cultural

It is most cost effective method of control. It includes several cultural practices such as preventing introduction of *Parthenium* seeds by keeping clean the equipments, livestock, animal feed, people, and vehicles, preventing physical spread of the seeds by cultivators, shoes, tires, machinery. (Robert, 2011).*Parthenium* weed can be suppressed by growing competitive crops (fodder sorghum, sunflower and maize) or self-perpetuating competitive plant species like *Cassia sericea, C. tora*, *Tagetuserecta (marigold)*, and *Abutilon indicum,*

*Crotonbonplandianus*and *C. sparsiflorus, Cassiaauriculata*, in non-crop areas which will compete with the weed and reduce its population. In certain parts of India, crop rotation using marigold (*Tagetes*spp.) during rainy season, instead of the usual crop, is found effective in reducing *parthenium*infestation in cultivated areas. Burning can kill *parthenium*weed above ground plant parts and seed near the soil surface, but buried seeds may survive.

Chemical Control

A large number of chemicals have been tried. The use of Glyphosate, Atrazine and Metribuzin has been promising. In wasteland situation, if grasses are to be saved and Parthenium is to be killed, metribuzin (0.3 to 0.5%) should be used. 2,4-D (1 to 1.5 kg/ha) and metribuzin (0.3 to 0.5%) can safely be used in crops of grass family like sorghum, sugarcane, wheat, rice, oat etc. For complete vegetation management including Parthenium, glyphosate (1 to 1.5 kg/ha) is recommended. Diquat 0.5 kg/ha in 500 litre spray effectively controlled Parthenium at all growth stages. Metribuzin (0.50 to 0.75 kg/ha) may be used as pre-emergence herbicide for control Parthenium in potato, tomato and soybean just after sowing. Atrazin (1-1.5 kg/ha) may be used in maize as pre-emergence herbicides. Diauronyr (1-1.5 kg/ha) may be used in maize as pre-emergence herbicides. Chloromuron-methyl (10-12 g/ha) may be used to kill Parthenium in soybean after 25-3- days of sowing.

BIOLOGICAL CONTROL

Several insects and pathogens have been tried. The leaf feeding beetle *Zygogramma bicolorata* and the stem-galling moth, *Epiblemastrenuana*are widely used in several countries to manage *Parthenium*. *Z. bicolorata*is now widely used in India to control *Parthenium*. Basarkar and Khandelwal (2008) worked on control of weed *P. hysterophorus* L. by inhibiting the pollen germination and pollen tube growth.

CONCLUSION

The noxious P. hysterophorus grows in a wide variety of habitats and causes changes in above ground vegetation as well as in below ground soil nutrients. Awareness must be created among the inhabitants of the countries about the impacts of *Parthenium*. How this weeds look like, how the seeds are spread from one place to another and the possible methods of control should be taught to all of the peoples so that all the members of the community can be involved in combating the weed. In case of *Parthenium*, which has infested large areas of India, an integrated approach using cultural, physical, chemical, and biological techniques coupled with community participation has been quite successful.

REFERENCES

Ahmed M. N., Rao P.R. and Mahender M.1988. Experimental introduction of acute toxicity in buffalo calves by feeding *Parthenium hysterophorus* Linn. *IndianJournal of Animal Sciences.***58**, 731–734.

B.Veena. Kushwaha and Shivani Maurya.2012. Biological utilities of

Parthenium hysterophorus. J. Appl. & Nat. Sci.. **4**(1): 137-143.

Basarkar, U.G. and Khandelwal S.R. 2008. Control of weed Parthiniumhysterophorus L. by Inhibition Pollen Germination and Pollen tube growth. The 12th World Lake Conference: 1074- 1081.

Dogra K.S., Sood S.K., and Sharma R. 2011.Distribution, biology and ecology of partheniumhysterophorusl. (congress grass) an invasive species in the northwestern indianhimalaya (himachalpradesh). *African Journal of Plant Science*.**5** (11): 682-687.

Khan H, Marwat B.K., Hassan G, Khan M.A. and Hashim S.2014.Distribution of Parthenium weed in Peshawar valley,Khyber Pakhtunkhwa-Pakistan.*Pakistan Journal of Botany*. **46**(1): p. 81-90.

Maharjan S, Shrestha BB, Jha PK. 2007. Allelopathic effects of aqueous extract of leaves germination and seedling growth of some of *Parthenium hysterophorus* L. on seed cultivated and wild herbaceous species. *Scientific World*. **5**(5): 33- 39.

Oudhia P, Tripathi RS. 1998. Proc. First Int. Conf. on Parthenium Management, University of Agril. Sciences, Dharwad, India, 6-8.136 – 139,

Picman J and PicmanA K.1984. "Autotoxicity in *Partheniumhysterophorus*and its possible role in control of germination," *Biochemical Systematics and Ecology***12**(3): 287–292.

Robert H.2011.Identification, Impacts, and Control of Ragweed *Parthenium* (*Parthenium hysterophorus* L.)1. http://edis. ifas. ufl.edu.

S.N. Khosla and S. N. Sobti,.1981. Effective control of *Parthenium hysterophorus* L. Pesticides.**15**, 18-19.

Sushilkumar and Varshney J.G. 2010. *Parthenium* infestation and its estimated cost management in India. *Indian Journalof Weed Science* **42**(1&2): 73-77.

Sushilkumar. 2012. Current spread, impact and management of *Parthenium* weed in India. *International Parthenium News***5**: 1-6.

Effect of Chromium Supplementation on the Performance of Dairy Cows

Abinash Das, K. Sethy*, B. Chichilichi, S. S. Parhi, S. R. Barik and S. Khadenga

Department of Animal Nutrition
College of veterinary science and Animal Husbandry
Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, 751003,
**Corresponding Author: babuivri@gmail.com*

Chromium is a transition metal element having atomic number 24 [$_{24}$Cr]. It stands 21st in abundance among the minerals on the earth crust. Although chromium may theoretically occur in all oxidation states from –2 to +6, it is mostly found in the trivalent and hexavalent forms. Chromium^{+6} is readily reduced to Cr^{+3}. Cr^{3+} forms complexes with organic and inorganic ligands stable in aqueous solutions and relatively inert in terms of chemical reactions (Mackay and Henderson, 2002). Trivalent chromium (Cr^{3+}) is the most stable oxidation state in which chromium is found in living organisms and is considered to be a highly safe form of Chromium (Lindeman, 1996). Cr^{3+} is known for its in vivo antioxidative activity and favourable effects on the stability of proteins and nucleic acids . Hexavalent chromium (Cr^{6+}) is mostly of industrial origin and is associated with chromium toxicity. Fifty years ago Walter Mertz and Klaus Schwarz at the US National Institutes of Health (NIH) discovered that rats fed a pelleted feed developed hyperglycemia (elevated blood glucose) and hyperinsulinemia, associated with impaired glucose tolerance. This effect was reversed by feeding a supplement rich in Cr, which led to isolation of "glucose tolerance factor"(GTF). Chromium is an active component of glucose tolerance factor. Without Cr, glucose tolerance factor has been shown to be ineffective. Detailed structure of GTF is unknown but it is assumed that the factor consists of $Cr^{3+,}$ nicotinic and glutamic acids, glycine, and cysteine (Ducros1992). Most of Cr present in animal tissues is bound in GTF. The primary effect of Cr is to enhance communication between insulin and its receptors located on the cell membrane of insulin sensitive tissues by increasing membrane fluidity and rate of insulin internalization (Evans and Bowman, 1992).

Dose of Chromium in Animals:

Currently, there is no established chromium requirement for ruminants. Improvement in impaired glucose tolerance after chromium supplementation is the most sufficient means to determine deficiency. Chromium deficiency is marked primarily by disturbances in glucose, lipid, and protein

metabolism, decreased insulin sensitivity of peripheral tissues, as well as impaired growth and longevity in experimental animals. There is also little information on the biological activity/availability of certain Cr forms in feedstuffs for livestock.

The basal Cr concentrations reported for experimental diets for ruminants (range: 0.3 to 1.6 ppm) is usually higher than the supplemental Cr added to these diets (0.25 to 0.5 ppm). Generally, the Cr in most ruminant feedstuffs is considered poorly available. After the publication of the NRC document and Bunting's literature review, different sources of organic Cr have been developed and used in the livestock industry with more consistent results, one of them being chromium propionate manufactured and commercialized as KemTRACE® brand Chromium Propionate by Kemin Industries, Des Moines, IA. For ruminants, benefits of supplementing organic chromium complexes were observed during the initial weeks following transport to feedlots when animals were stressed and during the transition period of first-lactation dairy cattle.

In July 2009, the FDA issued a regulatory discretion letter which permitted the use of chromium propionate as a source of Cr in cattle diets. Chromium propionate can be added to cattle diets at levels up to 500 ppb or 0.5 mg Cr/kg of complete diet. For laboratory animals, 300 µg Chromium /kg diet is recommended (NRC, 1995).

Analysis of Chromium content in different feedstuffs:

Analysis for Cr in feeds is technically difficult in traditional laboratory settings, requiring specialized equipment, appropriate reference materials, and an ultra-clean lab. Exposure to metal surfaces in feed processing, handling and laboratory sample preparation may increase Cr contamination in samples. As such, the information available on basal levels of Cr in animal feeds is scarce and variable. Generally, forages and byproducts seem to contain more Cr than grains.

Impact of Chromium on animal performance:-

- In ruminants, supplementation of Chromium is recommended during heat stress periods, transit stress, early lactation transition phase and infection etc.
- The primary role of Chromium is to potentiate the action of insulin and this increased insulin activity promotes the intracellular uptake of glucose and reduces the circulating non-esterified fatty acids (NEFA) (Bryan *et al*., 2004). The result is an improvement in energy metabolism through the increased uptake of glucose by the cells (Davis and Vincent, 1997).
- Chromium Propionate supplemented dairy cows resulted in improved energy balance during transition, leading to improved lactation performance as well as reproduction.
- Improve intake during the transition period.
- In dairy cows, chromium supplementation has been shown to increase dry matter intake, (Besong *et al*., 1996).

- Reduce the impact of the negative energy balance.
- Limit the effects of metabolic disorders associated with negative energy balance.
- Chromium also activates certain enzymes and stabilizes proteins and nucleic acids.
- Decrease placental retention, and udder edema in older cows (Stahlhut,2004; Bryan *et al*., 2004 ; Burton *et al*., 1993; Besong *et al.,* 1996)

METABOLIC ROLE OF CHROMIUM:

(a) Glucose metabolism:

Low-molecular-weight chromium-binding substance "chromodulin" is assumed to take part in the glucose metabolism. The basis of the name chromodulin is the similarity of its proposed mechanism of action to that of the Ca-binding protein calmodulin. Chromodulin is a naturally occurring oligopeptide composed of glycine, cysteine, aspartate and glutamate (Yamamoto *et al*., 1987).The molecule binds four equivalents of Cr^{3+}, despite its small size. It carries chromium into the urine after the intake of large dosages of chromium, both trivalent and hexavalent forms and can, therefore, assist in chromium detoxification. Chromium deficiency is found to cause reduction in insulin sensitivity in the peripheral tissues as well as a decrease in growth rate (Lindeman, 1996). The Fe-transport protein transferrin has been shown to be responsible for maintaining Cr^{3+} levels in the blood plasma and for transporting chromium to tissues in an insulin-responsive manner. Moderate increases in plasma membrane fluidity have been documented to increase glucose transport. Furthermore, it has been shown that basal glucose transport is not fully active in fat cells and that it can be increased further by augmenting membrane fluidity. Another aspect of chromium action is that it enhances the insulin sensitivity effect by increasing membrane fluidity and the rate of insulin internalization (Evans and Bowman, 1992).

Schwarz and Mertz (1959) had recognized chromium as a component of GTF, which enhance not only tissue sensitivity to insulin but also glucose utilization. Therefore, glucose uptake, glucose use for lipogenesis, glucose oxidation to carbon dioxide, and glycogenesis are increased by addition of chromium plus insulin to animal tissue (Anderson, 1987). It has observed that increased glucose removal rates following a glucose challenge in chromium deficient rats supplemented with 5 ppm $CrCl_3$. Higher glycogen reserves in animals receiving supplemental chromium indicates greater tissue response to insulin in these animals, resulting in the greater hypoglycemic response (Roginski and Mertz, 1969).It also observed increased glucose clearance rates and decreased glucose half-life following an insulin challenge in growing-finishing swine supplemented with 200 ppm chromium propionate, indicating improved insulin sensitivity.

Volatile fatty acids produced by microbes present in the rumen serve as the primary energy substrates for ruminant animals. Due to the fact that ruminants must synthesize their own glucose, their response to insulin is

different from those observed in non-ruminants. Growing steers tended to have lower plasma glucose concentrations when supplemented with chromium (0.2 ppm high chromium yeast); however, chromium supplementation did not affect insulin concentration. It has observed that decreased plasma glucose in growing calves supplemented with soybean meal and chelated chromium (1 mg Cr/kg DM).

Chromium supplementation was not shown to have an effect on plasma glucose, serum glucagon, or the molar ratio of insulin to glucose prepartum. Concentrations of serum insulin and the molar ratio of insulin to glucose decreased with increasing level of supplemental chromium during postpartum periods. Other blood metabolites such as glucose and serum glucagon were not affected by chromium supplementation postpartum. Glucose challenges were conducted both pre- and postpartum to determine chromium's effect on glucose metabolism in cows in late gestation as well as early lactation which is the transition phase. Plasma glucose concentration was not affected by chromium supplementation in either prepartum or postpartum glucose challenges. However, postpartum peak glucose and clearance rates (CR) decreased, while half life and the time to reach basal concentrations increased quadratically with increasing chromium supplementation. Basal insulin was higher in cows receiving chromium prepartum. Subiyatno *et al*. (1996) observed differences in glucose metabolism between primiparous and multiparous dairy cows supplemented with 0.05 ppm chromium in late gestation and early lactation. Serum insulin and the insulin to glucose ratio decreased in response to chromium supplementation in primiparous animals following a prepartum glucose challenge; however, the ratio of insulin to glucose was increased postpartum. Chromium supplementation decreased peak insulin in primiparous cows in the first 30 min following glucose infusion during the prepartum challenge. Multiparous animals had lower basal insulin than primiparous cows; however, concentrations were lower for all cows postpartum than prepartum. Plasma chromium concentrations were lower in chromium supplemented animals

Lipid metabolism:

It has studied that the action of chromium propionate on lipogenesis and lipolysis in adipose tissues in Holstein dairy cows from 21 days prepartum to 35 days post partum. Cr is found to increase the fat synthesis in the adipose tissue and decrease the net release. This might be through linkage of chromodulin with the insulin receptor leading to increased glucose flux into the adipocyte. Insulin generally reduces lipolysis (decreasing the supply of fatty acids to the liver), decreases hepatic ketogenesis and increases ketone body utilization. Experiment on humans and lab animals frequently suggest there is reductions in circulating concentrations of cholesterol and (or) nonesterified fatty acids (NEFA). It has observed the same effect in ruminants.Chromium is also found to influence the metabolism of cholesterol and triglycerides although the mechanism is not established. It also

observed the lower plasma NEFA concentrations in prepartum multiparous dairy cows fed a total mixed ration supplemented with chromium methionine. Besong *et al*. (1996) observed a 45% reduction in plasma beta-hydroxybutyrate and an almost 50% reduction in liver triglyceride concentrations on day 30 of lactation in Holstein cows fed Cr (0.8 ppm as Cr-picolinate), beginning 30 days prepartum. It also observed trends for reduced blood beta-hydroxybutyrate concentrations in multiparous but not primiparous cows. In early lactation, increased insulin effectiveness may have significant health and performance implications. During calving stress, cows are in negative energy balance, and/or are over-conditioned, excessive adipose mobilization may lead to accumulation of triglycerides in the liver and reduced liver function. In addition, there is generally a strong association between fatty liver and the development of ketosis.

Protein metabolism:

Activity of chromium in protein metabolism is mediated by anabolic action of insulin. Evans and Bowman (1992) had demonstrated increased amino acid and glucose uptake by skeletal muscles of rats that had been incubated with chromium-picolinate. This alteration in uptake of nutrients was associated with the alteration of insulin parameters and thus dependent on chromium. Roginski and Mertz (1969) observed that supplementation of chromium increases amino acid uptake by tissues and also intensify the incorporation of amino acids into heart proteins in rats. These increases in protein accumulation in the organs of these animals resulted in greater overall weight gain when compared to rats not receiving supplemental chromium. In swine, supplementation of chromium picolinate increased longissimus muscle area and percentage of muscling in the carcass.

Nucleic acid metabolism:

Chromium in the trivalent state is assumed to be involved in the structural integrity and expression of genetic information in animals. Chromium protects RNA against heat denaturation. Binding of chromium to nucleic acids is stronger than in any other metal ions (Okada *et al*.,1982). It plays an important role in gene expression by binding to chromatin, causing an increase in initiation loci and subsequently, an increase in RNA synthesis. Chromium is thought to have a role in nucleic acid metabolism because an increase in stimulation of amino acid incorporation into liver protein was observed during in vitro studies.

Stress relieving effect of Chromium:

The stress relieving effect of chromium has been well studied. Stress factors stimulate the hypothalamus leading to the production of corticotropin releasing factor, which stimulates the pituitary to produce adrenocorticotropic hormone, which in turn stimulates the adrenal cortex to increase the production and release of corticosterone. There is a sharp increase in the secretion of cortisol during stress. High circulating concentrations of cortisol reduce tissue insulin sensitivity .Corticoids increase blood glucose concentration and reduce the glucose utilization by peripheral tissues thus functioning as insulin antagonists. The

immediate effects include decreased entry of blood glucose into muscle and adipose tissue, increased glycogenolysis and gluconeogenesis, and increased mobilization of fatty acids from adipose tissue. Extended stress and insulin insensitivity results in reduced immune function.Chromium are found to influence the secretion of corticosteroids. A number of reports confirm decreased sensitivity to stress in chromium supplemented animals through a reduced concentration of cortisol in blood. Chromium excretion in urine is found to be enhanced by all stress-inducing factors.

Effect of Chromium on immunity:

Although chromium is believed to have different kinds of inborn, humoral and cellular immunomodulatory effects, the fundamental mechanism of intercellular and intracellular action remains unknown. The immune function may be affected in association with insulin and/or cortisol activity since corticosteroids have a depressing effect on immune system. It is also assumed to be mediated by production and regulation of certain cytokines. In some experiments increased cell mediated immunity is observed on Cr feeding. The reason for the variable responses of chromium supplementation on immune responses in domesticated livestock species is unclear. Factors that may contribute to the inconsistent findings between studies may include: 1) the initial chromium status of the animals; 2) the amount of available chromium in the control diet; 3) the form of chromium supplemented; and 4) the type or degree of stress imposed on the animals. Leukocyte proliferation, antibody production, and cytokine production, were affected by supplementation of chromium.

Chromium in lactation:

Data from some lactation studies suggests that supplemental Cr may increase milk yield under certain metabolic circumstances. It has reported in two experiments where supplemental Cr increased early lactation milk production in primiparous but not in multiparous cows. Besong *et al*. (1996) observed increased milk yield in the first 60 days of lactation in cows supplemented with Cr. It is not yet clear how supplemental Cr may increase milk yield in early lactation. A slight reduction in the rate of mobilization of fatty acids from adipose tissue may simply help stabilize hepatic fat metabolism, reduce hepatic ketogenesis, and perhaps allow feed intake to increase more rapidly after calving. It has postulated that increased milk yield may be the result of the indirect effects of Cr on hepatic glucose production (gluconeogenesis). Glucose uptake by the mammary cells appears to be independent of the action of insulin. In addition, circulating insulin concentrations are generally higher in low-yielding compared with high-yielding dairy cows.

CONCLUSION

Chromium is an essential micronutrient as it has got an enormous role in carbohydrate, protein, and lipid metabolism also in improving the immune function. It is essential for normal functioning of insulin so the physiological function which is insulin dependent can be influenced by dietary deficiency of chromium. Organic source of chromium is found to be highly bioavailable and the

beneficial effects of supplementation has been proven by various studies conducted in livestock and lab animals. Chromium supplementation alleviates the negative effects of stress, thereby improves the performance and health of the livestock, leading to better farm profitability.

REFERENCE

Anderson RA. 1987. Chromium in Trace Elements in Human and Animal Nutrition, Vol.1, 5th (Ed.), Academic Press Inc. New Yolk. pp. 225-244.

Besong S, Jackson JA, Trammell DS and Amaral-Philips D. 1996. Effect of supplemental chromium picolinate on liver triglyceride, blood metabolites, milk yield and milk composition in early-lactation cows. J. Dairy Sci. 79(suppl.1): 79-85.

Bryan MA, Socha MT and Tomlinson DJ. 2004. Supplementing intensively grazed late-gestation and early lactation dairy cattle with chromium. J. Dairy Sci., 87: 4269–4277.

Burton JL, Mallard BA, Mowat DN. 1993. Effects of supplemental chromium on immune response of periparturient and early lactation dairy cows. J. Anim. Sci., 71: 1532-1539.

Davis CM and Vincent JB. 1997. Chromium oligopeptide activates insulin receptor tyrosine kinase activity. Biochemistry 1997; 36:4382-4385

Ducros V. 1992: Chromium metabolism. Biol. Trace Elem. Res. 32: 65-77

Evans GW and Bowman TD. 1992. Chromium picolinate increases membrane fluidity and rate of internalization. J. Inorg. Biochem. 46:243–251.

Lindeman MD. 1996. Organic Chromium – the missing link in farm animal nutrition? Feeding Times, 1: 8-16

Mackay RA and Henderson W. 2002. Introduction to Modern Inorganic Chemistry. CRC Press, 610 pages.

National Research Council. 1995. Nutrient requirement of the laboratory rat. In: Nutrient requirements of laboratory animals. Natl. Acad. Sci., Washington DC. PP. 11-58

Okada S, Taniyama M and Ohba H. 1982. Mode of enhancement in ribonucleic acid synthesis directed by chromium (III)-bound deoxyribonucleic acid. J. Inorg. Biochem., 117: 41-49.

Roginski EE and Mertz W. 1969. Effects of chromium (III) supplementation on glucose and amino acid metabolism in rats fed a low protein diet. J. Nutr. 97:525-530

Stahlhut HS. 2004. The effect of supplemental chromium and copper status on glucose metabolism, performance and reproduction of beef cattle. MSc. Thesis, North Carolina state university, USA.

Subiyatno A, Mowat DN, and Yang ZW. 1996. Metabolic and hormonal responses to glucose and propionic acid infusions in periparturient cows supplemented with chromium. J. Dairy Sci. 79:1436-1445.

Yamamoto A, Wada O, Ono T. 1987. Isolation of a biologically active low-molecular-mass chromium compound from rabbit liver. Eur. J. Biochem., 165:627-631.

Semen Sexing-Boon for Indian Dairy industry

Anjali Kumari[1], RaginiKumari[2], Indu Devi[1], ShiwaniTiwari[1], Ranjana Sinha[1] and Tripti Kumari[1]

[1]Ph.D. LPM Section NDRI, [2] Ph.D. DCB Division NDRI
[1]Corresponding Author- anjalirvc@gmail.com

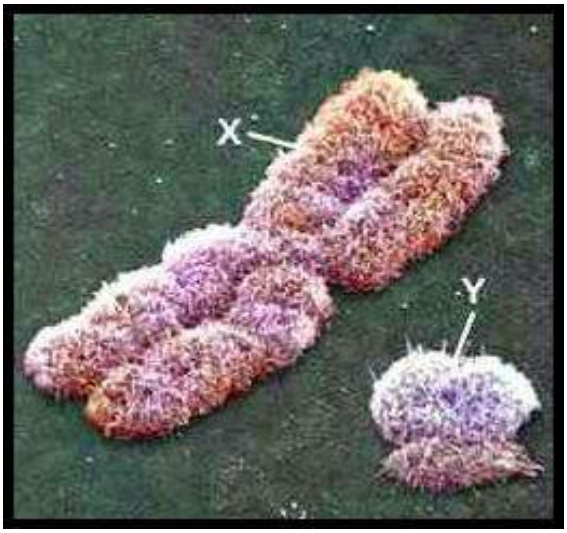
India has huge population of livestock (512.05 million). This population contributes nearly 4.11% in total GDP at current prices during 2012-13(19th livestock census).Out of which 299.606 (58.5%) million are cattle and buffalo.It shows that cattle and buffalo has huge impact on Indian economy.It is the 1st way of prying the situation,2nd one is that out of which 84.023 million is male population. This population has very less use in raising the Indian economy. Most of us think that this isunresolvable issue since probability of birth of male calf is 50%.Probability estimate shows that chances of lossto a dairy holder is 50% after 1 calf crop.In fact this loss can be diminished by application of technology named "SEMEN SEXING".

INTRODUCTION

A breakthrough in bovine industry made in 1980 by USDA researchers. That was selecting and separating the particular type of sperm cell to fertilize the egg cell. Sexed semen is actually the semen containing specific type of sex chromosome. Actually X and Y chromosomes are different in terms of length and DNA content (Morruzi, 1979). This feature is utilised and separated through semen sorting and selection.The process of sexing semen has been expanded upon since its inception in the 1980's, which ultimately resulted in the first calf to be born using sexed semen and artificial insemination in 1997. Since then, over 20,000 calves have been born using sexed semen.There is no evidence that these sexing procedures result in abnormal offspring (Tubman et al., 2004). When we will use this technology properly on a dairy, we can help farmers grow their herds internally in less time.

Technology

Technology behind semen sexing is sorting and selection. Sorting is done by

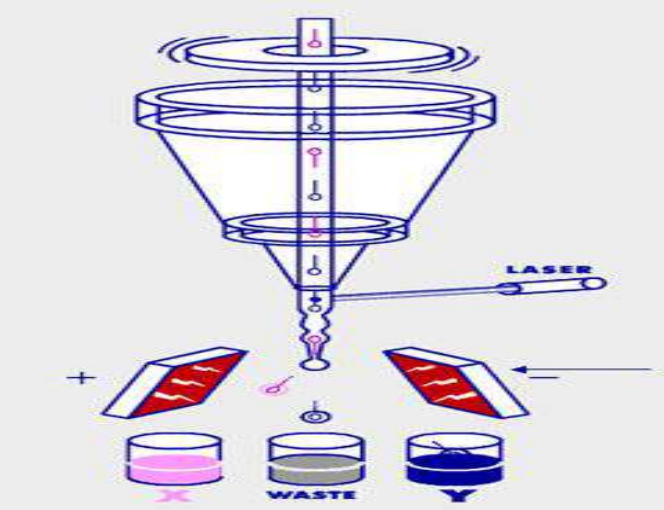


flow cytometry for DNA content of sperm (Weigel, 2004; Seidel, 2007).Separation of X and Y bearing sperm is based on 3.8%

difference in DNA content.For this firstly sperm are treated with harmless fluorescent DNA binding dye (Stain-Hoecsht33342)that allows differentiation in the amount of DNA in the sperm. Sperm are then diluted and placed in droplets. The droplet enters the detector where a laser is used to energise the dye. During the sorting process the machine identifies the sperm as X or Y and it puts a charge on the droplets. An electrical field deflects the sperm towards the collection vessel.

Fig: 1 Size of X and Y bearing sperm

The sperm hit the fluid in collection vessel at about 50 kph. The sorted sperm are then centrifuged and re-suspended.



Although the sorting process is 90% accurate, approximately half the sperm cannotbe sorted because they are damaged or machine could not determine X or Y. To properly sort, sperm must be precisely oriented as they pass through the laser and fluorescence detectors in the flow cytometer. Due to flat shape of bull sperm heads only about 60-70% are correctly oriented and half of these are female. Thus only 15% of sperm going into machine are recovered as viable, sexed semen.

Despite reliably producing a 90% gender bias, the fertility of the sexed semen product is compromised compared with conventional semen. The success sorting process is dependent on the accuracy and efficiency of sperm analysis for DNA. The flow cytometer/cell sorter in use today make over 30000 consecutive evaluation of individual sperm each second for each nozzle and sort the sperm into three containers: X-sperm, Y-sperm and unsexable plus dead sperm. Even at these speeds it is not economical to package

Fig-2 Flow cytometer

sperm at standard number per insemination. Unfortunately, the process is slow relative to the number of sperm in typical artificial insemination dose. Furthermore, the process damages sperm, although to a lesser degree than current procedures for cryopreservation. Because of these limitations, commercially available sexed semen for artificial insemination has lower sperm number per dose (about 2 million) than are used conventionally (>20 million sperm /dose). However, with excellent management pregnancy rates in cattle with 2 million sexed sperm per insemination doseare about 80% of those with conventional semen at normal sperm doses. This lowered fertility, in part due to damage to sperm during sorting, plus the extra cost of sexed semen limits the applications that are economically feasible. The main application is for dairy heifers to have heifer calves, either for herd expansion of for sale as replacements. Though the accuracy of selection of sperm of desired sex is good with flow cytometric method, the yield is

slow and low and involves high cost as we are getting only about 20% of original semen which is of desired sex.

Practical applications

1. The main application is shift in the sex ratio of live calves from the standard 50:50 to an average of 90% females and 10% males.
2. Increases the likelihood of replacement heifers of superior genetic merit, hence faster genetic progress in the herd.
3. For any herd, the use of sexed semen to ensure that the required number of replacement heifers needed each year are produced from within the herd has the significant advantage from a biosecurity perspective to control the presence and spread of various diseases.
4. For herds under expansion, heifer calves born from 90% of all virgin heifer calvings reduces the need to purchase additional replacements from outside the herd.
5. Targeted and increased milk production.
6. Breeding heifers to have heifer calves to decrease the incidence of calving difficulty.
7. Control over the birth of unwanted males which is not suitable for rearing (Breeding/draught purpose).
8. Reduces the percentage of sperm with damaged DNA as the sperm with damaged DNA are discarded during sorting purpose.
9. Increasing selection intensity by choosing genetically superior dams of replacements.
10. Providing young bull (faster progeny testing programmes).
11. Use sexed semen for in vitro fertilization, superovulation and embryo transfer programmes make it cost effective and increase its efficacy.Since the first calves produced with accurately sexed semen resulted from in vitro fertilization (IVF) requires many fewer sperm than artificial insemination (Cran et al., 1993).

LIMITATIONS

1. Reduced conception rates, normally claimed to be 80% to 85% of those for traditional semen.
2. The range of sires available is restricted compared with conventional semen. This may limit genetic progress towards your herd's breeding objectives.
3. High cost of sexed semen straw limits affordability to poor/rural farmers.
4. High dependency on imported sexed semen than indigenously produced.
5. Low concentration of straw (2 million) per straw.
6. Greater sensitivity of sexed semen straw to handling during thawing and AI.
7. Reduced and variability in conception/pregnancy rate could be attributed to selection of breedable females, handling of semen, right time of AI, technical expertise of inseminator and more intrinsically damage to sperm, early capacitation of sperm, altered gene expression leading to embryo impaired embryo development and mortality.
8. Due to fragile nature of sexed semen and the use of ¼ cc straws, semen handling when thawing, loading and inseminating is critical.

9. One of the biggest limitations of seedstock breeders is that a relatively small percentage of AI bulls are available as sexed semen. This severely limits the breeder's options for genetic selection. If sexed semen is used heavily then the amount of genetic diversity may decrease due to small number of sires available.
10. Risk of over production of offspring from particular bull (most wanted pedigree bull).
11. The breeding period is increased due to reduction in conception risks with sexed semen and consequently in greater age of first calving.

CONCLUSION

This technology has many applications and limitations. From these we can conclude that we can use this technology for field application with some considerations. Some of these considerations were given below.

1. It is recommended to only use sexed semen on maiden heifers, as they present the best chance of becoming pregnant in the face of reduced conception rates.
2. We can effectively use sexed semen in herds where conception rate is at list 60% with convention semen.
3. We can take the help of specifically trained AI technician for insemination of cow with sexed semen.
4. Cow/heifer being inseminated by sexed semen should be healthy and of high body condition score.
5. We have to keep in mind the cost of sexed semen, cost per pregnancy and cost from additional days open (because of reduced fertility) before using in cows in large scale.
6. A large study in New Zealand with primiparous beef heifers (Morris et al., 1986) illustrates that death losses from birth to weaning were 10% for heifer calves and 18% for bull calves, mostly due to sequellae of dystocia. To decrease dystocia substantially, one could use bulls that sire a low percentage of calves with difficult birth plus semen sexed to produce 90% heifer calves. There is the added benefit that these first calf heifers should be better genetically, on average, than the older cows in the herd.
7. However, the benefit by using sexed semen in well maintained heifers outweighs the cost of sexed semen and slight reduction in conception rate.
8. Fewer animals will be required per unit of product, making use of this technology ecologically sound. Less feed will be required and less manure will be produced than without sexed semen.

REFERENCES

Cran DG, Johnson LA, Miller NGA, Cochrane D, Polge C. 1993. Production of calves following separation of X- and Y-chromosome-bearing sperm and in vitro fertilization. Vet Rec 132:40-41.

Moruzzi, J. F. 1979. Selecting a mammalian species for the separation of X- and Y chromosome-bearing spermatozoa. Journal of Reproduction and Fertility 57(2):319- 323.

Seidel, G.E. Jr. 2002. "Economics of Selecting for Sex: The Most

Important Genetic Trait." Theriogenology 59.2: 585.

Tubman LM, Brink Z, Suh TK, Seidel GE Jr. 2004. Characteristics of calves produced with sperm sexed by flow cytometry/cell sorting. J AnimSci 82:1029-1036.

Weigel, K.A. 2004 ."Exploring the Role of Sexed Semen in Dairy Production Systems." J. Dairy Sci. 87: (E. Suppl.): E120-E130.

Photo references:

Fig-1

http://www.sexingtechnologies.com/articles/technique.

Fig-2

http://www.eurodressage.com/equestrian/2013/01/21/sexed-semen-set-take-equine-industry.

Strategies to Prevent, Control and Eradicate Animal Diseases:

Fore step to Improve Animal Health Worldwide

Rakesh Kumar[1]*, VenketaramireddyBalena[1], Snehil Gupta[2] and Shailesh Kumar Patel[1]

Division of Pathology
Ph.D. Scholars, ICAR-IVRI, Izatnagar, Bareilly, U.P. 243122
Corresponding author E mail: rakudoc@gmail.com

Health is a common theme for all the creatures viable in earth including human beings and animals. According to WHO "health is a state of complete physical, social and mental well-being. However nowadays a statement of socially and economically productive life also has been introduced in this definition (WHO, 1978). But in a narrow view health means no evidence of diseases and functionally normal humans/animals. Thediseases are basically an outcome of imbalance between host and environment. This ecological imbalance is capable of disturbing the balance of nature. Most of the diseases are infectious to both animals and human. Hence the public health significance of these diseases is a major factor which signifies the need of prevention and control of the infections. Many strategies are followed to get rid of these infections which includes strategies at producer's level, management level, biological levels and scientific levels (Domenech *et al.,* 2006). The strategies for control and eradication of disease requires many factors including infrastructure to financial assistance and many others.Prevention, control and eradication of diseases are quite different terms. So it is important to distinguish these all. The measures designed to exclude a disease from an unaffected population is called as prevention**.** Prevention can reduce both incidence as well prevalence of the diseases.

Types of prevention

S. No	Type	Characteristics	Preventive measure
1.	Primary Prevention	Decrease exposure to causal factor. Modify determinants to prevent and decrease incidence.	Vaccination and quarantine
2.	Secondary Prevention	Early disease detection, so early treatment	Use of suitable screening tests like Mallein, strauss test, MRT etc.

3.	Tertiary Prevention	Long term cases are treated	Rehabilitation

Measures to prevent a disease to spread (Ahmed, 2005):

I. Eliminate/ reduce the source of infection
II. Reduce the number of susceptible animals
III. Break the connection between source and susceptible animals

The control measures are the basic efforts which are applied to reduce the frequency of existing infection and preventing the circulation of infectious agents and should be followed very strictly (Barrett 2004;Toma*et al*., 1999). It can only reduce the prevalence of the disease in a population.The term eradication is a time limited campaign and it can be used at local, national or global scale. Louis Pasteur stated that the eradication of diseases from the globe is under the human control (Dubos and Dubos 1953). The microbial control is considered as the one of the most important control for the elimination of infections/ diseases (Swick, 1995).

The term eradication can be used in different ways:

I. Global eradication (if disease not present anywhere in nature e.g. Small pox).
II. Regional eradication (Rinderpest eradication in India).
III. At local level (eradication of Trypanosomiasis in Northen Nigeria as vector tse-tse fly is cleared).

Different strategies followed to prevent, control and eradicate a disease:

1. Quarantine
2. Slaughter and Stamping out policy
3. Active immunization (vaccination)
4. Chemotherapy
5. Movement of host
6. Modified grazing
7. Control of biological vectors
8. Control of mechanical vectors
9. Niche filling
10. Environment and management control
11. Genetic improvements
12. Minimal diseases methods
13. Doing nothing

1. **Quarantine:** These are the measures applied at national, international and regional levels with enforced physical isolation of animals which are infected or suspected to be infected or non-infected, but are at risk so kept segregated from the healthy animals. This word Quarantine originated from Latin word which means "forty" which was the period up to which immigrant humans beings were kept segregated to prevent the spread of plague (Miller, 1996).The period of quarantine depends upon:

I. Incubation period of the agent
II. Time taken for confirmation of the disease
III. Time taken for the treatment of the animal

For example, in rabies free countries dogs are first kept in quarantine to ensure weather they are free from the disease or not.

2. **Slaughter and Stamping out policy:** To prevent the spread of the infection, the infected animals are stamped out or killed.

This can be done selectively or by complete depopulation of the animals. In selective methods test and slaughter policy is followed, while in depopulation the entire flock (infected and healthy) are killed. Slaughter is only followed in terminal7. stages of eradication programs. To reduce the risk of transmission, slaughter is often accompanied with disinfection, burning/ burial of carcass called as **stamping out** (Odontsetseg*et al*., 2005; Kungu*et al*., 2015).

3. Active immunization (vaccination): Vaccines are used to stimulate the immune system by antibodies production and enhancement of T cells response, which weakened or kill the pathogens. These are often used to prevent disease. Active immunization can be done in high risk conditions called as strategic vaccination e.g. Ring vaccination in FMD outbreaks. Each type of vaccines have some advantages and disadvantages. The live vaccines are more potent than killed but can show reverse action leading to infection. So, live vaccine should be critically handled (Tizard, 1984; Kuby*et al*., 2007).

4.Chemotherapy: At the time of high risk, antibiotics, anthelminthics, drugs and hyper-immune sera can be used to treat diseases e.g. The use of antibiotics in poultry feed can promote growth and can prevent bacterial infections also.

5.Movement of host: The animals are moved from areas of high risk (Fèvre*et al.,*2006) e.g. Horses are kept indoors at night to prevent AHS infection, as *Culicoides* (night flying vectors) can transmit *Orbivirus,* the causative agent of AHS.

6.Modified grazing: Mainly the roundworm infection can be prevented by this method. The different types of grazing methods and their impact on disease control (Thatcher, 2012 and Beckett, 1993):

Control of biological vectors

Different ways to control biological vectors includes:

I. Use of insecticides to kill vectors e.g. Abate most effective mosquito larvicidal agent (WHO, 1975).

II. Introduction of animals which compete for habitat e.g. If a snail, *Marisa cornuarietis* is introduced it will compete with *Biomphalariaglabrata* for habitat (vector forSchistosomiasis) (Cowie, 2001).

Modified Grazing Methods		
S. No.	**Type of Grazing**	**Impact**
1.	Mixed	Adult cattle (immune) grazed with calves (susceptible), cattle grazed with sheep, as cattle resistant to *Ostertagiacircumcinata* infection while sheep is susceptible.
2.	Alternate	Grazing of pastures alternatively by different species of animals e.g. In sheep and cattle alternate grazing can reduce chances of *Ostertagia spp.*and *Nematodirus spp.* Infection.
3.	Sequential	Susceptible and resistant animals of same species

		are allowed to graze at different timese.g*Trichostrongyle spp.*infection in calves (susceptible) can be reduced if grazed after adult cow (resistant).

III. Destruction of habitat e.g. drainage of land which is habitat of snails which are important vectors for Fascioliasis.

IV. Use of sterile males e.g. by using cobalt 50 radiations, which acts on pupa can make screw worm (*Cochliomyiahominivorax* and *Chrysomiabezziana*) males sterile and hence no offspring after mating are produced.

8. **Control of mechanical vectors** by using insecticides and disinfection procedures.
9. **Niche filling/ Epidemiological interference:** The presence of one organism with a niche can prevent the presence of other organism is called as Niche filling/ Epidemiological interference.
10. **Environment and management control:** Most of the diseases are just the outcomes of imbalance between host and environment. So by reducing the level of such imbalances can reduce the disease occurrence. The measures includes proper ventilation, lighting, regular maintenance of milking equipment's and proper feeding schedule etc.
11. **Genetic improvements:** The incidence of diseases can be reduced by early diagnosis by radiography and ultrasonography etc. Thus the infected animal is not allowed to breed. This method of identification of genetic diseases is known as **Genetic screening**. Nowadays the animals are inserted with some desirable genes (transgenic animals) or the genes are removed (knockout animals) to improvise the characters and get the desired characters (`WHO, 1968 and Pal, 1967). This technique is very effective for controlling the mosquito population (Rao, 1974).
12. **Minimal diseases methods:** These methods are used in commercial pig or chicken industries. In this method disease can be reduced by disinfecting infected areas, treating infected animals and using caesarian techniques.

Before undertaking a control or eradication campaign several factors are be taken into consideration as given below (OIE, 2014; 2015):

I. Knowledge of natural history, maintenance and transmission of disease
II. Adequate infrastructure
III. Diagnostic facilities
IV. Surveillance
V. Sufficient replacement stock
VI. Opinion and co-operation of producer
VII. Opinion and co-operation by public
VIII. Consideration of public health issues
IX. Requirements of compensation and legislation
X. Financial support

CONCLUSION

Prevention and control are the key concepts to get rid of the animals from diseases, as many of the diseases are interchangeable between animals and human beings. These diseases are often called as zoonotic diseases. According to OIE list, there are at least 119 diseases which are of great importance to animals and human beings. So, it is mandatory for any nation to take over these diseases by providing good surveillance, early detection and crucial veterinary services which can be only the ways to prevent civilization from these dreadful rivals. These activities are quite capable for food security, public health, animal welfare and prevention of infections. For the successful prevention, control and eradication of diseases collaboration at national and international ground is must. The control and eradication programs must be supported by legislation and producers critically.

REFERENCES

Ahmad, K. 2005. Control of animal diseases caused by bacteria: principles and approaches. Pakistan Vet. J. 25(4).

Barrett, S. 2004. Eradication vs. Control: The Economics of Global Infectious Disease Policy Bulletin of the World Health Organization 82 (9): 683–88.

Beckett, F. W. 1993. An evaluation of a modified preventive drenching programme

Cowie, R. H. 2001. Can snails ever be effective and safe biocontrol agents? International journal of pest management, 47 (1): 23-40.

Domenech, J., Lubroth, J., Eddi, C., Martin, V. and Roger, F. 2006. Regional and international approaches on prevention and control of animal transboundary and emerging diseases. Annals of the New York Academy of Sciences, 1081 (1): 90-107.

Dubos, R. and J. Dubos. 1953. The White Plague: Tuberculosis, Man and Society. London: Gollancz. Quoted in Fenner, Hall, and Dowdle 1998.

Fèvre, E. M., Bronsvoort, B. M. D. C., Hamilton, K. A., and Cleaveland, S. 2006. Animal movements and the spread of infectious diseases. *Trends in microbiology,* 14 (3): 25-131.

Kindt, T. J., Goldsby, R. A., Osborne, B. A., and Kuby, J. 2007. Kuby immunology. Macmillan.

Kungu, J. M., Dione, M. M., Ocaido, M. and Ejobi, F. 2015. Status of Taeniasoliumcysticercosis and predisposing factors in developing countries involved in pig farming.

Miller, R. E. 1996. Quarantine protocols and preventive medicine procedures for reptiles, birds and mammals in zoos. Rev. Sci. Tech. Off. Int. Epiz. 15 (1): 183-189.

Odontsetseg, N., Mweene, A. S. and Kida, H. 2005. Viral and bacterial diseases in livestock in Mongolia. *Japanese Journal of Veterinary Research*, *52* (4): 151-162.

OIE – Guidelines for animal disease control – May 2014

OIE – Guidelines for animal disease control-2015

Pal, R. 1967. WHO chronicle. 21: 348.

Rao, T.R. 1974. J. Com Dis. 6: 57.

Swick, R. A. 1995. Importance of nutrition on health status in poultry. Amer. Soybean Assoc. Tech. Bull. MITA (P) No. 083. Pp: 5.

Thatcher, A. 2012. Grazing Strategies to Prevent Parasitism of Organic Dairy Calves.

Tizard, I. R. 1984. Immunology: an introduction (pp. 108-111). New York: Saunders College Publishing.

Toma, B., Dufour, B., Sanaa, M., Benet, J. J., Moutou, F., Louza, A. and Ellis, P. 1999. Applied Veterinary Epidemiology and Control of Diseases in Population. AEEMA, Alfort, France, pp: 219-220.

WHO. 1968. Techn. Rep. Ser., No. 398.

WHO. 1975. Techn. Rep. Ser., No. 561.

WHO. 1978. Health for all. Sr. No.1