Indian Farmer

ISSN 2394-1227

A Monthly Magazine

Volume: 2 | Issue-12 | December- 2015 | Pages 72

Nodulation in Mungbean

www.indianfarmer.net

INDIAN FARMER

A Monthly Magazine

Volume: 2, Issue-12 December -2015

Editorial Board

Editor In Chief

Dr. V.B. Dongre, Ph.D.

Editor

Dr. A.R. Ahlawat, Ph.D.

Members

Dr. Alka Singh, Ph.D.
Dr. K. L. Mathew, Ph.D.
Dr. Mrs. Santosh, Ph.D.
Dr. S. S. Patil, Ph.D.

Subject Editors

Agriculture
Dr. R. S. Tomar, Ph.D

Veterinary Science
Dr. P. SenthilKumar, Ph.D.

Home Science
Dr. Mrs. Surabhi Singh, Ph.D.

Horticulture
Dr. Timur Ahlawat, Ph.D

(Note: 'Indian Farmer' may not necessarily subscribe to the views expressed in the articles published herein. The views are expressed

Utilization of Waste Water In Agriculture

Rachit Kashyap*[1], Fatteh Singh Meena[2] and Abhay Sharma[1]

[1]Department of Environmental Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, India
[2]Department of Agriculture, Mata Gujri College, Fatehgarh Sahib-140406, Punjab, India
*E-mail of corresponding author: rachit198@gmail.com

Abstract

Wastewater use in agriculture has substantial benefits, but can also pose substantial risks to public health especially when untreated wastewater is used for crop irrigation. Farmers often have no alternative but to use untreated wastewater because there is no wastewater treatment and freshwater is either unavailable or too expensive. The major risks to public health are microbial and chemical. Wastewater use in agriculture can also create environmental risks in the form of soil and groundwater pollution. However, if properly planned, implemented and managed, wastewater irrigation can have several benefits for the environment, as well as for agriculture and water resources management. Given these risks and benefits, countries seeking to improve wastewater use in agriculture must reduce the risks, in particular to public health and maximize the benefits.

INTRODUCTION

In many regions of the world, particularly in water scarce urban and peri-urban areas and where competition for water is high, wastewater is being used for agricultural purposes. While some countries implement agricultural wastewater use practices and guidelines that follow national regulations or international guidelines and safety standards, in many other countries, especially in the developing world, use of wastewater is an unregulated but common practice. The lack of implementation of guidelines and safety standards can lead to an otherwise avoidable aggravation of health risks that could result in significant secondary impacts. Wastewater use is a growing practice worldwide. As freshwater sources become scarcer, wastewater use has become an attractive option for conserving and expanding available water supplies. Waste water use can have many types of applications, including irrigation of agricultural land, aquaculture, landscape irrigation, urban and industrial uses, recreational and environmental uses, and artificial ground water recharge (Asano *et al*., 2007). Principally, waste water can be used for all purposes for which freshwater is used after giving appropriate treatment. With a few exceptions worldwide, wastewater use applications are restricted to non-potable uses, or at most to indirect potable uses. Wastewater use in agriculture is by far the most established application, and the one

with the longest tradition. In most cases the irrigated lands are located in or near the urban areas where the waste water is generated. Estimates on waste water use worldwide indicate that about 20 million hectares or agricultural land is irrigated with (treated and untreated) wastewater (Jiménez and Asano, 2008). Especially in lower income countries and in arid and semi-arid high-income countries, wastewater irrigation is the most prominent and also the most rapidly expanding wastewater use.

The problem with this growing trend toward more agricultural waste water use is that in low income countries, but also many middle-income countries, the practice either involves the direct use of untreated wastewater or the indirect use of polluted waters from rivers and streams. With freshwater either unavailable or too expensive, and wastewater treatment not keeping up with urban growth, urban farmers often have no alternative but to use highly polluted water. Many of them belong to the urban poor who depend on agricultural activities as a source of income and employment generation as well as food security (UNDP, 1996) and (World Bank, 2000).

BENEFITS OF WASTE WATER USE IN AGRICULTURE

Benefits for Agriculture

- Reliable and possibly less costly irrigation water supply.
- Increased crop yields, often with larger increases than with freshwater due to the waste water's nutrient content.
- More secure and higher urban agricultural production, and contribution to food security.
- Income and employment generation in urban areas
- Improved livelihoods for urban agriculturalists, many of whom are poor subsistence farmers, including a large share of women.

Benefits for water resources management

- Additional drought-proof water supply, often with lower cost than expanding supplies through storage, transfers, or desalinization.
- More local sourcing of water.
- Inclusion of wastewater in the broader water resources management context.
- More integrated urban water resources management.

Environmental benefits

If wastewater use schemes are managed well, they can have several environmental benefits (Mara and Cairncross, 1989):

- Avoidance of surface water pollution, which would occur if the wastewater were not used but discharged into rivers or lakes. Major environmental pollution problems, such as dissolved oxygen depletion, eutrophication, foaming, and fish kills can thereby be avoided.
- Conservation or more rational use of freshwater resources, especially in arid and semi-arid areas—i.e. fresh water for urban demand, wastewater for agricultural use.
- Reduced requirements for artificial fertilizers, with a concomitant

reduction in energy expenditure and industrial pollution elsewhere.

- Soil conservation through humus build-up and through the prevention of land erosion.
- Desertification control and desert reclamation, through irrigation and fertilization of tree belts.

RISKS OF WASTEWATER USE IN AGRICULTURE

Microbial risks

The pathogens present in waste waters are the agents of excreta-related diseases and so comprise the viruses, bacteria, protozoa and helminths that cause these diseases. Many excreta-related diseases can be spread by wastewater use in agriculture to those working in wastewater-irrigated fields and/or those consuming wastewater-irrigated foods, especially when eaten uncooked (e.g., salad crops and some vegetables). However the consumption of waste water-irrigated foods is only one possible route of transmission and this route may or may not be of local public health importance.

Soil-transmitted helminthic infections represented the major actual and potential health risk to both those working in wastewater-irrigated fields and those consuming wastewater-irrigated foods uncooked when untreated wastewater was used for crop irrigation, but not when treated wastewater was used. Bacterial feco-oral diseases, such as diarrhea and cholera can be transmitted to those consuming wastewater-irrigated salad crops and raw vegetables. Land application has been a popular option for disposing of municipal wastewater and sewage sludge worldwide for more than a century. While most of the operations appear to be successful, reports from countries such as China suggested that large-scale irrigation of crops with mostly untreated municipal and industrial wastewaters could be harmful to crops and cause injuries to humans because of poorly controlled discharge of toxic and hazardous constituents in the wastes. Concentrations of potentially hazardous pollutants in the municipal wastewater and the resulting sewage sludge varied considerably from location to location and, for the same community, were subject to temporal variations due primarily to point-source discharges from industries. The frequency of detection for inorganic pollutants, such as the trace elements in the wastewater, usually ranges from 50 to 100 percent and they are invariably concentrated into the sewage sludge in the course of wastewater treatment. The frequency of detection for organic pollutants was considerably lower. They range usually from 5 to 10 percent and their concentrations, when found, were low. Community-wide industrial wastewater pretreatment provisions to prevent the discharge of pollutants by industries have been effective in reducing the pollutant concentrations in wastewater and sewage sludge.

CONCLUSION

Wastewater use in agriculture can create risks in the form of soil and groundwater pollution. However, if properly planned, implemented and managed wastewater irrigation can have several benefits for the environment, as well as for agriculture and

water resources management. Given these risks and benefits, countries seeking to improve wastewater use in agriculture must reduce the risks, in particular to public health and maximize the benefits.

REFERENCES

Asano, T., F.L. Burton, H. Leverenz, R. Tsuchihashi, and G. Tchobanoglous. 2007. Water Reuse: Issues, Technologies, and Applications. New York, NY: McGraw Hill.

Jiménez, B. 2008. "Wastewater Reuse in Latin America and the Caribbean." In: Jiménez, B. and T. Asano, eds. "Water Reuse: An International Survey of Current Practice, Issues and Needs." London: IWA Publishing, pp 177-95.

Mara, D.D., and S. Cairncross. 1989. Guidelines for the Safe Use of Wastewater and Excreta in Agriculture and Aquaculture: Measures for Public Health Protection. Geneva: World Health Organization.

UNDP (United Nations Development Program). 1996. Urban Agriculture: Food, Jobs and Sustainable Cities. UNDP Publication Series for Habitat II, Volume One. New York: UNDP.

World Bank. 2000. Project Appraisal Document: Tehran Sewerage Project. Report No. 20154 IRN. Washington, DC: World Bank.

Vaccination In Cattle

Sandeep Kumar Sangwan*[1] and Abhey Singh Yadav[2]

[1]PhD Scholar and [2]Professor
Department of Animal Genetics and Breeding,
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar
*Corresponding author's email address: sangwan36@gmail.com

Vaccination is the administration of an antigen (in-activated organisms used as an antigen) to stimulate a protective immune response against an infection agent. The initial scientific approach of biological products was established by Jenner's work on effectiveness of cowpox in immunization of human beings on effectiveness of cowpox. But now a days this phenomenon of immunization by vaccines is also used in animals to control various diseases which can occur in a herd & can decrease the production capacity.

ACTIVE IMMUNITY

Immunity produced as a result of administration of an antigen, thus triggering an immune response

SUCCESSFUL VACCINATION

Vaccination is one of the most effective way of preventing specific disease by inducing immunity in animals. All vaccines are not capable of providing lifelong immunity. Thus it is essential to know period of effectiveness of particular vaccine, the dosage and route of vaccination & storage conditions for stocking vaccines. Following aspects can help to make vaccination program a success

1. Perform vaccination in healthy stock
2. Cows in advanced pregnancy should not

be vaccinated
3. Calves between 4-6 months be vaccinated.
4. During outbreak-vaccination program should not be carried out
5. Keep all vaccines under refrigeration until ready to use.
6. At time of vaccination, the reconstituted vaccines, particularly live viral vaccines, should keep on ice.
7. Follow manufactures's directions
8. Destroy all unused vaccines which could not be used within validity period
9. Clean up & disinfect all equipments & cloathing after vaccination performed by trained & qualified personnel
10. Keep a record of brand, kind & batch number of vaccines used for various animal species with dated.

Table No.1: Vaccination program for cattle is carried out for following diseases

Disease	Nature of vaccine	Days & season	immunity	dose
Brucellosis	A suspension of living culture of Brucella abortus strain -19 Indian Immunologicals	female calves of 4-6 months of age Although older animals may be vaccinated	Once in life time Durable immunity which persists satisfactory over first or second pregnancies, boosted by natural in-apparent infection	2 ml s/c
Anthrax	Spore vaccine made by non-virulent non-capsulated strain of bacillus anthracis of 50% glycerine sol. (intervet)	All ages, 4-6 months onwards, in endemic areas feb to may	Immunity is established in 10 days after vaccination & last about one year	2 ml s/c
Haemorrhagic septicemia	Alum Precipitated (HVVI, Hisar)	All ages, 4-6 months onwards, May to june	1st time at six months of age, then every six months (May/June and October/ November)	5 ml s/c
	Oil Adjuvant (HVVI, Hisar)		Immunity last about one year	3 ml Deep I/M
Black quarter	From clostrium species after formalinisation HVVI, Hisar	All ages, 4-6 months onwards, All seasons but usually carried out before rainy seasons	Immunity last about one year	5 ml s/c
H.S. & B.Q. Combined vaccine	(intervet)	1st vaccination 6 months and above	annually	4 ml s/c
Rinderpest	A freeze dried bovine kidney	All ages 4-6 month	Durable immunity lasting	5 ml s/c

	cell culture rinderpest virus vaccine	onwards. Winter months	several years	
Foot & mouth disease FMD	Aluminum hydroxide adsorbed gel FMD vaccine (Intervet, Indian Immunologicals)	All ages 4-6 month onwards, although younger than 4 nonths can also be vaccinated Nov to December.	Immunity established after 15 days & persists for 6-8 months 1st time at 3 months of age, booster at 9 months of age and then every six months	5 ml S/C
	Oil adjuvant vaccine (Intervet)		Duration of immunity is 8-9 months	3 ml S/C
	Raksha oil adjuvant Indian Immunological		Duration of immunity is 8-9 months	2 ml Deep I/M
Rabies	Only post exposer	Six doses 0,3,7,14,30,90		1 ml i/m, s/c
Theileria	Theilaria vaccine Rakshavac-T (Indian immunologicals)	1st vaccination 2months and above	Revaccination after every 3 years	3 ml s/c

Role of Hormones In Regulating Reproduction In Farm Animals

Shabir Ahmad Lone*[1], Aasif Ahmad Sheikh, Showkat Ahmad Bhat, Bilal Ahmad Ganaie, Sunil Kumar, Narendra Kumar, Thulasiraman Parkunan, Mohsin Ayoub Mir and Mohammad Rayees Dar

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

Reproduction is regulated by marked interplay between nervous system and endocrine system. These two systems interact to initiate, coordinate and regulate (ICR) all reproductive functions. Nervous system generates two types of reflexes, i.e., simple neural reflex and neuroendocrine reflex. After receiving an external stimulus (stress, temperature, photoperiod, visual and tactile), message is conveyed to sensory neurons (recognition of stimulus) and is further transmitted (through spinal cord and inter-neurons) to efferent neurons. After this stage, treatment of massage is different between simple neural and neuroendocrine reflexes. In simple neural reflex, efferent neurons innervate target tissue and release neurotransmitter for action, e.g., muscles for sexual behavior and ejaculation. In neuroendocrine reflex, efferent neurons reach hypothalamus, thus stimulating release of neurohormone into blood. Neurohormones reach target tissue and response is shown by target tissue, e.g., suckling reflex and milk ejection. In suckling reflex, message goes to hypothalamus, oxytocin is released which reaches mammary glands (Target).

Endocrinology

Deals with biochemistry, physiology, pharmacology and molecular biology of hormones.

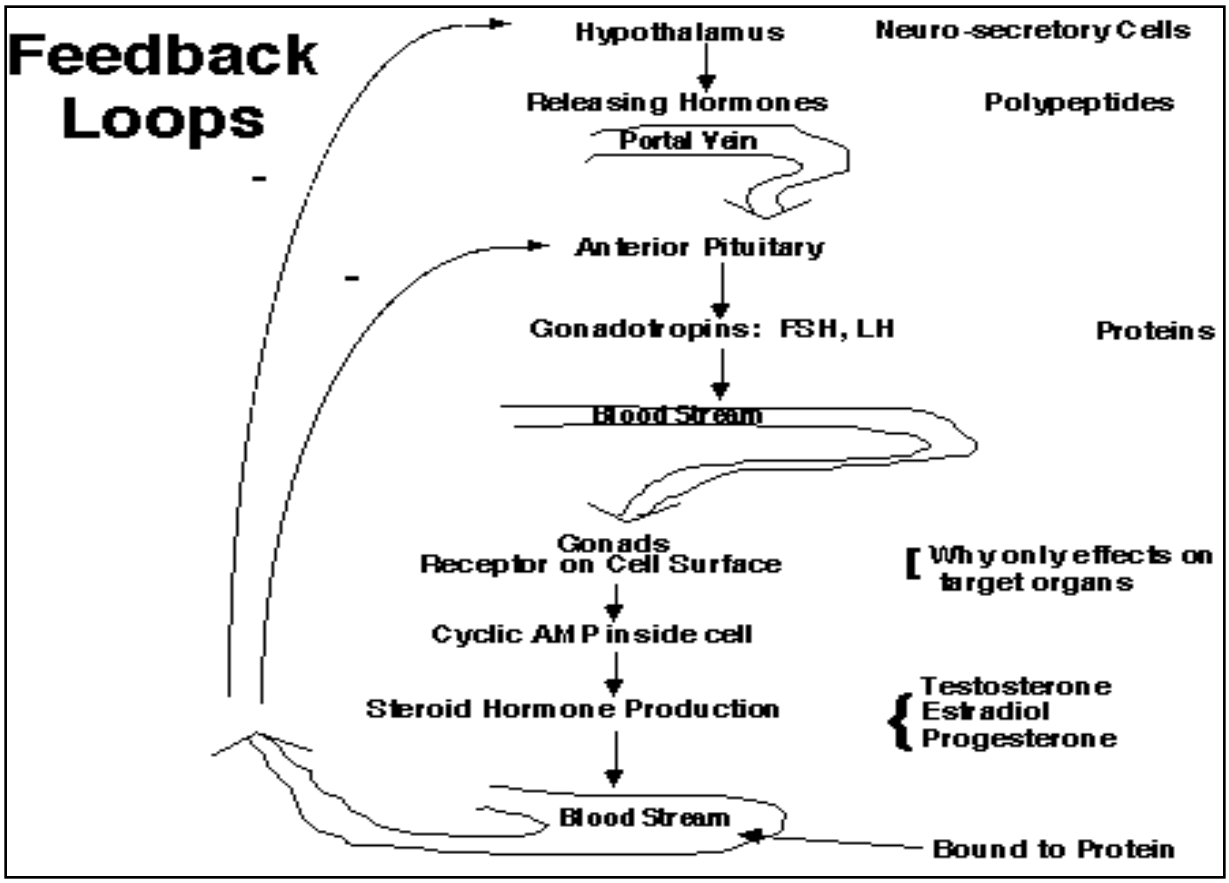
Hormones

chemical substances synthesized and released by endocrine ductless glands directly into blood stream and are transported to target tissue to stimulate or inhibit the functional activity of a target organ. Functional activity involves alterations in metabolism, synthetic activity or secretory activity. Target tissue contains specific receptors for specific hormones to produce new products or hormones. Blood concentrations of hormones are in nanograms (10^{-9}) to pictograms (10^{-12}) per ml. e.g. FSH, LH.

Hypothalamus

Hypothalamus is a neural control center for reproductive hormones. Approximately 0.003% part of entire brain and is composed of bilaterally paired nuclei. Hypothalamic nuclei are clusters of nerve cell bodies. A group of hypothalamic nuclei influencing reproduction are named surge

and tonic center. Surge center is composed of preoptic nuclei (POA) and anterior hypothalamic area, whereas tonic center is composed of ventromedial nucleus (VMN) and arcuate nucleus (ARC). Neurons in these regions secrete GnRH. Various hypothalamic nuclei have different functions and are stimulated by different sets of conditions.



Hypothalamo-hypophyseal portal system

(for anterior pituitary/adenohypophysis) GnRH neuron axons from cell bodies located in surge and tonic center extend into pituitary stalk region (the median eminence) where neuron endings terminate on sophisticated and highly specialized capillary network called HHP system. Hypothalamic neuron terminals release neurohormones into HHP system. This portal system enables extremely small (pg) quantities of releasing hormones to be deposited in the capillary plexus of the pituitary stalk/the median eminence, thus enabling direct action of neurohormones on cells of anterior pituitary before being diluted by systemic circulation. Posterior pituitary (neurohypophysis) does not contain portal system. Neurohormones are deposited directly into capillaries in the post pituitary, e.g. oxytocin which is synthesized from the supraoptic nuclei and the paraventricular nuclei (PVN) located neuron cell bodies is transported down axons to post pituitary and is thus stored here before being released to systemic circulation upon receiving stimuli.

Role of Reproductive Hormones

Hypothalamic hormones

GnRH/LHRH (Gonadotropin releasing hormone/ luteinizing hormone releasing hormone)

It is a decapeptide with MW around 1183D. GnRH is synthesized in hypothalamus and is carried to anterior pituitary gland. Target cell of GnRH is gonadotroph cells in anterior pituitary. **Functions**: It stimulates synthesis and secretion of FSH and LH from anterior pituitary. Clinical applications of GnRH are based upon its ability to stimulate surge release of LH and FSH upon single GnRH injection. Deficiency leads to delayed puberty and infertility related to ovulatory problems. Commercial preparation available is Receptal containing GnRH analogue named Buserelin acetate.

Oxytocin

Hypothalamic hormone (based on site of synthesis) and posterior pitutary hormone (based upon site of release). This is also produced in small amounts from corpus luteum. Target tissue is myometrium and endometrium of uterus and myoepithelial cells of mammary gland.

Functions

Induces contractions of uterus and oviduct musculature, help transport of male and female gametes, involved in milk letdown and promotes uterine prostaglandin synthesis. Clinical applications involve milk letdown, difficult parturition related to uterine inertia, expulsion of fetal membranes and uterine involution. Commercial preparation is Pitocin etc.

Anterior pituitary hormones

FSH (Follicle stimulating hormone)

It is released from gonadotroph cells and MW is 32,000D. Target tissue is ovary (granulose cells). Functions involve stimulating the growth of growing follicles. FSH in combination with estrogen causes formation of FSH and LH receptors in granulose cells, thus stimulating adequate development of granulose cells. Overall the functions of FSH are follicle development and estrogen synthesis. Clinical applications involve use for superovulation during embryo transfer. Preparations available are Gonadotropin FSH, Folltropin-V.

LH (luteinizing hormone)

It is released from gonadotroph cells and MW is 30,000D. Target tissue is ovary (theca interna and luteal cells). Functions involve final maturation of follicle; LH surge release is required for ovulation, transforms granulose cells to lutein cells thus leading to formation of corpus luteum and stimulates progesterone secretion from luteal cells in the ovary. Clinical applications involve use in ovulatory problems. Preparation available is Gonadotropin LH, Lutropin-V.

Prolactin

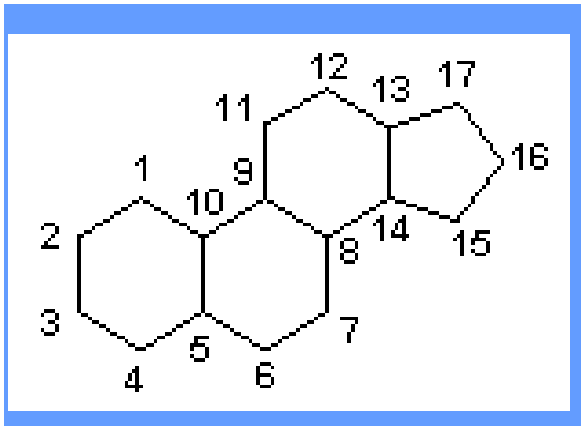
A peptide released from anterior pituitary and MW is 24,000D. Target tissue is mammary cells.

Functions

Prolactin is luteotropic in rat, mouse and sheep i.e., helps in maintenance of corpus luteum. In large animals, prolactin is antigonadotropic and is related with onset and maintenance of lactation. Prolactin also acts on CNS to induce maternal behavior i.e., nesting behavior and care of new born.

Gonadal steroid hormones

Basic nucleus of all steroid hormones is a Cyclopentano-perhydro-phenanthrene nucleus.



Biological action of steroids can be predicted from number of carbons present.

Estrogen

LH stimulates theca cells to secrete testosterone which is subsequently aromatized to estrogen in granulosa cells under FSH stimulation. Target tissue is hypothalamus, reproductive tract and mammary gland.

Functions:

Action on CNS/hypothalamus/anterior pitutary:

Estrogen acts on CNS and creates desire for mating in females known as behavioral estrus. Some amount of progesterone is required for inducing estrus in bovines. First ovulation at puberty is without behavioral estrus because of the fact that progesterone is not available.

Estrogen has negative feedback on tonic center of hypothalamus and positive feedback effect on surge (preovulatory) center to control FSH/LH release.

a) Reproductive functions:

Responsible for secondary sex characters. Reproductive tissue depends upon estrogen for growth, e.g., uterus, ovary and mammary gland. Estrogen causes growth of duct system of mammary gland.

b) Specific actions on genital tract:

1) Vulva: edema and relaxation.
2) Vagina: goblet cells in ant vagina secrete mucus during estrus and late pregnancy, estrogen causes growth and keratinisation of vaginal epithelium especially in dog and cat known as "Mitogenic effect".
3) Cervix: causes cervical relaxation, induces goblet cells to secrete mucus, induces opening of cervix.
4) Uterus: Estrogen increases uterine vascularity and turgidity, causes development of endometrial glands, induces migration of leucocytes thus increasing phagocytosis and giving protection against infections.
5) Oviduct: Estrogen increases oviductal contractility thus helping in gamete transport, under estrogen influence fimbriae become turgid which is suitable for ovum pickup, induces tube locking in sheep i.e. fertilized ovum cannot move to uterus until latter is ready.
6) Ovary: induces contractility of ovarian musculature and helps in ovulation.
7) Ligaments: induces relaxation.

Clinical applications: This hormone is rarely used due to side effects like induces drastic decrease in milk yield and disrupts hypothalamic endocrine system, estrogen has luteotropic action in sows thus can be used for estrus synchronization in pigs and estrogen can be used for induction of lactation in barren dairy animals. Clinical

preparation available is synthetic estrogen known as diethyl stilbesterol (DES).

Progesterone

Progesterone is secreted from luteal cells, placenta and adrenal glands. LH stimulates its secretion. Target tissue is uterine endometrium, myometrium, mammary gland and hypothalamus. Functions: progesterone is known as hormone of maternity.

Specific actions on genital tract:

1) Endometrium: induces secretion from endometrial glands which were previously prepared by estrogen, induces mucosal thickening, coiling of endometrial glands and edema of stroma.
2) Myometrium: inhibits contractions and inhibits response to oxytocin. Thus, progesterone prepares uterus for implantation and maintenance of pregnancy by increasing secretory glands in endometrium and inhibiting the activity of myometrium.
3) Mammary glands: develop secretary tissue of mammary gland along with help of estrogen.
4) Nidation and pregnancy: essential for this function.
5) Estrus symptoms: slight amount is required. During second ovulation, progesterone from regressing corpus luteum act synergistically with estrogen to produce estrus symptoms.
6) Progesterone is necessary for maternal behavior.

Clinical applications: Progesterone prevents abortion, used in birth control pills (prevents LH surge /ovulation), used for synchronization of estrus cycle, used for induction of lactation with estrogen. Clinical preparations available are Duraprogen and proluton depot as injections in the form of implants as PRID (progesterone releasing intravaginal device) and CIDR (controlled internal drug release). PRID is a silicone coil impregnated with progesterone.

Gonadal peptide hormones

Inhibin

It is a glycoprotein which is released from granulose cells of follicles. Its function is to inhibit the release of FSH from ant pit without altering the release of LH from ant pit. Target tissue is gonadotroph cells of anterior pitutary.

Uterine hormones

Prostaglandins

PGs are 20-C unsaturated hydroxyl fatty acids with cyclopentane ring. The precursor for PGs is arachidonic acid. PGF2 alpha is released from endometrial glands whereas PGE2 is released from ovary, uterus and embryonic membranes. Target tissue for PGF2 alpha involves corpus luteum, uterine myometrium, ovulatory follicle whereas for PGE2 involve early corpus luteum Functions: PGF2 alpha: helps in ovulation, CL regression induced by PGF2 alpha initiated constriction of blood vessels, aids in gamete (sperm) transport in females PGE2: stimulates uterine contractions, dilates blood vessels, helps in ovulation, no luteolytic action and assists in maternal recognition of pregnancy in mare. Clinical application: PGF2 alpha: estrus synchronization, luteal cyst treatment. Clinical preparations available are Vetmate, Iliren and Lutalyse.

Placental hormones

PMSG/eCG (Pregnant mare serum Gonadotropin/equine chorionic Gonadotropin)

A glycoprotein with alpha and beta subunits similar to LH and FSH but has higher sialic acid content responsible for long half life. It is secreted from endometrial cups of mare from day 40 to day 150 of gestation. PMSG is isolated from pregnant mare's blood and is not present in urine. Target tissue of PMSG is ovary. Functions: causes growth of bunch of follicles which either ovulate or get luteinized leading to formation of accessory corpora lutea. PMSG has mainly FSH like activity. Clinical applications involve use during superovulation and anestrus. Clinical preparations available are Folligon.

hCG (human chorionic gonadotropin)

A glycoprotein with alpha and beta subunits, secreted from chorion (trophoblast) of blastocyst. hCG can be detected as early as day 6 after conception in humans. hCG has predominantly LH like activity and less FSH like activity. Major advantage of hCG over pituitary LH is its longer half life which increases its effectiveness for induction of ovulation. hCG is isolated from urine. Function of hCG is to facilitate production of progesterone by ovary. Clinical applications involve pregnancy diagnosis in humans and used for treatment of ovulatory defects in bovines. Clinical preparation available is Chorulon.

Placental lactogen

Placental lactogen is a protein hormone which is secreted from placenta of human, goat, sheep and cow. This can be detected in serum in last trimester of pregnancy. Target tissue is mammary gland of dam and function involves mammary stimulation of dam.

Protein B

Protein B is isolated from bovine placental tissue as early as day 22 after conception. It has half life of 7 days. Protein B is a signaling agent transmitting massage not to destroy corpus luteum. It has potential to be developed as a tool for early pregnancy detection in cattle during coming years.

hMG (human menopausal Gonadotropin)

Menopause is a stage when no follicle or CL formation is there on ovary and concentrations of progesterone and estrogen are decreased. This happens usually after 50 years of age. hMG is released from ant pit because no negative feedback control of estrogen and progesterone from ovaries is present because in menopause lady ovarian activity stops. Biological action is like FSH and less like LH.

Physiological Adaptation of Mammals To Climate Change

Lakshmi Priyadarshini[1*], Tripti Kumari[2], Thulasiraman Parkunan[1], Mohammad Rayees Dar[1] and Aasif Ahmad Sheikh[1]

[1]Ph.D. Scholar, Dairy Cattle Physiology Division
[2]Ph.D. Scholar, Division of Livestock Production Management
ICAR-National Dairy Research Institute, Karnal-132001(Haryana)
*Corresponding author email: drlpaa@gmail.com

Climate change impacts on agriculture and livestock are being witnessed all over the world, but in the developing countries like India, its effect is much more drastic as a large section of the population depends on agriculture for livelihood. The Intergovernmental Panel on Climate Change (IPCC) synthesis report (2013) predicted an increase in global temperatures of between 1.5 °C and 4.5 °C during the 21st Century (Hetem et al., 2014).The heat stress is the most important climatic stress in Indian subcontinent, which adversely affects the livestock production and sometimes even threatens the survival of the animals. Small ruminants are critical to the development of sustainable and environmentally sound production systems. Among the climatic components that may impose stress on the productive and reproductive performance of sheep and goats are ambient temperature, humidity, air/wind direction, photoperiod, solar radiation, wind speed, etc of which the ambient temperature is the most important variable. Climatic Stress (Heat and Cold) affects the performance and productivity of mammals in all phases of production/life. The degree of changes which undergoes during the various adaptive processes in the changing/altering climates are

- Physiological
- Morphological
- Behaviour
- By change in population density
- By change in gene frequency
- By change in range distribution
- Migration

Physiological adaptation in mammals

Hot	Cold
Vasodilation Arterioles dilate (enlarge) so more blood enters skin capillaries and heat is lost.	**Vasoconstriction** Arterioles get smaller to reduce blood going to skin: keeping core warm.
Sweating Sudorific glands secrete sweat which removes heat when water changes state.	**Shivering** Rapid contraction and relaxing of skeletal muscles. Heat produced by respiration.
Pilorelaxation This means the hairs flatten.	**Piloerection** Hairs on skin stand up.
Stretching Out By opening up, the body was a larger surface area.	**Curling Up** Making yourself smaller so smaller surface area.

© science aid.co.uk/biology

HOMEOSTASIS

Physiolological adjustment to the thermal environment

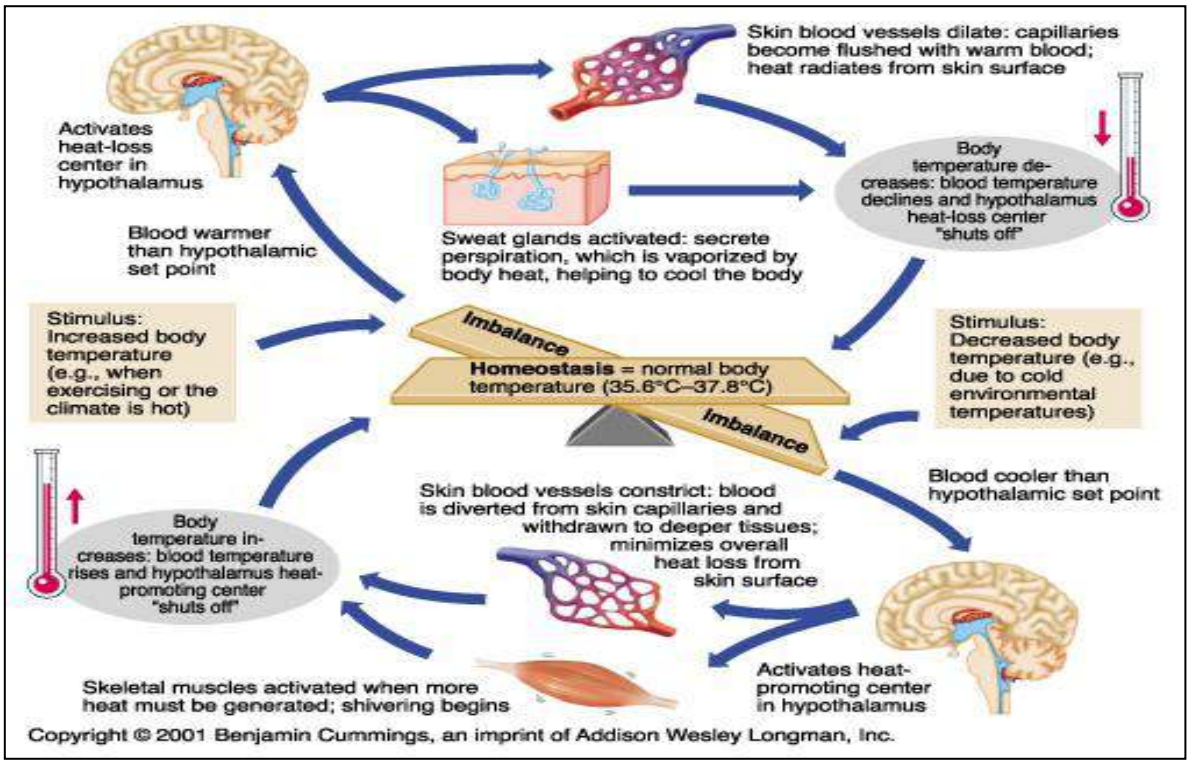
Nonevaporative heat loss- It includes Conduction, convection and radiation.

Evaporative heat loss- There are four strategies used in mammals to increase evaporative heat loss.

1. Panting
2. Sweating
3. Wallowing
4. Saliva spreading

1. **Panting**- Hairy breeds (body bearing thick fur) of animals have limited ability to sweat, relying heavily on panting to increase evaporation of water across the moist surfaces of the lungs, tongue and mouth. Mammals like cats, dogs and pigs, have limited sweat gland (foot pads and snout), rely on panting or other means for thermal regulation. The sweat produced on pads (paws/palms/soles) mostly serves to increase friction and enhance grip.

2. Sweating- An endotherm/warm blooded animal is an animal that regulates its own body temperature, typically by keeping it at a constant level.



To regulate body temperature, an organism may need to prevent heat gains in arid environments. Evaporation of water, either across respiratory surfaces or across the skin in those animals possessing sweat gland, helps in cooling

body temperature to within the organism's tolerance range. The relative contribution of each of the processes that transfer heat away from the body varies with the environmental temperature (Robertshaw, 2006).

3. Wallowing

Skin area/body mass ratio in buffalo and cattle is similar, but the sweat gland population density is about one-sixth of *Bos Taurus* cattle. Under hot/hot & humid climate, buffaloes are unsuitable for draft purpose, hence it requires a wallow for wetting its skin.

4. Saliva spreading

It is way of evaporative cooling of body done by some small animals like rodents which spreads saliva on their body to overcome heat stress.

CARDIOVASCULAR SYSTEM

The cardiovascular system exerts control upon the core temperature of an animal by influencing the flow of heat between the core and superficial tissues. At thermo neutrality, a balance between expansion and contraction of the peripheral blood vessels maintains thermal stability; a high temperature gradient between the skin and environment allows cooling of the animal with but small changes in surface temperature. With increasing heat load, the temperature gradient at the shell declines and requires greater blood flow to remove heat from animal to environment. Moderate warming can elevate skin temperature by 36°F (20°C). Water conservation process and facilitate homeostasis at high environmental heat loads (Hetem et al., 2014).

Selective brain cooling (SBC)

The extent to which the brain will be cooled by selective brain cooling is related to heat exchange at the naso-mucosal surfaces, blood flow to the sinus and within the carotid artery, and the anatomical arrangement of the carotid rete and sinus. Some mammals may be able to use selective brain cooling better than others, because they have differences in the carotid rete. Mechanism allows the brain to remain cooler than the rest of the body. It integrates both thermal and non-thermal regulatory functions. There are two distinct types of selective brain cooling in homeotherms:

(1) By using pre-cooling of arterial blood destined for the brain, with cool venous blood returning from the nose and head skin

(2) By using venous blood to cool the brain directly (Caputa, 2004)

- ✓ The carotid rete is well developed in artiodactylas and felids and their SBC is extremely effective (Mitchell et al., 1987).
- ✓ Well-developed carotid rete but SBC efficacy inferior in some animals like camels, Antelopes, Goats, Oxen and Norwegian reindeer.
- ✓ Dogs having a rudimentary rete but SBC quite effective.
- ✓ Another SBC mechanism in horses is heat transfer from the internal carotid artery to air along the guttural pouches (Baptiste et al., 2000).

HORMONE AND ADAPTATION

- ✓ Glucocorticoids provide an initial integrating signal, which in conjunction with other hormones and paracrine secretions may

determine specific behavioural and physiological responses to adapt to different environmental conditions (Wingfield and Kitaysky, 2002).

- ✓ Thyroid gland activity lowers to adapt in heat stress condition (Nazifi et al., 2003).
- ✓ In case of heat stress the level of melatonin increased significantly ($p \leq 0.05$) in farm animals (Sejian et al., 2012f).
- ✓ Melatonin and prolactin to upregulate heat shock protein (HSP) 70 gene expression during heat stress (Collier et al., 2008).

Fertility and adaptation

By stressing the female, environmental heat triggers blood flow changes that reduce the blood flow to the uterine tract, damaging or killing developing embryos. It is well documented that conception rates and fertility decrease in the summer in temperate zones, and in the subtropical and tropical climates (McLean, 1991).

Environmental heat and conception rate

Uterine blood flow (UBF) is a developing embryo's source of oxygen, nutrients, water, and hormones and also transports damaging heat away from the embryo. Reduction of UBF can damage, or kill, developing embryos. The higher the environmental temperature it leads to the greater the reduction of UBF (McLean, 1991). It is a kind of adaptation to overcome environmental effect.

- ➢ With temperatures increasing from 23.9°C to 32.2°C, conceptions dropped from 52 to 32% and stayed low during the summer months (Badinga et al. 1985).
- ➢ Arizona and Missouri cattle conceptions range from 50% in the cool months to about 20-0% in the hot months (Johnson 1985).

Adaptation for surviving winter season

The principal threats to winter survival are starvation and low temperatures. Method to increase heat production is non-shivering thermogenesis and shivering thermogenesis (Hafez, 1968). To combat the cold stress, the animal must increase its metabolic rate to supply more body heat (Tarr, 2007). Factors which affects animal production ability are:

a) Acclimation: The coat must be clean and dry to provide maximum protection to the large animals. Dirt or moisture on the coat reduces its insulation value dramatically.

b) Fat layer: It acts another insulating layer between the animal's core and the environment.

c) Metabolic rate: animals also increase their metabolic rate to increase heat production and help to maintain body temperature. This increase the appetite and animals eat more.

- ✓ Some mammals catch food to survive winter both pikas in alpine regions and Red squirrels in the boreal forest and chipmunks in both alpine and forest regions catch food (Smith and Reichman, 1984).

- ✓ Snowshoe hares (*Lepus americanus) in winter also* tend to have very low fat levels and are subjected to intense predation pressure for parts of the 10-year cycle (Krebs et al., 2001).
- ✓ Hares in winter have only sufficient internal reserves to survive 2–4 days without feeding (Whittaker and Thomas, 1983).
- ✓ The non-breeding young from one summer must survive winter to become the breeding adult population of the next.
- ✓ Most small mammal species living at northern latitudes maintain lower body mass during autumn and winter than they do in summer (Hansson, 1990).
- ✓ *Meadow voles* (*Microtus pennsylvanicus) lost 20% of their body mass* and consumed 30% less food under short photoperiod characteristic of winter conditions (Dark et al.1983).
- ✓ Reduce both the energy demands and the time needed to forage.
- ✓ This lower body mass presumably represents a physiological optimum for winter survival, as voles that are either too small or too large do not survive winter (Aars and Ims, 2002).
- ✓ Moderate levels of glucocorticoids during winter may be one of the adaptations that small mammal species have to survive this period (Boonstra, 2004).

Torpor

Torpor is a state of decreased physiological activity in an animal and little energy due to a reduced body temperature and metabolic rate.

Types-

- ✓ "Daily torpor" ex- marsupials and rodents
- ✓ Torpor lasting days to weeks (Geiser, 2004) If period is longer than weeks then it is called

hibernation in case of cold condition and aestivation in case of summer.

- ✓ Chipmunks, Ground squirrels, and Marmots coupled with internal fat storage undergo hibernation. It is strategy for decrease metabolic expenditure (Ashton et al., 2000).

Fasting

- ✓ The ability to suppress the stress response may permit fasting animals to utilize fat stores and spare protein by preventing the catabolic, protein-mobilizing effects of GCs.
- ✓ King penguins in the Antaractic can fast for up to 3–4 month while incubating and molting (Cherel et al., 1988b).
- ✓ Svalbard ptarmigan (*Lagopus mutus hyperboreus*) rely on fat reserves as energy stores during the winter period (Boonstra, 2004).

CONCLUSION

- ✓ In climate change condition, physiological adaptation is one of important type of adaptation in mammals for their survival.
- ✓ Mammals do panting, sweating, wallowing, saliva spreading, selective brain cooling (SBC), aestivation etc like physiological adaptation to overcome heat stress.
- ✓ Nonshivering thermogenesis, shivering thermogenesis, torpor, hibernation etc are kind of adaptation to overcome cold stress.

REFERENCES

Aars, J. and Ims. R. A. (2002). Intrinsic and climatic determinants of population demography: The winter dynamics of tundra voles. Ecology 83:3449–3456.

Ashton, K. G., Tracy,M. C. and Queiroz,A. de (2000). Is Bergmann's rule valid for mammals? Amer. Nat. 156:390–415.

Badinga, L., Collier, R. J., Thatcher, W. W. and Wilcox C. J. (1985). Effects of climatic and management factors on conception rate of dairy cattle in subtropical Florida. Jour. Dairy Sci., Vol. 68, pp. 78-85.

Baptiste,K.E., Naylor, J.M.,Bailey, J., Barber, E.M.,Post, K., Thornhill,J. (2000). A function for guttural pouches in the horse Nature, 403: 382–383.

Boonstra, R. (2004). Coping with Changing Northern Environments: The Role of the Stress Axis in Birds and Mammals. BioOne, 44(2): 95-108.

Caputa, M. (2004). Selective brain cooling: a multiple regulatory mechanism. Journal of Thermal Biology, 29(7–8): 691–702.

Cherel, Y., Robin, J. P., Walch, O., Karmann, H., Netchitailo, P.and Maho,Y. L. (1988b). Fasting in king penguin. I. Hormonal and metabolic changes during breeding. Am. J. Physiol. 254: 170–177.

Collier, A., Orr, L., Morris, J., Blank, J. (2008). The effects of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) on the mortality and growth of two amphibian species (Xenopus laevis and Pseudacris triseriata). Int J Environ Res Public Health. 5(5): 368-77.

Dark, J., Zucker, I.and Wade,G. N. (1983). Photoperiodic regulation of body

mass, food intake, and reproduction in meadow voles. Am. J. Physiol. 245: R334–338.

Geiser, F. (1994). "Hibernation and Daily Torpor in Marsupials – a Review". *Australian Journal of Zoology* 42 (1): 1–16.

Geiser, F. (2004). "Metabolic rate and body temperature reduction during hibernation and daily torpor". *Annu. Rev. Physiol.* 66: 239 274.

Hafez, E.S.E. (1968). Badreldin, department of animal science, Washington state university, Pullman, Washington, 183- 193.

Hansson, L. (1990). Ultimate factors in the winter weight depression of small mammals. Mammalia 54:397–404.

Hetem, R. S., Fuller, A., Maloney, S.K., Mitchell, D. (2014). Responses of large mammals to climate change. Temperature, 1:10 – 22.

Johnson, H. D. 1985. Physiological responses and productivity of cattle, in Yousef, M. K., ed., Stress Physiology in Livestock, Volume II, Ungulates. Boca Raton, CRC Press, Inc., pp. 3-23.

Krebs, C. J., Boonstra, R., Boutin, S. and Sinclair,A. R. E. (2001). What drives the ten-year cycle of snowshoe hares? Bioscience, 51:25–35.

McLean, D. M., (1991). A climate change mammalian population collapse mechanism, in Kainlauri, E., Johansson, A., Kurki-Suonio, I., and Geshwiler, M., eds., *Energy and Environment*: Atlanta, Georgia, ASHRAE, p. 93-100.

Mitchell, D., Laburn, H.P., Nijland, M.J.M., Zurovsky, Y., Mitchell, G. (1987). Selective brain cooling and survival, S. Afr. J. Sci., 83: 598–604.

Nazifi, S. and Vesal, N. (2003). Hematological values of healthy roseringed parakeets *(Psittaculla krameri).* Journal of Applied Animal Research. 24 (2): 165-168.

Robertshaw, D. (2006). Mechanisms for the control of respiratory evaporative heat loss in panting animals. Journal of Applied Physiology. 101(2): 664-668.

Segian, V. (2013) Climate change impact on production and reproduction, adaptation mechanism and mitigation strategies in small ruminants: a review. Indian journal of small ruminants, 19:(1), 1- 21.

Sherwood, S.C.and Huber, M. (2010). An adaptability limit to climate change due to heat stress. PNAS, 107: (21), 9552–9555.

Smith, C. C. and Reichman O. J. (1984). The evolution of food caching by birds and mammals. Ann. Rev. Ecol. Syst. 15:329–351.

Tarr (2007). Cold stress in cows. Ministry of agriculture, food and rural affairs, Ontario.

Wingfield, J.C., Kitaysky, A.S. (2002). Endocrine responses to unpredictable environmental events: stress or anti-stress hormones? Integr Comp Biol. 42(3): 600-9.

Whittaker, M. E. and ThomasV. G. (1983). Seasonal levels of fat and protein reserves of snowshoe hares in Ontario. Can. J. Zool. 61:1339–13.

Factors Affecting Nodulation in Mungbean (*Vigna radiata* L.Wilczek)

Apurba Pal

[1]Ph.D. Scholar, Department of Plant Physiology, BCKV, Nadia-741252
Corresponding author email:apapurbapal@gmail.com

Mungbean (*Vigna radiata* L.Wilczek) is one of the important legumes and a well-known economic crop in tropical and subtropical countries. Its seeds contain approximately 24.2% protein, 1.3% fat and 60.4% carbohydrates, calcium and phosphorous are measured as 118 and 340 mg per 100 g of seeds, respectively and is rich in vitamin-A. It is often included in rice or corn-based crop rotation to replenish nitrogen, improve soil fertility and control pests and diseases. As a leguminous plant, mungbean could be nodulated by rhizobia, causing the formation of a new organ (i.e. nodule) and establishing a nitrogen-fixing symbiosis .Within the root nodules, these bacteria fix atmospheric nitrogen into ammonia, providing the nitrogen requirements of cultivated legumes and reducing the need for artificial fertilizer which can be expensive and cause environmental problems. Consequently, the symbiotic bacteria are of enormous agricultural and economic value. In biological nitrogen fixation, several environmental conditions are limiting factors to the growth and activity of the N2-fixing plants. Typical environmental stresses of N2-fixing systems include acidity, alkalinity, salinity, drought stress, nutrient deficiency, fertilizers, heavy metal, soil nitrate, temperature and biocides. It is known that soil acidity, temperature, and salinity affect rhizobial persistence in the soil and the rhizosphere of plants, as well as the efficiency of nodulation (Riccillo *et al.,* 2000).

NODULATION

Legumes are capable of fixing atmospheric nitrogen through a symbiotic association with soil bacteria called *Rhizobium*. These bacteria form nodules on the roots of leguminous plants. Rhizobia are special bacteria that can live in the soil or in nodules formed on the roots of legumes. In root nodules, they form a symbiotic association with the legume, obtaining nutrients (carbohydrate) from the plant and producing ammonia in a process called biological nitrogen fixation, or BNF. Rhizobia are classified according to their compatibility with particular legume species.

Benefitial effects of (*Brady) Rhizobium* on mungbean cultivation:

- Inoculation of *Rhizobium* sp. causes a greater increase in growth and yield and the number of nodules per root system.

- In addition to their beneficial N2-fixing activity with legumes, *Rhizobia* can improve plant P nutrition by mobilizing inorganic and organic P. Conjunctive use of *Rhizobium* with Phosphate Solubilizing Bacteria (PSB) revealed synergistic effect on symbiotic parameters and grain yield of mungbean.
- The single and dual inoculation *Rhizobium* and phosphorus (P) solubilizing bacteria with fertilizer (P_2O_5) significantly increases root and shoot weight, plant height, spike length, grain yield, seed P content, leaf protein and leaf sugar content.
- Tillage versus no-tillage experiment revealed more nodulation and leg-hemoglobin content in no-tillage treatment. The P-solubilizing strains and the N_2-fixing bacterial strains have great potential in being formulated and used as biofertilizers.

Factor affecting nodule formation in mungbean

1. Water stress
2. pH
3. Temperature
4. Salinity
5. Mineral nutrition
6. Plant Growth Regulators (PGRs)

1. Effect of water stress on nodulation in mungbean

Drought stress reduced fresh and dry weight of root and shoot, decreased the diameter of pink bacteroid tissue and number of root nodules. However, ABA and CCC pre-soaking treatments partially alleviated the inhibitory effect of drought. ABA treatment caused a maximal increase in proline accumulation while maximal increase in peroxidase activity was observed in plants raised from seeds treated with CCC. Likewise, endogenous levels of phytohormones GA and IAA were also increased following ABA application. Whereas, CCC increased IAA. (Table.1). The effects of CCC was similar to ABA under water stress and may be implicated to combat water stress on farmers level because of better cost benefit ratio as compared to ABA (Farooq and Bano, 2006).

2. Effect of pH on nodulation of mungbean

Soil acidity per se can limit rhizobial growth and persistence in soil. Fast-growing *Rhizobia* are generally considered more sensitive than are *Bradyrhizobia*. Failure to nodulate is also common in acid soils, in part because of lowered numbers of rhizobia, but also because acid pH affects attachment. For many strains problems in nodulation can be expected once soil pH falls below pH 5.2. A few strains were sensitive on one host cultivar and tolerant on the other, implying that acid tolerances of symbiotic legumes cannot be compared validly in trials with only one inoculants (Munns *et al.*, 1979).

3. Effect of temperature on nodulation of mungbean.

Exposure to high temperatures at these times can lead to the loss of the symbiotic plasmid in *Rhizobium*, or reduce cell

numbers below the levels needed for good nodulation. The optimum temperature for many legumes is around 25^{o}C; exposure to temperatures of > 40^{o}C, even for short periods, can cause irreparable loss of nodule function. Constant high temperatures and diurnally administered temperature regimes reduces the growth, nodulation and nitrogen fixation of mungbean (*Vigna radiata* L. Wilczek) plants and growth responses of five different cowpea bradyrhizobial strains. Mungbean genotype and bradyrhizobial strains responded differently to high temperatures. Mungbean plants survived at diurnal regimens of high temperature and constant root but, germination high temperatute reduced than normal temperature (Hafeez *et al*., 1991).

4. Effect of sodium chloride on nodulation of mungbean

The effects of saline or alkaline conditions are likely to be greater on the host or symbiosis than on the *Rhizobia*. Alkaline soil conditions limit the availability of iron, zinc, manganese and boron in the soil, thereby reducing plant growth and N_2fixation. Cells of *Rhizobium* exposed to high salt concentrations will often accumulate osmoregulants such as glutamic acid, trehalose, glycine, betaine and proline, which help to maintain turgor in the cell, and limit the damage caused by salts. The growth and nodulation of *Vigna radiata* were compared at four levels (0-0.3 % NaCl added to garden soil) of salinity in pot experiments. Dry mass of plants, 7 and 11 weeks after the commencement of salinity treatment, decreased with increasing salinity levels. Number of nodules and fresh weight of nodules per plant decreased with increasing salinity (Table.2). As the number of nodules decreased, average size of the nodules increased with increasing salinity levels (Nosheen *et al.*, 2004).

5. Effect of Mineral nutirents on nodulation of mungbean

- Nodule development was stimulated in the presence of nitrate but was increasingly depressed by the higher levels of nitrate. Nitrate increased the ethylene production in 5-day-old seedlings, while it caused a reduction in the nodulation status (nodule number and nodule weight) and nodule efficiency in mungbean plants.
- Molybdenum application can play a vital role to increase nitrogen fixation by *Rhizobium* and for the formation of nodule.
- A cobalt-mediated decrease in ethylene production reduced the inhibition of nodulation by nitrate in *Vigna radiata* (mungbean).
- Zinc has been widely reported to be involved in the activation of enzyme systems and is involved in root formation and shoots elongation in plants where they contribute towards auxin production. It is interesting to note that as the number of number of nodules increased along with the increased in plant dry weight, there was a corresponding decrease in nitrogen content of the nodules (Table.3).

Zinc had a significant effect in increasing both nodulation and vegetative growth in mungbean plants. The optimum level for maximum nodulation was found to be 5.0 kg/ha.

Iron deficiency generally decreases nodule formation, leghaemoglobin production and nitrogenase activity, leading to low nitrogen concentrations in the shoots in some legumes. The sensitive stage of nodulation to iron deficiency appears to be nodule initiation. Under iron deficiency, further division of root cortical cells is limited and the proliferation of (brady) rhizobia in roots is inhibited (Tang *et al*., 1992).

6. Effect of Plant Growth Regulators on nodulation

- Salicylic acid (SA) is recognized as an endogenous regulator of plant metabolism, mainly involved in induction of systemic acquired resistance (SAR). Elicitation of plant defense responses might also block beneficial plant-microbe interactions and result in negative effects on plant growth.
- Drastic reduction in number and fresh weight of nodules were also observed due to salinity, however, kinetin successfully reduced the stress effect up to a considerable extent by enhancing the number and fresh weight of nodules (Singh *et al.*, 1984).
- Salinity stress severely affects the growth, nodulation and yield of mungbean (Vigna radiata L.). However, inoculation/co-inoculation with rhizobia and plant growth promoting rhizobacteria (PGPR) containing 1-Aminocyclopropane-1-carboxylic acid (ACC) deaminase improve the plant growth by reducing the stress induced ethylene production through ACC-deaminase activity.
- Nodule number also increased significantly. Plants treated with 200 mg penicillin/dm^3 at early flowering stage produced about 2 times more nodules than the control. Significant increase in nodulation, viz. number, weight and size of nodules was observed. Nodular protein and leghaemoglobin were also enhanced till later stage of growth. The enhancement effect was observed with lower concentrations of brassinolide, against control.
- Inoculation/co-inoculation with *Pseudomonas* spp. and/or *Bradyrhizobium* had significant effect on root elongation, total biomass and nodulation. Maximum root elongation was observed in the case of *Bradyrhizobium* and *Pseudomonas putida* biotype applied alone or in combination. Total plant biomass was also maximum where same co-inoculation was employed. The most prominent effect of co-inoculation was observed in terms of number of nodules, and fresh and oven dry weight of nodules. Co-inoculation of Q7 with *Bradyrhizobium* resulted in 11-fold more number of nodules than uninoculated control and 48% than *Bradyrhizobium* alone (Shaharoona e*t al.*, 2006).

CONCLUSION

From the above results, it appears that nodule formation in mungbean plant is dependent on several factors. These results suggest that inoculated mungbean was N-limited and that inoculation of mungbean using current technology may be somewhat ineffectual. Low nodulation and nitrogen fixation of commercial mungbean most likely results from the suppressive effects of nitrate and/or insufficient numbers of bradyrhizobia in the soil. When low symbiosis and low soil nitrate are combined, N is likely to limit crop growth, and potentially grain yield. Suggested strategies for improving mungbean nodulation and nitrogen fixation include selection of more symbiotically competent plant and bradyrhizobial genotypes and more effective utilisation of established soil populations of mungbean *Bradyrhizobia.*

REFERENCES

Farooq, U. and Bano.(2006).Effect of Abscisic Acid and Chlorocholine chloride on Nodulation and Biochemical Content of (*Vigna radiata* L.) Under water stress. A *Pak. J. Bot*., **38**(5): 1511-1518.

Hafeez, F. Y., Asad, S and Malik, K. A.(1991). The effect of high temperature on *Vigna radiata* nodulation and growth with different bradyrhizobial strains. *Environmental and Experimental Botany*. **31**(3):285–294.

Munns, D. N., Keyser, H. H., Fogle, V. W., Hohenberg, J. S., Righetti, T. L., Lauter, D. L., Clarkin, K. L. and Whitacre, K. W. (1979). Tolerance of Soil Acidity in Symbioses of Mung Bean with Rhizobia D. *Agronomy Journal*, **71**: 256-260.

Nosheen, N., Elahi, Mustafa, S. and Mirza. (2004).Growth and Nodulation of Mungbean (*Vigna radiata* L. Wilczek) as affected by Sodium Chloride. *Journal of Research (Science)*. **15(**2): 139-143.

Quah, S. C., Raidi, S. Z. and Bujang , I. (1994).Nodulation in mungbean. In: Koh,C.L.(ed).The Role of Genetics in National Development. *Proceedings of the The First National Congress on Genetics*.16l-163**.**

Riccillo, P. M., Muglia, C. I., de Bruijn, F. J., Roe, A. J., Booth, I. R. and Aguilar, O. M. (2000).Glutathione is involved in environmental stress responses in *Rhizobium tropici*, including acid tolerance. *J. Bacteriol*.,**182**(1):1,748-1,753.

Shaharoona, B., Arshad, M. and Zahir, Z. A. (2006). Effect of plant growth promoting rhizobacteria containing ACC-deaminase on maize (*Zea mays* L.) growth under axenic conditions and on nodulation in mung bean (*Vigna radiata* L.) *Letters in Applied Microbiology*. **42**(2):155–159.

Singh, B. and Badhoria, B. S. (1984). Response of greengram to potassium and zinc application.

Journal of Agricultural Science. **102**: 253 -255.

Tang, C., Robson, A. D. and Dilwarth, M. J. (1992). The role of iron in the (brady) Rhizobium legume symbiosis, Journal of Plant Nutrition. **15**(10): 2235.

Table.1. Effect of water stress on diameter of pink bacteriod tissues (mm^{-3}), number of nodules/plant of and the Colony Forming Unit (Cfu) for Rhizobium per g of soil.

Treatment	Diameter of pink bacteriod tissues		Number of nodules		Cfu for Rhizobium After Harvest	
	Varieties		varieties		Varieties	
	NM98	NCM 209	NM98	NCM 209	NM98	NCM 209
Control	0.309a	0.348a	16.6a	18.3a	22 ×10^4	23×10^4
Water stress	0.157bc	0.123d	10.6d	9.6d	15×10^4	12×10^4
Re-watering	0.247a	0.162c	11.6d	10.3b	17×10^4	14×10^4
Water stress+ABA	0.210b	0.207bc	14.0b	15.0b	20×10^4	19×10^4
Water stress+CCC	0.172b	0.160cd	9.3d	10.0d	22×10^4	19×10^4
ABA	0.235ab	0.253b	12.0c	13.6c	26×10^4	25×10^4
CCC	0.210b	0.288ab	14.0bc	14.6bc	25×10^4	24×10^4
L.S.D	0.0818	0.0818	2.40	3.30	22×10^4	23×10^4

Table.2. Effect of NaCl concentration on nodule number, nodule fresh mass and nodule size of Vigna radiata, 7 and 11 weeks after the commencement of salinity treatment. Each value represents mean of 9 plants ± SEM.

		7 weeks			11 weeks		
NaCl conc. Added to soil (%)	**EC_e (ds/m)**	**Nodule number/ plant**	**Nodule fresh mass (g/plant)**	**Nodule size (mm)**	**Nodule number/ plant**	**Nodule fresh mass (g/plant)**	**Nodule size (mm)**
0	1.07	0.55 ±0.22	0.03 ± 0.01	1.38± 0.30	3.70 ± 0.47	0.13 ± 0.02	2.72±0.30
0.1	1.28	0.44± 0.24	0.02 ± 0.01	1.25± 0.25	2.00 ± 0.6	0.10 ± 0.05	2.90±0.42
0.2	1.80	0.28± 0.19	0.02 ± 0.01	1.60± 0.40	1.33 ± 0.54*	0.08 ± 0.04	3.66±0.52
0.3	2.41	0.11±0.01 *	0.01 ± 0.00*	2.00± 0.36	0.00	0.00	0.00

** Significantly different to the control at P < 0.05.* (Nosheen et al., 2004)

Table.3. Mean values for all characters examined at four levels of zinc treatments (Average over replicates and varieties).

Variety	Nodules per plant	Plant dry weight	Plant height	Trifoliate per plant	%N in nodules	% K in nodules
UPM 45-lB	8.38a	0.68ab	26.61bc	3.88ab	6.06a	1.28a
VCI13	19.56b	0.83bc	27.56bc	4.31c	6.22ab	1.74b
UPM l0-10B	21.31bc	0.61a	26.48ab	4.00b	7.77c	1.58ab
VCI 1638	22.94c	0.73ab	25.88a	3.75a	7.03bc	1.43ab
V3476	24.62d	0.92c	28.14c	3.56a	7.62c	1.45ab

(NB. Mean values with the same alphabet are not significantly different at 5% probability).

(Quah et al., 1994)

Table.4. Effect of coinoculation of selected rhizobacteria containing 1-aminocyclopropane-1-carboxylic acid-deaminase on root elongation, total biomass and nodulation in mungbean in a pot trial (average of five replicates)

Treatment	Root elongation (cm)	Total biomass (g)	Number of nodules	Fresh weight of nodules (g)	Oven dry weight of nodules (g)
Control	15·5 c*	17·2 c	3 e	0·06 d	0·001 b
Q7 (*Pseudonomas putida* biotype)	20·4 a	20·3 bc	18 d	0·47 b	0·058 ab
Q14 (*Pseudonomas fluorescens*)	17·8 bc	19·8 bc	14 d	0·42 b	0·021 b
Bradyrhizobium japonicum	20·7 a	20·4 bc	25 c	0·34 bc	0·050 ab
Q7 + Q14	19·5 ab	22·6 ab	19 d	0·33 bc	0·020 b
Q7 + *Bradyrhizobium*	20·1 a	24·7 a	37 a	0·75 a	0·100 a
Q14 + *Bradyrhizobium*	17·1bc	21·4 a	18 d	0·43 bc	0·020 b
Q7 + Q14 + *Bradyrhizobium*	17·2 bc	22·9 ab	27 b	0·33 bc	0·040 abc

**Mean values sharing the same letter(s) in a column do not differ significantly according to Duncan's multiple range test (P = 0·05).* (Shaharoona et al., 2006)

Kisspeptin - A Key Player For Production

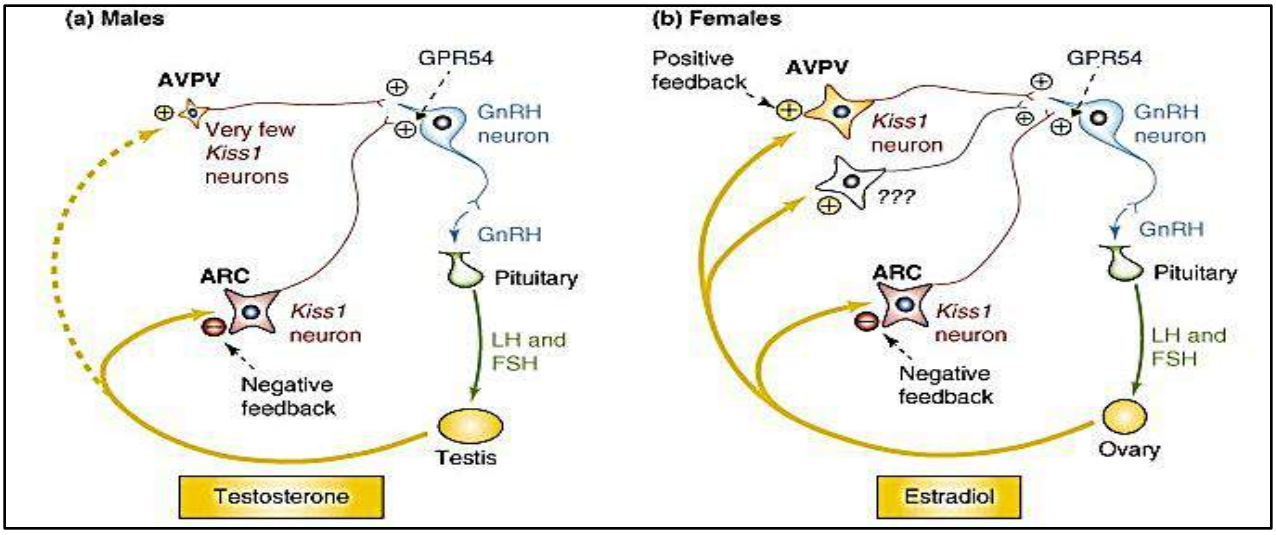
Varsha Jain, Brijesh Patel, Mohammad Rayees Dar* and Nishant Kumar

National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana, INDIA
**Corresponding author Email id: rayeesr21@gmail.com*

All vertebrates experience marked changes in reproductive physiology during the developmental transitions from a sexually immature, pre-pubertal state to a post-pubertal, reproductivelyactive state. Kisspeptin has emerged as a key player in the initiation of puberty and reproductive function. Kisspeptin potently stimulates the release of gonadotropins predominantly through the release of gonadotropinreleasing hormone (GnRH). The role of kisspeptin in the regulation of the hypothalamic-pituitary-gonadal (HPG) axis. The kisspeptins were originally identified as a product of a metastasis suppressor gene, KISS-1, in malignant melanomas(Lee *et al*., 1996). Kisspeptins are the peptide products of KISS1 gene, which operate via the G - protein-coupled receptor GPR54, regulators of neurons secreting GnRH, the major hypothalamic node for the stimulatory control of the HPG axis. They are potent elicitors of gonadotropin secretion in various species and physiological processes. Moreover, KISS1 neurons in the hypothalamus participate in crucial features of reproductive maturation and function, such as brain-level sex differentiation, puberty onset and the neuroendocrine regulation of gonadotropin secretion and ovulation. The release of GnRHis due to an action on the anterior pituitary and also involves the release of luteinizing hormone (LH) and follicle stimulating hormone (FSH). These gonadotropic hormones lead to sexual maturation and gametogenesis. Kisspeptin expressing neurons are targets for regulation by sex steroids, furthermore, these neurons are directly regulated by the negative and positive feedback actions of sex steroids in distinct regions of the forebrain. Inactivating mutations of the kisspeptin receptor result in hypo-gonadotrophic hypogonadism in humans and kisspeptin receptor activating mutations cause precocious puberty.This abnormality is due to the mutation in GPR54 and several other phenotypes related to this mutation included a smaller sex
steroid and gonadotropin concentration in the circulating blood and even sterility. Kisspeptin stimulates the neurons that are involved in the release ofGnRH and possibly may have some impact on the release of LH andFSH.

Location and distribution of kisspeptin

Expression of both receptor (GPR54) and ligand (KISS1) are the highest in placenta, with additional distribution throughout the central nervous system (Highest level in hypothalamus and pituitary than



cerebellum, cortex and brainstem). There are also some reports of variable expression in adipose tissue, pancreas, liver, small intestine, peripheral blood lymphocytes, testes, lymph nodes, aorta, coronary artery and umbilical vein.Kisspeptin expressing neurons are located inanteroventral periventricular nucleus (AVPV), Periventricular nucleus (PeN), Antero- dorsal preoptic nucleus (ADP) and arcuate nucleus (Arc) (Arai, 2009).

Mechanism of action of kisspeptin

The enhancement of endogenous KISS-1 tone in the hypothalamus takes place during pubertal attainment and such activation of GPR54 is apparently sufficient to trigger the neuroendocrine events leading to the onset of puberty. Kisspeptin stimulates the neuroendocrine reproductive axis and sex steroids differentially regulate the expression of KISS-1 mRNA in different nuclei within the forebrain. Kisspeptin released by neurons in the AVPV and Arc stimulates GnRH release, which induces the release of LH and FSH. The gonads respond to gonadotropins by secreting sex steroids, which then feedback to regulate the activity of kisspeptin neurons, inhibiting KISS-1 expression in the Arc and inducing its expression in the AVPV (Figure).The inductive effect of sex steroids on KISS-1 expression in the AVPV may contribute to the preovulatory LH surge in females and possibly T-mediated sex behavior in the male (Kuffman *et al*., 2007).

ROLE OF KISSPEPTIN

Role in puberty

The onset of puberty is marked by an increase in gonadotropin secretion, which leads to sexual maturity and the ability to reproduce (Rhie, 2013). Gonadotropin secretion is brought about and regulated byGnRH, leads to the release ofLH and FSH, which primarily target the gonads to trigger puberty and reproduction. The primary event that leads to the beginning of puberty is the activation of GnRH neurons. This event is thought to involve kisspeptin/GPR54 signaling, which leads to the eventual activation of GnRH neurons(Smith and Clarke, 2007).

Role in Estrous cycle

The stimulation of the gonadotropin axis by the kisspeptin, suggested possible involvement in the positive feedback loop between estrogen, GnRH and LH and regulation of the estrous cycle. Kisspeptin mRNA expression changed as a function of the estrous cycle with kisspeptin expression being at its lowest at proestrus and it is highest at dioestrus(Bond and Smith,2014). However, the expression of kisspeptin is at its highest in the AVPV at proestrus, when it is also at its lowest in the Arc.Kisspeptin levels were maximum in ovary at proestrus and the levels remaining low throughout the rest of the cycle with the exception of a transient increase at dioestrus. There were no changes in GPR54 expression of kisspeptin/GPR54 in the AVPV mediates the process of the GnRH surge at proestrus and ovulation. Kisspeptin neurons in the Arc are likely to play a role in the negative feedback regulation of GnRH and gonadotropin secretion(Smith *et al.*, 2005).

ROLE IN REPRODUCTION

Kisspeptin plays major role during pregnancy, in early-term placentas, GPR54 was at higher rate than placentas at-term. The expression of kisspeptin, however, remains unchanged in the placenta throughout pregnancy. The increase in the expression of GPR54 in early-term placentas may due to the increased presence of intrusive trophoblasts during the beginning of pregnancy. Kisspeptin-54 during pregnancy, 1000x increase was observed in early pregnancy and 10000x increase were seen in third trimester. Following birth, kisspeptin-54 levels returned to normal, showing the placenta as the source of these increased kisspeptin levels (Mead *et al.*, 2007).

Role in spermatogenesis and male fertility

GnRH secretion is controlled by KISS1 gene-encoding kisspeptins, which are critical for the onset of puberty and the control of adult fertility. Administration of kisspeptins markedly stimulate the release of LH, FSH and testosterone and the inactivation and mutation of KISS1 causes failure of pubertal progression, reduction of gonadal size, low testosterone level and infertility. GnRH DNA vaccines induce stronger immune responses, reduce the serum testosterone levels and suppress the fertility. Therefore, KISS1 may be a more effective target for developing a DNA immune castration vaccine. The immune castration effect of a KISS1 antagonistic DNA vaccine in ram lambs was evaluated in terms of identifying a specific KISS1 antibody response, and assessing its effect on serum testosterone levels, altered gonadal function and sexual behavior (Han *et al.*, 2015).

ROLE IN SEASONAL REPRODUCTION

Kisspeptin, a neuropeptide product of the KISS-1 gene, has recently been implicated in the regulation of seasonal breeding in a number of species, including Siberian hamsters. Kisspeptin expression is reduced in the AVPV following exposure to inhibitory day lengths and exogenous kisspeptin activates the reproductive neuroendocrine axis of reproductively

quiescent animals(Greives *et al.*, 2008).In several species, reproduction is controlled photo periodically. The role of kisspeptin in timing of puberty made them likely modulators of the photoperiodic control. In Syrian hamsters, where reproduction is promoted by long days and inhibited by short days. Kisspeptin were significantly lower in short-day animals, effect reliant on melatonin signaling, as pineal gland ablation prevent its downregulation. Brain kisspeptin mRNA expression was lower during anestrusin the Arc of ewe due to non-steroid dependent seasonal effect. Therole of kisspeptin is in control of seasonal changes in reproductive function (Smith *et al*., 2008).

ROLE IN TUMOR SUPPRESSION

Kisspeptin plays a role in tumor suppression reported by a study wheremalignant tumor cells were injected into a model system. Later on the system was tested for genes involved in the injected chromosome 6. KISS1 was discovered to be the only gene expressed in non-metastatic cells and absent in metastatic cells(Lee and Welch 1997). Kisspeptin is an essential regulation factor, CRSP3 as the exact gene responsible for KISS1 regulation within chromosome 6.In another study, KISS1 and Kisspeptin were found in primary, metastatic tumors, and growing tumors in decreased levels.When kisspeptin is active in cells the tumor stays consolidated and does not spread and growfurther (Mead *et al*., 2007).

ROLE IN LACTATION

There were reduced expression of KISS1 mRNA in the ARC region and GPR54 mRNA expression in the AVPV oflactating rats (Yamada *et al*., 2007), providing a possible mechanism to explain the reduction of LH secretion during lactation. The suckling stimulus appears to be responsible for the suppression of KISS1 mRNA expression in the ARC γ-Aminobutyric acid and/or catecholamines may be candidates for the inhibitory inputs to the kisspeptin neurons.

REFERENCES

Arai AC, 2009. "The role of kisspeptin and GPR54 in the hippocampus". *Peptides* **30**(1): 16–25

Bond JA and Smith JT, 2014. "Kisspeptin and energy balance in reproduction".*Reproduction* **147**(3).

Greives TJ, Kriegsfeld LJ and Demas GE, 2008. Photoperiod and Testosterone Interact to Drive Seasonal Changes in Kisspeptin Expression in Siberian Hamsters (Phodopussungorus). *Journal of Neuroendocrinology*,**20**:1339–1347

Han Yanguo, Liu Guiqiong, Jiang Xunping ,IjazNabeel, TesemaBirhanu and XieGuangyue Xia.2015. KISS1 can be used as a novel target for developing a DNA immuno castration vaccine in ram lambs.*Vaccine***33**:777–782.

Kuffman AS, Clifton DK and Steiner RA,2007.Emerging ideas about kisspeptin-GPR54 signaling in the neuroendocrine regulation of reproduction.*Trends of neuroscience***30**(10):504-511.

Lee JH and Welch DR, 1997. Suppression of metastasis in human breast carcinoma MDA-MB-435 cells after transfection with the metastasis suppressor gene, KISS-1. *Cancer Research*; **57**:2384–2387.

Lee JH, Miele ME, Hicks DJ, Phillips KK, Trent JM, Weissman BE and Welch DR, 1996. KISS-1, a novel human malignant melanoma metastasis suppressor gene. *Journal of the National Cancer Institute*,**88**:1731–1737.

Mead EJ, Maguire JJ, Kuc RE and Davenport AP, 2007. Kisspeptins: a multifunctional peptide system with a role in reproduction, cancer and the cardiovascular system. *British Journal of Pharmacology*,**151** (8):1143–1153.

Rhie YJ, 2013. "Kisspeptin/G protein-coupled receptor-54 system as an essential gatekeeper of pubertal development". *Annals of Pediatric Endocrinology & Metabolism***18**(2): 55–59

Smith JT and Clarke IJ., 2007. "Kisspeptin expression in the brain: catalyst for the initiation of puberty". *Reviews in Endocrine & Metabolic Disorders***8**(1).

Smith JT, Coolen LM, Kriegsfeld LJ, Sari IP, Jaafarzadehshirazi MR, Maltby M, Bateman K, Goodman RL, Tilbrook AJ, UbukaT, Bentley GE, Clarke IJ and LehmanMN., 2008. Variation in kisspeptin and RFamide-related peptide (RFRP) expression and terminal connections to gonadotropin-releasing hormone neurons in the brain: a novel medium for seasonal breeding in the sheep. *Endocrinology*, **149**:5770–5782.

Smith JT, Cunningham MJ, Rissman EF, Clifton DK and Steiner RA,2005. Regulation of Kiss1 gene expression in the brain of the female mouse. *Endocrinology*, **146**:3686–3692.

Yamada S, Uenoyama Y, Kinoshita M, Iwata K, TakaseK,MatsuiH, Adachi S, Inoue K, Maeda KI and Tsukamura H. 2007. Inhibition of metastin (kisspeptin-54)-GPR54 signaling in the arcuate nucleus-median eminence region during lactation in rats. *Endocrinology*, **148**:2226–2232.

Pulses: A Powerful Weapon Against

Cancer, Diabetes, Blood Pressure And Cardiovascular Diseases In Human Beings

Arti Katiyar[1*] and S. K. Singh[2]

[1]Senior Research Fellow, [2]Principal Scientist Entomology
Division of Crop Protection, Indian Institute of Pulses Research, Kanpur- 208024, U.P.
*Corresponding Author: artikatiyar25@gmail.com

Abstract

Pulses are high in dietary fibre which is reported to be important for healthy bowel function. They contain soluble dietary fibre which helps in lowering blood cholesterol. Pulses have a low glycaemic index or GI (<55). Low GI foods are recommended to avoid hyperglycemia and/or increase in blood insulin levels which are risk factors for cardiovascular disease, mortality, and Type 2 diabetes. They contain antioxidants viz. vitamin E, selenium, phenolic acids, phytic acids, copper, zinc and manganese. Pulses have phytoestrogens which may help in prevention of hormone related cancers, such as breast and prostate cancer. Pulses are good sources of folate which is useful in prevention of diseases, such as heart disease and cancer. The B vitamin folic acid significantly reduces the risk of neural tube defects (NTDs) like spina bifida in newborn babies. Chickpea, faba bean and lentil contain saponins which lower blood cholesterol. Pulses are gluten-free and offer a great variety for those on a gluten-free diet (e.g., for Celiac disease, a gastro-intestinal disorder). Thus pulses acts as a powerful weapon against chronic diseases in humans.

INTRODUCTION

Pulse crops (Fabaceae or Leguminosae) are second only to cereals (Gramineae) in their importance as human food crops. These are used in crop rotations owing to their ability to fix nitrogen, which has a positive impact on soil fertility and subsequent crop productivity. Pulses are the nutrient rich seed of leguminous plants. They are a rich source of protein, minerals and vitamin C. The major pulses used for human consumption include chickpea (*Cicer arietinum*), pigeonpea (*Cajanus cajan*), lentil (*Lens culinaris*), green gram (mungbean) *(Vigna radiata),* blackgram (urdbean) (*Vigna mungo*), fieldpea (*Pisum sativum*), lupin (*Lupinus spp*.), rajmash or frenchbean (*Phaseolus vulgaris*), lima bean (*Vigna lunatus*), adzuki bean (*Vigna angularis*), rice bean (*Vigna umbellata*), mothbean (*Vigna acontifolia*), dry broad bean (*Vicia faba*) and cowpea (*Vigna unguiculata*). Pulse crops aid in the reduction of global warming, eutrophication, acidification and land degradation. Legumes are major sources of calories and proteins for a large proportion of the world population. In terms of quantity, cereals occupy the first place as source of calories and proteins, and grain legumes are the next. As they are more accessible and affordable to lower income populations, pulses are the major source of protein for resource-poor people around

Figure 1 Different types of pulses

the world and have been referred as 'poor man's meat'. Protein calorie-malnutrition is believed to be the primary nutritional problem in most developing countries of the world. Therefore enhancing the quality and utilization of pulses is one of the best ways to tackle protein/energy malnutrition and micronutrient deficiencies in developing countries. India is the largest producer and consumer of pulses in the world, accounting for about 25% of their global production, 27% of their global consumption and about 33% of the world's area under pulses. Besides protein, pulses are good source of minerals, trace elements and vitamins, particularly thiamin, riboflavin, niacin and folic acid. Generally most of the pulses store energy in the form of complex carbohydrates, resistant starch and oligosaccharides, which is an important attribute for satiety and weight management in human beings (Mudryj *et.al.* 2014, Kushwah, *et.al.*2002, Hangen, and M. R. (2002). It is now well established that the proteins of pulses and cereals are nutritionally complementary, the essential amino acids that are deficient in one may be provided by the other. Consequently, a balanced blend of amino acids from pulses and cereal may have a greater nutritional value. Inclusion of one or more pulses in human diet provide diversity as well as enhanced nutritional quality. Pulse grains are also rich in dietary fibre, complex carbohydrates, resistant starch and vitamins and minerals such as folate, potassium, selenium and zinc. They are low in fat, and being a plant food, contain no cholesterol (Fig 1). Pulses also contain enzyme inhibitors, lectins, oligosaccharides, polyphenols, phytate and saponins also known as anti-nutritional factors, that affect the digestibility and bioavailability of micronutrients. In this era of intense research and with the advancement in diagnostic techniques, many of the non-nutritive bioactive components of pulse grains have been shown to have positive health effects. The on-going research is investigating and substantiating the role of

pulses, as well as the individual bioactive components offering protective and therapeutic effects on chronic health problems such as obesity, cardiovascular diseases, diabetes and cancer. Promoting and incorporating pulses as part of healthy diet could lead to reduced risks of these diseases

NUTRITIONAL VALUES OF PULSES

Pulses are excellent source of protein providing 20-30 g protein per 100 g and about 50-60 % carbohydrate. Pulses contain from 1040 to 1430 kJ per 100 g (similar to cereal grains), provided mostly by carbohydrate rather than fat. The mono and oligosaccharides represent only a small per cent of total carbohydrate in pulses, whereas, starch is the most abundant carbohydrate. Pulses are low in fat (1-6%), most of which is provided by polyunsaturated and monounsaturated fatty acids (Table 1).

Table 1: Proximate composition of pulse grains (Per 100 g)

Pulse	Energy Kcal	Protein (g)	Fat (g)	Carbo-hydrate (g)	Total dietary fibre (%)
Chickpea (*Cicer arietinum* L.)	368	21.0	5.7	61	22.7
Pigeonpea (*Cajanus cajan* L.)	342	21.7	1.49	62	15.5
Lentil (*Lens culinaris* Medik.)	346	27.2	1.0	60	11.5
Mungbean (*Vigna radiata* L.)	345	25.0	1.1	62.6	16.3
Urdbean (*Vigna mungo* L.)	347	24.0	1.6	63.4	
Fieldpea (*Pisum sativum* L.)	345	25.1	0.8	61.8	13.4
Rajmash (*Phaseolus vulgaris* L.)	345	23.0	1.3	62.7	17.7
Cowpea (*Vigna unguiculata*)	346	28.0	1.3	63.4	18.2
Horsegram (*Macrotyloma uniflorum*)	321	23.6	2.3	59.1	15.0
Mothbean (*Vigna aconitifolius*)	330	24.0	1.5	61.9	-

Source: "Pulses for Human Health and Nutrition" Jagdish Sing et. al., August, 2013

HEALTH BENEFITS OF PULSES

Many studies have also shown pulses' benefits on various cancers, mostly colorectal, prostate, breast, lung, esophageal and stomach cancers because of their fiber, micronutrient, and antinutrient content. Pulses also benefit and prevent cardiovascular disease because of their action on blood pressure, platelet activity, lipid profiles, and inflammation (Fairchild, *et.al.* 1996 Bjorck *et.al* 2000, Amarteifio *et.al.*2002, Bressani 1972). The resistant starch in pulse products is helpful with diabetes, weight management, HIV, and aging and stress. We should all include consuming pulses and other bean products in our daily menus for increased health and chronic disease prevention and management. Some health benefits of pulses are given below-

1. Pulses and diabetes management

Diabetes mellitus, defined by an elevated blood glucose concentration is associated with an increased risk of heart disease,

blindness, kidney disease and nerve damage. Obesity and reduced physical activity are the risk factors for the development of Type 2 diabetes. Inclusion of pulses in diet can benefit those with diabetes and help prevent healthy people from becoming diabetic. Whole grain foods might protect the development of diabetes as well as being useful in management of already developed Type 2 diabetes mellitus is relatively recent. People who consume 3 or more servings of whole grain foods per day are less likely to develop Type 2 diabetes mellitus than low consumers servings per week. Consumption of low GI foods (<55) results in moderate levels of glucose as opposed to high GI foods (>70), which causes rapid elevation in blood glucose. Pulses are low GI foods with GI values ranging from 28-52. The low GI in pulses is due to abundance of non-starch polysaccharides, resistant starch and oligosaccharides. A decrease of blood glucose response has also been attributed to phytic acid, lectins, amylase inhibitors, or polyphenol compounds. A substantial increase in dietary intake of pulses as replacement food for more rapidly digested carbohydrate might therefore be expected to improve glycemic control and thus reduce incident diabetes

2. Pulses and cancer risk

There are significant evidences which link a diet rich in plant foods including pulses, with a reduced risk several types of cancers. Inverse correlations between pulse consumption and colon cancer mortality and risks of prostrate cancer, gastric cancer and pancreatic cancer has been reported in several epidemiological studies. It has been reported that bean or lentil intake is associated with a lower risk of breast cancer. Pulses are excellent source of B-vitamin folate, which may play a protective role against colorectal, cervical, breast and pharyngeal cancers. Folates (with beans as an excellent dietary source) influences DNA stability *via* its important role in the synthesis of nucleotides and DNA methylation. Selenium, primarily due to its potent antioxidant effect, appears to have a protective effect against colorectal, prostrate and lung cancers. Pulses are major source of saponins, which also have antioxidant effect and exhibit direct and selective cytotoxic action against cancer cells. Pea protease inhibitors also show promise as cancer chemoprventive agents. Several studies have shown the protective effects of dietary fiber against development of colorectal cancer. The relatively high concentration of dietary fiber (15-30%) in pulses could contribute to its protective effects. The non-digestible carbohydrate in pulses (insoluble dietary fiber, oligosaccharides, resistant starch) are potential prebiotics, stimulating growth and/or activity of bacteria such as bifidobacteria and lactobacilli in the colon, resulting in increased formation of butyrate, a short chain fatty acid with demonstrated anti-tumor and anti-inflammatory activity. In addition, pulses particularly beans, contain a number of polyphenols with antioxidant and anti-mutagenic activities that could inhibit the formation of tumors.

3. Pulses for cardiovascular health

Pulses and whole grains are recommended in diet to reduce the risk of coronary heart

disease (CHD). These foods have been shown to decrease serum LDL cholesterol and triglycerides (two major risk factors for CHD) as well as other risk factors, such as hypertension, diabetes and obesity. Among pulses, chickpea is the most hypocholesteremic agent and germinated chickpea is reported to be effective in controlling cholesterol level. In several clinical trials, consumption of pulses was observed to significantly reduce serum lipid levels. Total serum cholesterol was reduced by 7%, LDL cholesterol by 6% and serum triacylglycerols by more than 17%., with no significant change in HDL cholesterol. Pulses consumption of four times or more per week compared with less than once a week, was associated with 22% lower risk of CHD and 11% lower risk of cardio vascular diseases (CVD). Replacement of refined rice with whole grain and legume powder as a source of carbohydrate in a meal showed significant beneficial effects on glucose, insulin and homocysteine concentrations and lipid peroxidation in coronary artery disease (CAD) patients. These effects are likely to substantially reduce the risk factors for CAD and diabetes. The effect was primarily attributed to the content of soluble dietary fibre which has been shown to reduce total and low density lipoprotein, cholesterol levels, as well as insulin resistance.Pea, chickpea and mungbean protein hyrolysates have been shown to have angiotensin converting enzyme (ACE) inhibitory activity. Since ACE plays a key role in modulating blood pressure, ACE inhibitors, including those derived from pulses, may improve cardiovascular health. The cardio protective effect of

4. Pulses and gluten-free diet - Celiac disease

Celiac disease (CD) is an inherited disorder in which the absorptive surface of the small intestine is damaged by a substance called gluten. Gluten is the general name for the storage proteins called “prolamins” found in wheat, rye and barley. The only treatment for CD is a strict gluten-free diet for life. Undiagnosed and untreated, CD can result in malnutrition, increased risk of osteoporosis, cancer, development of other autoimmune conditions such as thyroid disease, miscarriage, infertility in both women and men, neurological and other health problems. Because the symptoms of CD vary so widely in nature and severity, especially among adults, misdiagnosis such as irritable bowel syndrome, fibromyalgia, chronic fatigue syndrome and allergies are common. CD can occur at any age and is sometimes triggered after a viral infection, surgery, pregnancy or severe stress. In the gluten- free diet, all forms of wheat, rye and barley must be strictly avoided. This can be a major challenge, as gluten is found in so many different foods. Fortunately, many foods are gluten-free by nature, including pulses.

CONCLUSION

Pulses (beans, peas, and lentils) have been consumed for at least 10 000 years and are among the most extensively used foods in the world. A wide variety of pulses can be grown globally, making them important both economically as well as nutritionally. Pulses provide protein and fibre, as well as a significant source of vitamins and

minerals, such as iron, zinc, folate, and magnesium, and consuming half a cup of beans or peas per day can enhance diet quality by increasing intakes of these nutrients. In addition, the phytochemicals, saponins, and tannins found in pulses possess antioxidant and anti-carcinogenic effects, indicating that pulses may have significant anti-cancer effects. Pulse consumption also improves serum lipid profiles and positively affects several other cardiovascular disease risk factors, such as blood pressure, platelet activity, and inflammation. Pulses are high in fibre and have a low glycemic index, making them particularly beneficial to people with diabetes by assisting in maintaining healthy blood glucose and insulin levels. Emerging research examining the effect of pulse components on HIV and consumption patterns with aging populations indicates that pulses may have further effects on health. In conclusion, including pulses in the diet is a healthy way to meet dietary recommendations and is associated with reduced risk of several chronic diseases.

REFERENCES

Amarteifio, J. O.; Munthali, D. C.; Karikari, S. K.; Morake, T. K. (2002). The composition of pigeon pea (Cajanus Cajan (L) Millsp) grown in Botswana. *Plant Food Human Nutrition* 57 (2) 173 – 7.

Björck, I.; Liljeberg, H.; Ostman, E. (2000). Low glycaemic – index foods. *British Journal of Nutrition* 83 Supp1 S149 – S155

Bressani, R. (1972): Legumes in Human diets and how they might be improved in: *Nutritional improvement of food legumes by breeding*. (Milner M. ed.). New York, Protein Advisory group of United Nations.

Fairchild, R. M.; Ellis, P. R.; Byrne, A. J.; Luzio, S. D.; Mir, M. A. (1996). A new breakfast cereal containing guar gum reduces postprandial plasma glucose and insulin concentration in normal-weight human subjects. *British Journal of Nutrition* 76, 63 – 73.

Hangen, L.; Bennink, M. R. (2002). Consumption of black beans and navy beans (Phaseolus vulgaris) reduced azoxymethane – induced colon cancer in rats. *Cancer* 44(1) 60 – 65.

Kushwah, A.; Rajawat, P.; Kushwah, H. S. (2002). Nutritional evaluation of extruded Faba bean (Vicia faba L.) as a protein supplement in cereals based diet in rats. *J. Exp Biol.* 40(1) 49 – 52.

Mudryj AN, Yu N, Aukema HM (2014) Nutritional and health benefits of pulses. *Appl Physiol Nutr Metab*. ;39:1-8. dx.doi.org/10.1139./apnm-2013--0557.

Minimizing The Power Requirement For Pumps In Dairy Industry

Adarsh M.Kalla, Devaraju.R and Mohanjee Lal

Assistant professor, Department of dairy engineering
Dairy science college, Gulbarga, KVAFSU, Bidar
Corresponding author: Adarshkalla002@gmail.com

Abstract

The dairy processing industry engaged in the conversion of raw milk to consumable dairy products consumes billion worth of purchased fuels and electricity per year. Energy efficiency improvement is an important way to reduce these costs and to increase predictable earnings, especially in times of high energy price volatility. The dairy manufacturing industry has radically improved its energy efficiency over the last 20 years through wide upgrading of equipment and the closure of smaller and less efficient factories. The Pumps in dairies are often operated inefficiently. The reasons will vary from process to process, but the constant outcome is the cost to industry through wasted energy, which runs into millions of rupees per year. Pumping systems account for nearly 20% of the world's energy used by electric motors and 25% to 50% of the total electrical energy usage in certain industrial facilities. Significant opportunities exist to reduce pumping system energy consumption through smart design, retrofitting, and operating practices. In particular, the many pumping applications with variable-duty requirements offer great potential for savings. The savings often go well beyond energy, and may include improved performance, improved reliability, and reduced life cycle costs.

INTRODUCTION

The dairy Industry faces an increasingly competitive environment, seeking out opportunities to reduce production costs without negatively affecting the yield and quality of the finished products. The challenge of maintaining high product quality while simultaneously reducing production costs can often be met through investments in energy efficiency, which can include the purchase of energy-efficient technologies and the implementation of plant-wide energy efficiency practices. The electricity cost is one of the major factors which influences the firm's decisions and growth of the industries. According to World Bank survey in 2006, Indian manufacturing firms indicated that electricity was the major constraint for their operations out of a list of 15, including electricity, access to finance, and corruption. (www.enterprisesurveys.org). Milk being a most perishable food it requires to be handled and conveyed carefully using reliable pumps. The pump acts just like a heart in the human system by pumping the milk from one section to another. Pumping systems account for nearly 20% of the world's energy used by electric motors and 25% to 50% of the

total electrical energy usage in certain industrial facilities (US DOE, 2004).Hence it makes us necessary to take prerequisite steps to reduce power consumption by pumps. In dairy industry different types of pumps are used based on their function and type of the product to be pumped. They are of two types:

Centrifugal pumps

A centrifugal pump consists of an impeller and an intake at its center. When the impeller rotates, liquid is discharged by centrifugal force into a casing surrounding the impeller. The velocity of the fluid gradually decreases in the casing where it is converted to pressure which is needed to discharge the fluid. (Ahmad tufail, 1985)

Positive displacement pumps

In positive displacement pumps the liquid is taken from one end and positively discharged at the other end for every revolution. They are further classified into Reciprocating and rotary pumps. If the displacement is by reciprocation of a piston plunger, then it is called as reciprocating pump. If the displacement is by rotary action of a gear or vanes in a chamber of diaphragm in a fixed casing then it is called as rotary pump.

Energy Efficiency Measures for Pump Systems

The basic components in a pump system are pumps, drive motors, piping networks, valves, and system controls. Some of the most significant energy efficiency measures applicable to these components and to pump systems as a whole are described below.

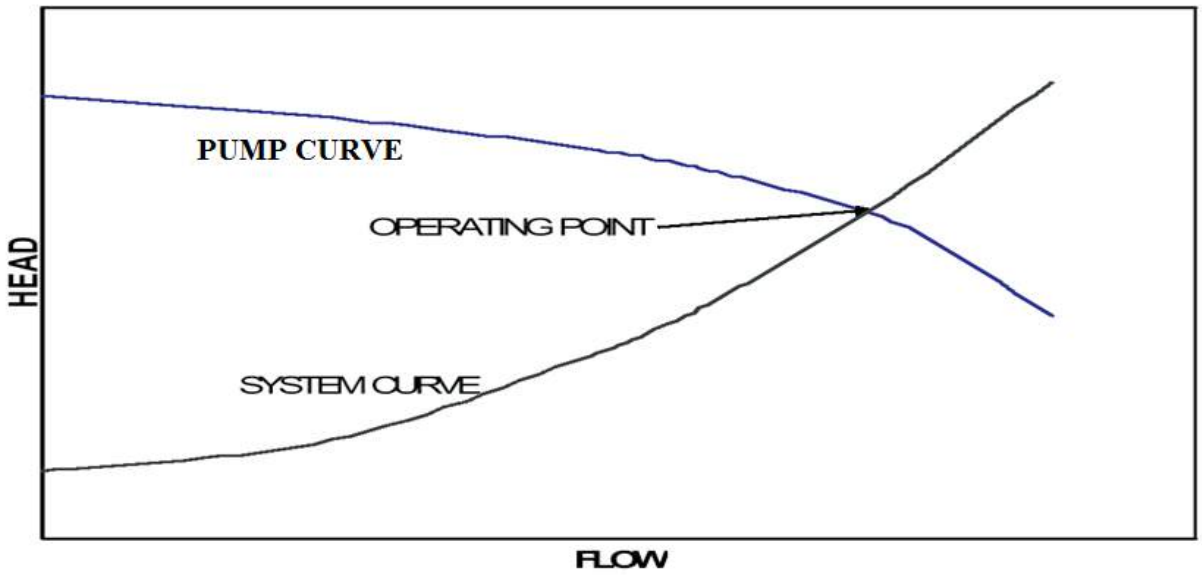
Pump system maintenance

In a typical life cycle cost, energy and maintenance costs will account for over 50–95% of pump ownership costs with initial costs less than 15% of pump life cycle costs (US DOE, 1998). The improper maintenance of pumps will lower the system efficiency and cause pumps to wear out more quickly, and increase pumping energy costs. The implementation of a pump system maintenance program will help to avoid these problems and lead to energy savings of anywhere from 2% to 7% (Xenergy, 1998). A solid pump system maintenance program will generally include the following tasks:

- Replacement of worn impellers, especially in caustic or semi-solid applications.
- Bearing inspection, repair and lubrication replacement, on an annual or semiannual basis.
- Inspection and replacement of packing seals and mechanical seals.
- Wear ring and impeller replacement. Pump efficiency degrades by 1% to 6% for impellers less than the maximum diameter and with increased wear ring clearances.
- Checking of pump/motor alignment, motor condition and motor winding insulation.

High-efficiency pumps.

Considering that a pump's efficiency may degrade by 10% to 25% over the course of its life, the replacement of aging pumps can lead to significant energy savings. The installation of newer, higher-efficiency pumps typically leads to pump system energy savings of 2% to 10% (Elliott 1994).



A number of high-efficiency pumps are available in market, selecting a pump that runs at the highest speed suitable for the application will generally result in a more efficient selection as well as the lowest initial cost.

Control systems

Control systems can increase the energy efficiency of a pump system by shutting off pumps automatically when demand is reduced, or, alternatively, by putting pumps on standby at reduced loads until demand increases.

Proper sized pipes

Pipes that have a smaller diameter size for a required velocity will require higher amount of energy for pumping. In much the same way that drinking a beverage through a small straw requires a greater amount of suction. Hence Where ever it is possible, the pipe diameters can be increased to reduce pumping energy requirements, but the energy savings due to increased pipe diameters must be balanced with increased costs for piping system components. It has been estimated that an energy savings of 5% to 20% can be obtained by proper pipe sizing. (Xenergy, 1998)

Pump selection

The pump is selected based on how best the system curve supplied by the user and pump curve intersects, when graphically superimposed on each other. The point at which system curve and pump curve intersect is called as the pump operating point or best efficiency point. At this point the pump operates at its high speed and gives best output. However, it is impossible for one operating point to meet all desired operating conditions.

The right selection of pump depends on operating point and how accurate the system curve is calculated. If actual calculated system curve is different from that calculated, the pump will operate at a flow and head different to that expected. Generally in industries, to have an additional safety margins to the calculated system curve the facility manager will sufficiently select a large sized pump that results in installing an oversized pump, which will operate at an excessive flow

rate, which increase energy usage and reduce pump life.

Selection of appropriate sized pumps.

Pumps that are oversized for a particular application consume more energy than is truly necessary. Replacing oversized pumps with pumps that are properly sized can often reduce the electricity use of a pumping system by 15% to 25% (Xenergy 1998). The efficiency of a pump is affected when the selected pump is oversized. This is because flow of oversized pumps is controlled using a throttle valve or a by-pass line. These devices provide an additional resistance by increasing the friction and reduce the efficiency as the output flow is reduced but not the power consumption. The inefficiency of oversized pumps can be overcome by, installation of variable speed drives, operating the pump at a lower rpm, or installing a smaller impeller or trimmed impeller.

Eliminating throttling valves and by pass control valves

The selection of oversized pumps results in excessive flow rate and increased head. To overcome these problems throttling valve and by pass control loops are used, which are the indications of oversized pumps as well as the inability of the pump to accommodate load variations efficiently. (Tutterow et al. 2000) However throttling valve reduces the flow rate, but not actually the power consumed. This method leads to vibration and corrosion of pumps and thereby increasing maintenance costs and reducing their life. The flow can also be reduced by installing a by-pass control system, in which the discharge of the pump is divided into two flows going into two separate pipelines. One of the pipelines delivers the fluid to the delivery point, while the second pipeline returns the fluid to the source. In other words, part of the fluid is pumped around for no reason, and thus is energy inefficient. The elimination of bypass loops and other unnecessary flows can also lead to energy savings of 10% to 20% (Xenergy 1998). But in some cases small by-pass line is required to prevent a pump running at zero flow required for safe operation of pump.

Impeller trimming

Impeller trimming is one of the methods used to reduce the pump flow rate. Impeller trimming refers to the process of reducing an impeller's diameter, so that it matches to the required flow rate and hence reducing the energy added by the pump to the system fluid. Changing the impeller diameter gives a proportional change in peripheral velocity, which in turn directly lowers the amount of energy imparted to the system. Trimming an impeller is slightly less effective than buying a smaller impeller from the pump manufacturer, but can be useful when an impeller at the next smaller available size would be too small for the given pump load.

Speed controllers/Adjustable-speed drives (ASDs)

Pumps that experience highly variable demand conditions are often good candidates for ASDs. As pump system demand changes, ASDs adjust the pump speed to meet this demand, thereby saving energy that would otherwise be lost to

throttling or bypassing. The resulting energy and maintenance cost savings can often justify the investment costs for the ASD (U.S. DOE 2006). The most generally used speed controllers are the variable frequency drives (VFDs). VFDs are by far the most popular type of VSD. Energy savings of between 30% and 50% have been achieved in many installations by installing VSDs.

CONCLUSION

This paper explores the key factors and significant opportunities to transform the dairy industry for energy efficient pumping by focusing on the system, rather than components. The broad-based energy management and pump system optimization results in substantial energy savings and improve the competitiveness of end-users. Currently there is a significant lack of understanding regarding the proper application and operation of pumps. This leads to excessive operating costs and energy. An expanded body of knowledge will help to reduce pumping system energy consumption through smart design, retrofitting, proper care and maintenance, improved performance and reliability, and reduced life cycle costs.

REFERENCES

Ahmad tufail, 1985; Dairy plant engineering and management, kitab mahal. 5th edition, Allahabad.

Elliot, R.N. (1994). Electricity Consumption and the Potential for Electric Energy Savings in the Manufacturing Sector. American Council for an Energy-Efficient Economy, Washington, D.C. Report IE942. *http://www.enterprisesurveys.org/Data/ExploreEconomies/2006/india*

Tutterow, V., D. Casada, and McKane, A., (2000). Profiting from your Pumping System. Proceedings of the 2000 Pump Users Expo, Louisville, Kentucky.

United States Department of Energy (DOE) (2006). Improving Pumping System Performance, A Sourcebook for Industry. Office of Energy Efficiency and Renewable Energy, Industrial Technologies Program, Washington, D.C. Report DOE/GO-102006-2079.

US. Ministry of Energy, Department of industrial energy analysis. 2004. Variable Speed Pumping – A Guide to Successful Applications. Newyork. *Executive Summary,* US DOE, LBNL-55836, pp 1-12.

US. Ministry of Environmental energy, department of Transport and Regions, 1998. Energy Savings in Industrial Water Pumping Systems. Newyork, good practice guide, pp.24

XEnergy, Inc. (1998). United States Industrial Electric Motor Systems Market Opportunities Assessment. Prepared for the United States Department of Energy's Office of Industrial Technology and Oak Ridge National Laboratory. Burlington, Massachusetts.

Antibiotic Residues In Meat

A Serious Public Health Issues?

A. Karthikeyan[1*], G. Suganya[2], K. Porteen[3], L.Gunaseelan[4], M.Sekar[5], M.Asokkumar[6], Sonuwara Begum[7] and P.Annal Selva Malar[8]

[1,2] M.V.Sc Scholar, [3, 6] Assistant professor, [4] Dean, [5] Professor and Head, [7] Ph.D Scholar, [8]Graduate Assistant Department of Veterinary Public Health and Epidemiology,
Madras Veterinary College, Chennai-600 007
[4] Veterinary College and Research Institute, Namakkal-637 002
*Email: drkarthikeyanvet@gmail.com

Meat is an important component of the human food basket and there is an increase demand for meat throughout the world. To meet consumer demand, intensification of animal production in recent times has been aided by the use of veterinary medicinal products *viz* antimicrobial drugs, growth promotors to prevent or treat diseases and to promote growth. Widespread use of antibiotics without following correct withdrawal period in the veterinary field has paved way for development of antibiotic residues in foods of animal origin, which can lead to adverse effects on consumers. With growing public health concern regarding food safety, efforts for improving food safety has occurred for several reasons, the most important of which may be increased consumer awareness and regulatory pressures to ensure food safety with reduction in the use of antibiotics and growth promotors, leading to presence of residues. Therefore, food processors worldwide implement various approaches to ensure the safety of the foods they produce.

ANTIBIOTICS/ANTIMICROBIALS

Antibiotics/Antimicrobials are substances which are produced naturally or synthetically, and capable of killing or inhibiting the growth of microorganisms. Antibiotics are used in animal production at therapeutic level for treatment of the diseases and sub therapeutic levels in feed to promote the growth. They are administered to the animals by various routes like parenteral, topical, oral (through water and feed), intra-mammary and intra-uterine.

SOURCES OF ANTIBIOTIC RESIDUES IN MEAT

Indiscriminate use of antibiotics in food-producing animals will leave residues in foodstuffs of animal origin like meat, milk, and eggs. India is producing beef either by sacrificing unwanted male and/or culled bovines and pose high threat to have high antibiotic residues since it does not have unique bovine breeds as food animals. These residues will enter in to the food chain when they are administered inadvertently to the food animals due to various reasons like

a) Misuse of approved drugs (Illegal or Excess use)

b) Inappropriate dosage levels and dosing schedules
c) Inappropriate route of administration
d) Use in an unintended species/age group
e) Improperly prepared/labeled feed
f) Lack of knowledge concerning approximate withdrawal time
g) Extra label use
h) Poor livestock production practices

PUBLIC HEALTH HAZARDS IMPOSED BY ANTIBIOTIC RESIDUES

The hazards due to antibiotic residues can be categorized in to two types as direct-short term hazards and indirect-long term hazards, according to duration of exposure to residues and the time onset of health effects (Muhammad *et al*., 2009). Various effects of antibiotic residues impose on both animal and humans are as follows:

a) Antibiotic resistance by bacteria in animals- Low levels of antibiotic exposure would result in alteration of micro flora, cause disease and possible development of resistant strains which cause failure of antibiotic therapy in clinical situations. For example, Tetracyclines induces antibiotic resistance in coliforms present in the human intestine (Lozano and Trujillo, 2012).
b) Development of resistant strains of bacteria and transfer of resistance genes from animals to man (Methicillin-resistant *Stahphylococcus aureus*, Vancomycin-resistant *Enterococci*, Multi-resistant *Mycobacterium tuberculosis* and Penicillin-resistant *Pneumococci*)
c) Drug allergy/ Hypersensitivity reactions (Penicillins, Cephalosporins, Lincomycin, Quinalones and Sulphonamides)
d) Drug Toxicity: Mutagenic [Nitrofurazone (Ahmed *et al*., 2008), Carbadox and Olaquindox (Lozano and Trujillo, 2012)], Teratogenic [Amoxicillin (Abou-Tarboush, 1994)], Genotoxic (Furazolidone, Carbadox, Chlromphenicol) (Lozano & Arias, 2008), Carcinogenic [Nitrofurazone, Furazolidone (WHO, 1993), Chlromphenicol (Doody *et al*., 1996) and Oxytetracycline (Mitchell *et al*., 1998)] and Neurotoxic (Aminoglycosides on newborn animals, Arsanylic acid in pigs and poultry)
e) Fatal reactions- Salinomycin and Narasin in turkeys (Lozano and Trujillo, 2012).
f) Side effects: Reproductive toxicity [Amoxicillin (Abou-Tarboush, 1994), Chloramphenicol and Doxycycline (Schaefer *et al*., 1996)], Cardiac toxicity (Eythromycin), Nephrotoxicity [Aminoglycosides and amphotericin (Granowitz and Brown, 2008)], Ototoxicity [Aminoglycosides and Macrolides] and Bone marrow toxicity [Chlromphenicol (Doody *et al*., 1996)].

POSSIBLE STRATEGIES FOR PREVENTION OF ANTIBIOTIC RESIDUES

1) The first step in residue prevention is to make individuals and organizations aware of the problem by veterinarians, organizations and government agencies.
2) Adoption of strict hygiene and good management practices at farm level may reduce need for antibiotics. Vaccination to prevent infectious

diseases may be of great value in the near future.

3) Antibiotic residues can be avoided by a well-planned drug use program. Irrational use of antibiotics in veterinary practices should be avoided and recommendations of the drug manufacturer regarding dosage, route of administration, treatment intervals and storage condition of antimicrobials should be followed.
4) Residue control strategy is based on a two-step approach: Detection of antibiotic residues using rapid screening procedures and instant grading and prohibition of food containing antibiotics more than MRL.
5) Development of simple and economic field test to identify drug residue in edible animal products to make sure that is free of inhibitors after the end of the withholding period.
6) Antibiotic withdrawal period should be established and strict observation of antibiotic withdrawal period should be made until the residues are negligible or no longer detected.
7) Processing of meat helps for the inactivation of some antibiotics. Refrigeration causes disappearance of penicillin. The freezing of animal-derived foods may also contribute to the reduction of some antibiotic contamination. The use of heat treatment, activated charcoal, resin and UV irradiation also help for antibiotic inactivation.
8) The use of alternatives to antibiotics, such as plant-derived antimicrobial substances (Ethno-veterinary practices), probiotics and immune modulators, may represent a promising option.
9) Maintaining treatment records of cows in order to determine appropriate withholding periods also helpful.

CONCLUSION

Food safety is the basic demand of consumers. Antimicrobial residues in foods of animal origin are worrying because of the toxicological risk to consumers and the risk of non-compliance with the regulatory requirements for trade. Meat industry in developing countries must offer products that are competitive in terms of quality and quantity to enter into the globalised international market. A well-defined quality management system for the production of safe foods of animal origin is to be established for the survival and development of meat, poultry and dairy industry. Thus, the implementation of various quality control programmes will enhance the production of safe food and will quash the harmful effects of antimicrobial residues in foods of animal origin.

REFERENCE

Abou-Tarboush, F.M. (1994). Teratogenic and toxic effects of Hiconcil (amoxicillin) on mouse fetuses. *Arab Gulf Journal of Scientific Research*, **2**: 133-140.

Ahmed, H.H., S.H.A. Ei-Aziem, and M.A. Abdel-Wahhab, (2008). Potential role of cysteine and methionine in the protection against hormonal imbalance and mutagenicity induced by furazolidone in female rats. *Toxicology*, **243**: 31-42.

Codex Alimentarius Commission, (2012). Maximum residue limits for veterinary drugs in foods, Updated as at the 35th Session of the Codex Alimentarius Commission.

Doody, M. M., M.S. Linet, A.G. Glass, R.E. Curtis, L.M.Pottern, B.B. Rush, J.D. Boice, J.F. Fraumeni, and G.D. Friedman, (1996). Risks of non-Hodgkin‟s lymphoma, multiple myeloma, and leukemia associated with common medications. *Epidemiology*, **7**: 131-139.

Granowitz, E.V. and R.B. Brown, (2008). Antibiotic adverse reactions and drug interactions. *Critical Care Clinics*, **24**: 421-442.

Lozano, M.C. and D.C. Arias, (2008). Residuos de fármacos de origen animal: panorama actual en Colombia. *Revista Colombiana de Ciencias Pecuarias*, **21**(1): 121-135.

Lozano, M.C., and M. Trujillo, (2012). Chemical Residues in Animal Food Products: An Issue of Public Health, Public Health - Methodology, Environmental and Systems Issues, Prof. Jay Maddock (Ed.), ISBN: 978-953-51-0641-8, InTech, DOI: 10.5772/37770.

Mitchell, J.M, M.W. Griffiths, S.A. McEwen, W.B. McNab and A.E. Yee, (1998). Antimicrobial residues in milk and meat: Causes, concerns, prevalence, regulations, tests and test performance: A review. *Journal of Food Protection*, **61**: 742-756.

Muhammad, F., M. Akhtar, Z. I. Javed, and M. Irfan Anwar, (2009). Role of veterinarians in providing residue-free animal food. *Pakistan Veterinary Journal*, **29**: 42-46.

Schaefer, C., Amoura-Elefant, E., Vial, T., Ornoy, A., Garbis, H. and Robert, E., (1996). Pregnancy outcome after prenatal quinolones exposure. Evaluation of case registry of European Network of Teratology Information Services (ENTIS). *European Journal of Obstetrics & Gynecology and Reproductive Biology*, **69**: 83-89.

World Health Organization (WHO), (1993). In Evaluation of Certain Veterinary Drug Residues in Food, Fortieth Report of the Joint FA

Table 1: Commonly used Antimicrobials and Growth promoters

S.No	Antimicrobials	Growth promoters
1)	Beta-lactams- Penicillins (Amoxicilin and Ampicillin) and Cephalosporins (Cefixime, Cefitaxim and Ceftiofur)	Peptide antibiotics- Avoparcin, Bacitracin, Efrotomycin, Enramycin, Thiopeptin and Vancomycin
2)	Aminoglycosides- Apramycin, Dihydrostreptomycin, Gentamicin, Neomycin and Streptomycin,	Macrolides- Erythromycin, Tylosin, Kitasamycin, Oleandomycin and Spiramycin
3)	Tetracyclines- Chlortetracycline, Doxycycline and Oxytetracycline	Organic arsenicals- Arsanilic Acid
4)	Quinolones- Ciprofloxacin, Danofloxacin, Enrofloxacin, Ofloxacin and Sarafloxacin	Lincosamides- Lincomycin
5)	Sulphonamides- Sulfadiazine, Sulfadimidine, Sulfamethazine, Sulfamethoxazole, and Sulfisoxazole	Quinoxaline 1,4-dioxides- Carbadox and Olaquindox
6)	Macrolides- Erythromycin, Tilmicosin and Tylosin	Pleuromutilins- Tiamulin
7)	Miscellaneous antibiotics- Chloramphenicol and Tinidazole	Polyethers- Monensin, Lasolocid, Narasin and Salinomycin
8)	Nitrofurans- Furazolidone, Nitrofurazone, Nitrofurantoin	
9)	Streptogramins- Virigamycin, Quinapristin and Dalfopristin	

Table 2: Common Antibiotic Maximum Residue Levels (CAC, 2012)

Antibiotics	Concentration (µg/g)			
	Cattle	Sheep	Pig	Chicken
Amoxicillin	50	50	50	
Ceftiofur	1000		1000	
Danofloxacin	200		100	200
Erythromycin				100
Gentamicin	100		100	
Lincomycin	200		200	200
Monensin	10	10		10
Narasin	15		15	15
Neomycin	500	500	500	500
Penicillin	50		50	50
Quinalones	75			
Spectinomycin	500	500	500	500
Spiramycin	200		200	200
Sterptomycin/ Dihydrostrepomycin	600	600	600	600
Sulphonamides	100			
Tetracyclines	200	200	200	200
Tilmicosin	100	100	100	150
Trimethoprim	50			
Tylosin	100		100	100

Integrated Control of Gastrointestinal Nematodes In Sheep

A. Meenakshisundaram*, T. Anna and S. Sasikumar

Department of Veterinary Parasitology
Veterinary College and Research Institute
Ramayanpatti, Tirunelveli - 627 358
** Corresponding author: fish1092@rediffmail.com*

Abstract:
Throughout the world, internal parasites pose one of the major health limitations for grazing animals. Although there are numerous internal parasites of grazing livestock, nematodes (roundworms) are the principal internal parasites that plague grazing ruminants. The focus of this paper was to provide an integrated strategy to control the most significant group of these parasites.

Gastrointestinal nematodes have a detrimental effect on animal health, leading to clinical and sub clinical diseases, which may result in financial loss and overall decreased productivity (Rahmann *et al*., 2002). Up to now, parasitic diseases were mainly controlled by the repeated use of anthelmintics in order to prevent and/or to cure infections. The compulsory and often excessive use of chemotherapeutics results in development of anthelmintic resistance which is a major problem to grazing livestock globally (Jackson and Coop, 2000). Due to the continued threat posed by anthelmintic resistance and the increasing public concern on the use of chemicals in farm industry necessitates to seek alternative methods to chemotherapy. An integrated approach, combining several methods, will be the only way to achieve a sustainable control of infections. The aim of this presentation is to summarise the level of research in alternative strategies for control and prevention of endoparasitic diseases.

Chemical Control – Anthelmintics

There are three families of drugs which are used to treat internal parasites in livestock viz., Benzimidazoles, Nicotinics and Macrolytic lactones.

- **Benzimidazoles** (White dewormers) - broad spectrum anthelmintic; safe to use; effective against round worms and tapeworms. Albendazole - effective against adult liver flukes, but not to be used in pregnant / lactating animals.
- **Levamisole** (Clear dewormer) - broad spectrum anthelmintic; effective against arrested larvae:

narrow margin of safety especially in the injectable form.

- **Macrolytic lactones or Avermectins** - broad spectrum anthelmintic; wide margin of safety; effective against external parasites.

Smart drenching - refers to the ways and means by which we use the drenches more selectively and effectively.

- ***Components of smart drenching are***,

- Select appropriate anthelmintic.
- Weigh each animal prior to deworming.
- Double the sheep dose when deworming goats for all dewormers, except levamisole which should be dosed at 1.5 times the cattle/sheep dose in goats since goats metabolize anthelmintics differently (it clears their system faster) than sheep and require higher doses.
- Alternation of chemical groups using a different anthelmintic group each year.
- Parallel or simultaneous use of two classes of dewormers if resistance is suspected.
- Drench only the animals that need treatment. Ttreatments should be targeted to the most susceptible animals like lambs/kids, lactating ewes/does and high producers.
- Leaving some animals untreated will help to reduce the intensity of selection for drench resistance in environments where there is a high risk (Van Whk, 2001).
- Newly purchased animals should be isolated and dewormed
- Combinations of products may slow down the development of resistance.
- Anthelmintics should not be used indiscriminately.
- Frequent deworming is costly and accelerates the development of anthelmintic-resistance.
- As under dosing is a potential danger for development of anthelmintic resistance, animals should not be under dosed. Ideally, animals should be weighed or the dose should be set for the heaviest animals in the group.
- Anthelmintics should be administered orally, over the tongue of the animal. Research has shown that benzimidazoles are more effective when the animals are fasted 12 to 24 hours before treatment or when two treatments are given 12 hours apart (repeating the drench 12 hrs after the first dose).

Strategic drenching - aims to reduce the number of treatments by timing the treatments to complement the environmental control of parasites. Ideal time to deworm a sheep or goat is prior to lambing/kidding (2-4 weeks prior).

Tactical drenching - refers to use of anthelmintics at a time when most of the total worm population is within the host and not on the pasture, such as when livestock are moved from a contaminated pasture to a parasite free or nearly free pasture

Tools for integrated parasite management

- **FAMACHA©** system identifies the anaemic animals on a 1 to 5 scale by examining and comparing lower

eyelids of sheep with a colour eye chart depicting varying degrees of anaemia and treats the animals that are anaemic (a sign of parasitism). This reduces the anthelmintic usage, slows down the development of resistance and saves the money. FAMACHA© is only effective for the treatment of *H. contortus*.

- **Faecal egg counts** can be used to determine the level of pasture contamination and the need for anthelmintic treatment.

Biological control by Nematode-destroying fungi

Fungi that exhibit anti-nematode properties such as *Duddingtonia flagrans, Harposporrium anguillulae* and *Arthrobotrys oligospora* have the potential to reduce the number of infective, parasitic nematode larvae developing on pasture. C**hlamydospores** produced by these fungi can be fed as feed additive. After passing through the animal, the spores germinate in faeces, forming specialized, **3-dimensional sticky networks** that trap the developing parasite larval stages on the pasture.

Botanical dewormers

Currently, there is great interest in "Botanical dewormers" as an alternative in controlling parasites. Herbal dewormers may have a place in parasite control but until there are some controlled tests to support them, it is not possible to recommend their use.

Cysteine Proteinase

A particular group of compounds, the **cysteine proteinases** present in plants such as ***papaya, pineapple and figs***, have been used as a novel group of anthelmintics, as they damage the nematode cuticle.

Copper Wire Particles

Copper oxide wire particles (COWP) have also been found to reduce parasite loads in sheep and goats. COWP available in the form of boluses are developed for copper deficiency. The form of copper used in COWP is poorly absorbed, reducing the risk of copper toxicity. When COWP are administered they remain in the rumen and release free copper into the abomasums which creates an environment that affects *H.contortus* ability to remain established. It is believed that copper helps to slow the development of anthelmintic resistance and also to boost the immune system.

Nutraceuticals (Bioactive forages) - A natural alternative

Feeding leguminous crops rich in condensed tannins resulted in reduced levels faecal egg counts which is mainly due to reduced worm fecundity and elimination of adult worms and ultimately reduced pasture contamination (Paolini *et al*., 2005b).

Improvement of animal resistance through selective breeding

- Animals with strong resistance to infection are being selected for future breeding.

Nutritional Management

Sheep and lambs on a higher plane of nutrition mount a better immune response to internal parasites than animals whose nutritional status is compromised. Animals on low protein diets are more susceptible to infection

because they produce less IgA (immunoglobulin). Higher levels of protein have been shown to improve the pregnant ewe's immune response to parasites after lambing (Valderrábano et al., 2002).

Pasture Management

- The base for successful parasite control in small ruminants is to keep the pasture infection level low so that the animals are not exposed to an excessive larval population on the pasture.

Grazing management

- Mixed grazing of a pasture by different species such as cattle and sheep together may reduce the infection as very little cross infection of parasites occurs between these two animal species. Cattle consume sheep and goat parasite larvae, which helps "clean" the pasture for the small ruminants.
- Controlled grazing (pastures remain ungrazed) methods permit pastures to rest and soil life to function well, and contamination can be reduced.
- As majority of worm larvae live in the first one to two inch from the ground onto vegetations, animals should not be allowed to graze below that point.
- The risk of infection is lowered by allowing the animals for grazing after the dew has dried or pasture has dried out during winter. This forces the larvae to stay at ground level and they are less likely consumed by animals.

STRATEGIC GRAZING

- Since young animals are most susceptible to parasitic infestation due to less immunity to parasites, the access of clean ungrazed pasture first to lamb, calf or kid may reduce the risk of parasite infection (Thamsborg *et al*., 1999).

Immunological control

- Efforts are on the way to develop broad spectrum molecular vaccine against gastrointestinal nematodes by using homologous of **H11, H-gal G8** and **TSBP** from *O.ostertagi* and *T.circumcincta* (non blood feeing nematodes).

CONCLUSION

In the future, to cope with the problems caused by the parasitic nematodes in grazing sheep, it is essential to implement integrated control strategies like existing nonchemical options (grazing management), as well some newly developed approaches (FAMACHA, resistant animals, bioactive forages, biological control, and perhaps, vaccines) in combination with appropriate use of existing drugs. This approach will reduce the reliance on chemical treatments.

REFERECNES

Jackson,F and R.L.Coop. (2000). The development of anthelmintic resistance in sheep nematodes. Parasitology., 120:95-107.

Rahmann, G., R. Koopmann and H. Hertzberg. 2002. Gesundheit erhalten statt krankheit kurierem. Forschungs Report. Verbraucherschutz Ernahrung, Landwirtschaft. Forschungs Report, Nr.1 pp. 4 – 7.

Paolini, V., De la Farge, F., Prevol, F., Dorchies, Ph. And Hoste, H., 2005b. Effects of the repeated distribution of sainfoin hay on the resistance and the resilience of goats naturally infected with gastrointestinal nematodes. Vet. Parasitol., 127 : 277-283.

Thamsberg S M, Roepstorff A and Larsen M 1999 Integrated and biological control of parasites in organic and conventional production system. Vet. Parasitol. 84: 169-186.

Valderrabano, J., Delfa, R. and Uriarte, J., 2002. Effect of level of feed intake on the development of gastrointestinal parasitism in growing lambs. Vet. Parasitol., 104 : 327-338.

Van Wyk, J.A. 2001. Refugia- overlooked as perhaps the most potent factor concerning the development of anthelmintic resistance. Onderstepoort J. Vet. Res. 68: 55-67.

Role of Minerals, Vitamins and Feed Additives

in Reproductive Performance of Dairy Animals

Subhash Chandra[1*], Narender Kumar[3], Mukesh Bhakat[1], Amit kumar [1], Shraddha Barjibhe[1], Narendra kumar[1], Indu Devi[1] Anshuman Kumar[2] and Alok Kumar Yadav[2]

[1]LPM, ICAR-NDRI, Karanl, Haryana, [2]AGB, ICAR-NDRI, Karanl, Haryana
National Dairy Research Institute, Karnal Haryana-132001
[3]Indian Veterinary Research Institute, Izatnagar, Bareilly, UP-143122
*corresponding author-subhashchandra20july@gmail.com

Minerals

Minerals play an important role in production and reproduction performance of dairy animals. Therefore mineral deficiencies and imbalances are often responsible for poor reproductive performance so balancing of minerals in adequate amount is important. So, exploration of mineral profile in soil, plant and animal for a particular region is desirable to develop suitable area specific mineral mixture to achieve optimum reproductive performance. Minerals are involved in body functioning starting from digestion to maintain homeostasis through balancing various function of body. Mineral supplementation in the ration should be balanced otherwise utilization of different mineral may hamper. Therefore mineral supplementation of appropriate quantity is more desirable to achieve optimum reproductive performance

Phosphorus

Phosphorus supplementation in appropriate amount has beneficial effect, where as increasing phosphorus level above normal requirement has no effect on production and reproduction performance. In case of phosphorus deficiency, it is associated with decreased reproductive performance like delayed sexual maturity and low conception rate. In a study it has been found that fertility of heifer was improved even after receiving 70-80% of their phosphorus requirement (Cromwell, 1997).

Calcium

In high yielding animals milk fever is a common problem due to calcium deficiency and it is associated with reproductive problems. Studies depicted that cows encountered with treated for milk fever, were 4.2 times more likely to require assistance at calving, 2 times more likely to have retained placenta and 1.6 times more likely to be treated for metritis. Therefore, prevention of milk fever is an important to diet of in maximizes

reproductive efficiency. The ratio of calcium to phosphorus in diet of milking cow diets should be kept between 1.5 to 2.5:1.

Selenium

Selenium deficiency normally occurs, when soil is deficient in selenium followed by feed grown on these soils. Selenium deficiency in dry cows has been reported to cause retained placenta. In a study when selenium deficient herd received supplementation of selenium (50 mg) and Vitamin E (680 IU) injections at 20 days prior to calving or were fed 1 mg of selenium per day, the incidences of retained placenta decreased (Hemingway, 2003)

Iodine

Iodine play an important role in reproductive performance through influence on thyroid gland. Iodine deficiencies may indirectly cause early embryonic death, abortion, stillbirths, prolonged gestation and an increase in the incidence of retained placenta as well as decreases in conception rate and ovarian activity. 15-20 mg of iodine supplementation every day is desirable to improve reproductive performance on the other side excessive iodine intakes have been associated with various health problems including abortion and decreased resistance to infection and disease.

Zinc

Zinc deficiency impact on spermatogenesis (the production of sperm) in the bull, delays sexual maturity and can cause foetal abnormalities.

Manganese

Manganese deficiency is rare in ruminants. Cows deficient in manganese are likely to have poor development of the follicles, delayed ovulation, more silent heats, and lower conception rates. These cows also tend to abort and give birth to weak calves.

Cobalt

Cobalt deficiency is associated with an increased incidence of silent heats, delayed onset of puberty, non-functional ovaries and abortion.

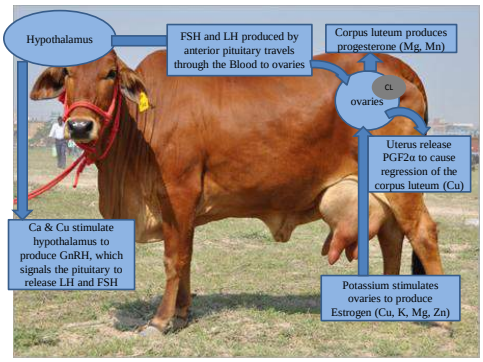


Fig-1: Role of minerals in animal reproduction

Copper

Copper is one of the essential trace metals which play an important role in animal reproduction through formation of complexes of copper (Cu2+) with gonadotropin- releasing hormone (GnRH) which is more effective in the release FSH and LH. Copper also play a significant role in maintaining normal fetus development in mammals.

Vitamins

In general the vitamin requirement of dairy cows are met by green fodder, rumen and tissue synthesis as well as feed supplementation. Most commercial concentrates contain

vitamins supplements so, the probability of infertility due to a vitamin deficiency is less. When commercial concentrates are not fed, vitamin supplements should be provided. Proper vitamin and mineral balance must be provided in dry cow rations when feed intake is restricted and (or) low quality forage is fed to achieve optimum body condition for better reproductive performance in next lactation. To ensure adequate intake, vitamins and minerals should be fed in small amounts along with ration.

Vitamin A

In general chances of vitamin A deficiency in dairy animals are less as green fodder contains beta carotene which is precursor of vitamin A. 30,000-50,000 units of vitamin A supplementation is recommended for dairy cows. Hay and silage containing alfalfa is excellent sources of carotene, but it depends on the storage condition. In vitamin A deficient cattle delayed sexual maturity, abortion, birth of dead or weak calves, retained placenta and metritis are common problems. In a study in Germany revealed that dairy cows and heifers consuming diets deficient in beta-carotene suffered from delayed uterine involution, delayed first estrus after calving, delayed ovulation, increased incidence of cystic ovaries, early embryonic death and abortion (Smith and Chase, 1980). Beta-carotene supplementation (300 mg/cow/day), is effective in restoration of reproductive function as compared Vitamin A supplementation. Supplement vitamin A if it is less than 100 mg/100 ml in the blood of cows.

Vitamin D

Vitamin D deficiency in dairy animals is very rare as normal amount of natural light helps in maintaining their own vitamin D which is required for normal calcium and phosphorus metabolism. However, deficiencies are seldom encountered in commercial herds as most commercial concentrates contain supplemental vitamin D in sufficient amounts to meet the cow's requirement of 10,000 IU per day.

Vitamin E

Scientific evidence is not documented regarding role of vitamin E alone on reproductive failure or improvement in dairy animals, but supplementation of selenium with vitamin E has profound role in improvement of reproductive performance. In one experiment, cows were fed low vitamin E rations for four generations, and they found no measurable effects on reproduction.

Supplementation of feed additive during transition period

a) Niacin supplementation is effective in case of high producing cows (mature cows producing over 35 kg and heifers over 25 kg milk per day), ketotic-prone cows and cows that lose excessive weight. To prevent ketosis and to maintain dry matter intake, 6 to 12 grams per day niacin supplementation until 10 to 12 weeks postpartum is effective.

b) Buffers are additives that maintain rumen pH between 6 to 6.3. Sodium bicarbonate and sodium sesquicarbonate are the most common commercial products fed @ 120 to 250

grams per cow per day. Magnesium oxide is not a buffer, but is an alkalinizer (raises pH). A combination of 2 to 3 part bicarb to one part magnesium oxide is recommended. Supplementation of propylene glycol is converted in the liver to glucose which can prevent ketosis and fatty liver problem. Drenching 0.5 kg per day to cows with elevated blood ketones (based on milk or urine color tests) has been successfully used in the field. Propylene glycol .1 to .25 kg in a grain mix or TMR (Total Mixed Ration) can also used to prevent ketosis, It normally converted in liver to glucose to prevent ketosis and fatty liver syndrome

C) Yeast culture and yeast product is very effective probiotic helps in better fibre digestibility by stimulating favorable bacterial population, maintaining rumen pit and improves VFA production. Probiotic supplementation is cost effective and level at supplementation varies from 10 to 115gms per cow per day.

Conclusion

Reproduction is important for dairy animals; therefore it should not be taken lightly, by giving emphasis on production performance only. The factors influence reproductive performance among them mineral play most crucial role. Therefore, area specific minerals mixture development by analyzing mineral level in soil, animal and plant is most pragmatic way to reduce the reproductive problems and improve productive performance which ultimately leads to economic benefit to the farmers. Time to time vitamin and feed additive supplementation is helpful in better reproductive and productive performance. During summer months mineral Blocks can be provided to the dairy animals to overcome any kind of mineral deficiency and for better reproductive performance.

REFERENCES

Bindari, Y. R., Shrestha, S., Shrestha, N., & Gaire, T. N. (2013). Effects of nutrition on reproduction-a review. *Adv Appl Sci Res*, *4*(1), 421-429.

Cromwell GL., *Handbook of copper compounds and applications*. **1997,** pp 177-202.

Hedges, V. J., Green, L. E., Blowey, R. W., Packington, A. J., & Bonser, R. H. C. (2002, January). Tensile strength of the white line in the claw of dairy cows supplemented with biotin. In *12th International Symposium on Lameness in Ruminants* (Vol. 9, No. 13, pp. 167-170).

Hemingway, R. G. (2003). The influences of dietary intakes and supplementation with selenium and vitamin E on reproduction diseases and reproductive efficiency in cattle and sheep. *Veterinary research communications*, *27*(2), 159-174.

Hutjens, M. F. (1991). Feed additives. *Vet Clinics North Am.: Food Animal Practice*, *7*(2), 525.

Judson, G. J., McFarlane, J. D., Mitsioulis, A., & Zviedrans, P. (1997). Vitamin B12 responses to cobalt pellets in beef cows. *Australian veterinary journal*, *75*(9), 660-662.

Kumar, S. (2003) Management of infertility due to mineral deficiency in dairy animals. Inproceedings of ICAR summer schoolon Advance diagnostic

techniques and approaches to metabolic and deficiency Reproduction in Animals, 8(2):308-314.diseases

Kumar, S., Pandey, A. K., Razzaque, Waquar, A. A. and Dwived, D. K. (2011). Importance of micro minerals in reproductive performance of livestock. *Veterinary World*, 4(5):230-233

Longitudinal field trial of the effect of biotin on lameness in dairy cattle. J. Dairy Sci., 84: 1969-1975.

Puls,R.(1994)Mineral levels in animal health. diagnostic Data, second Ed. Sherpainternational, Clearbrook,B.C. Canada

Smith RD and Chase LE (1980). Nutrition and Reproduction. *Dairy Integrative Reproduction Management*, Pp 1-5.

Tuormaa, T. E. (2000) Chromium Selenium Copper and other trace minerals in health and reproduction. Journal of orthomolecular medicine, 15:145-157.

Table 1: Role of minerals, vitamins and feed additive supplementation of dairy animals

	Role in animals reproduction	
Minerals		
Chromium	Play in the secretion of pregnancy specific proteins from the uterine endometrium which is helpful in preventing early embryonic mortality. It exerts a significant influence on follicular maturation and LH release.	Tuormaa, 2000
Iron	The reproductive performance of Iron deficient animals may be badly affected due to anaemia, reduced appetite and lower body condition. A deficient animal becomes repeat breeders and require increased number of inseminations per conception and occasionally may abort.	Kumar *et al*., 2011
Molybdenum	In case of molybdenum deficiency there is decrease libido as well as spermatogenesis and causes sterility in males and is responsible for delayed puberty, reduced conception rate and anoestrus in females.	Satish Kumar, 2003
Cobalt	Infertility is likely to arise as a secondary consequence of debilitating condition due to severe cobalt deprivation.	Judsonetal, 1997
	Cobalt deficiency is associated with delayed uterine involution, irregular estrous cycle and decreased conception rate.	Pulls, 1994; Satish Kumar, 2003
Vitamins		
B12	In case of B_{12} deficiency appetite and feed intake decrease which further leads to delayed sexual maturity and atrophy of the ovaries and uterus in cows. Cobalt is essential for B12 synthesis.	Hedges et al., 2002
Biotin	Feeding of 200 mg/day biotin reduces service period from 169 to 108 day and reduces service per conception from 2.96 Vs 1.5.	Hedges et al., 2002
Feed additives		
Beta-Carotene	Restoration of reproductive function and improve reproductive performance.	Hutjens, 1991

Identification of Farm Animals and Its Importance

Poonam Ratwan[1], Manoj Kumar[1], Ritika Gupta[2], Anjali Kumari[3] and Nancy Sheoran[4]

[1]Ph.D. Scholar, DCB Division, ICAR-NDRI Karnal-132001
[2]Ph.D. Scholar, DCN Division, ICAR-NDRI Karnal-132001
[3]Ph.D. Scholar, LPM Section, ICAR-NDRI Karnal-132001
[4]M.V.Sc. Scholar, Animal Nutrition, LLRUVAS, Hisar-125001

The identity of an animal has to be established soon after its birth. Many dairymen name their cows but do not have any marks for their identification. For a small herd the naming of animals may serve the purpose to some extent, but for large farms and moreover with pure breed animals, it is always necessary to put some sort of identification marks on each animal. Individual animal identification allows producers to keep records on an animal's parentage, birth date, production records, health history and other important management information.

PURPOSE OF IDENTIFICATION

1. Maintenance of proper records on dairy farm.
2. Proper feeding of animals.
3. Better management practices whenever required.
4. Designation and identification of animals.
5. Requirement for registration of purebred animals.
6. Helps in advancing loans and insurance of animals.
7. For issuing the health certificate.
8. Performing necessary medical treatment in the farm and in need to determine an exact scheme of treatment for the cured animal and later to have information about the prohibition period for milk and meat.

METHODS OF IDENTIFICATION

There are 2 methods of identification:

1. Temporary identification
2. Permanent identification

TEMPORARY IDENTIFICATION

i) We may put the mark with the help of paint. When using livestock paints or markers only use non-toxic materials intended for use on livestock.

ii) Hanging certain numbers with the help of neck chain.

iii) Ear tag

Ear tagging is most commonly and widely used method of identification of farm animals. Livestock ear tags were developed in 1799 under the direction of Sir Joseph Banks, President of the Royal Society, for identification of Merino sheep in the flock established for King George III. Matthew Boulton designed and produced the first batch of sheep ear tags, and produced subsequent batches, modified according to suggestions received from Banks. The first tags were made of tin.

An ear tag is a plastic or metal object used for identification of domestic livestock and other animals. If the ear tag uses Radio Frequency Identification (RFID) technology, then it is often referred to as an electronic ear tag. Electronic ear tags conform to international standards ISO 11784 and ISO 11785 working at 134.2 KHz, as well as ISO/IEC 18000-6C operating in the UHF spectrum. There are other non-standard systems such as Destron working at 125 KHz. Although there are many shapes of ear tags, the main types in current use are as follows:

- Flag-shaped ear tag: two discs joined through the ear, one or both bearing a wide, flat plastic surface on which identification details are written or printed in large, easily legible script.
- Button-shaped ear tag: two discs joined through the ear.
- Plastic clip ear tag: a moulded plastic strip, folded over the edge of the ear and joined through it.
- Metal ear tag: an aluminium, steel or brass rectangle with sharp points, clipped over the edge of the ear, with the identification stamped into it.

Each of these except the metal type may carry a RFID chip, which normally carries an electronic version of the same identification number.

An ear tag usually carries an Animal Identification Number (AIN) or code for the animal, or for its herd or flock. This identification number (ID) may be assigned by some national organisations (usually in the form of Property Identification Code, or PIC), or they may be handwritten for the convenience of the farmer ("management tags"). The National Livestock Identification System (NLIS) of Australia regulations require that all cattle be fitted with a RFID device in the form of an ear tag or rumen bolus (a cylindrical object placed in the rumen) before movement from the property and that the movement be reported to the NLIS. However, if animals are tagged for

internal purposes in a herd or farm, IDs need not be unique in larger scales. The

NLIS now also requires sheep and goats to use an ear tag that has the Property Identification Code inscribed on it. These ear tags and boluses are complemented by transport documents supplied by vendors that are used for identification and tracking. An ear tag can be applied with an ear tag applicator; however there are also specially-designed tags that can be applied by hand. Depending on the purpose of the tagging, an animal may be tagged on one ear or both. If there exists a national animal identification programme in a country, animals may be tagged on both ears for the sake of increased security and effectiveness, or as a legal requirement. If animals are tagged for private purposes, usually one ear is tagged.

PERMANENT IDENTIFICATION

i) Tattooing

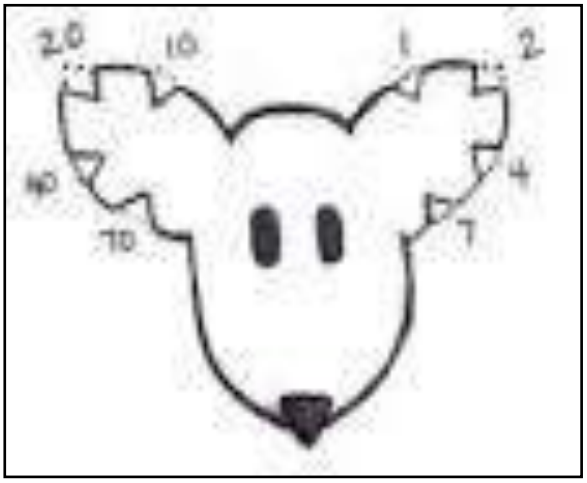
It has been adopted by beef breed associations as a standard for identifying animals because it is most satisfactory method for permanent individual marking. When properly done, a tattoo is permanent, definite and not easily changed.

ii) Branding: - There are 2 types of branding:

a) Hot branding:

Brand made of iron rod, numbered and passed through flame. The most common site for hot branding is the lower part of thigh. Site is prepared by washing and shaving. When brand is red hot, it is applied to the skin.

b) Cold branding:



In case of Cold branding, we use liquid nitrogen (-196°C). After dipping the numbered brand in liquid nitrogen it is applied to the shaven part (lower part of the thigh). Some of the cells beneath the skin are burnt.

iii) Electronic implant:

In this method chip in the form of bolus is inserted in rumen. Chip can be safely

kept in the rumen because it is indigestible.

iv) Ear Notching

Ear notching is widely used in the swine industry as a system of animal identification. Ear notching can also be used in other animal species, but it is not utilized as widely as it is in the swine industry. Ear notching involves removing V-shaped portions of the pig's ear that correspond to a specific litter number and also an individual pig number from that litter. Pigs being kept as replacement breeding stock and for exhibition purposes need to be ear notched. Ear tags are often used in conjunction with ear notches in a breeding herd. Theoretically, animals do not have to be caught to read the identification. However, it takes practice to read the notches quickly.

CONCLUSION

The basis for data collection and many other important management practices is accurate animal identification. Based on an animal's records producers and managers can make many valuable decisions. As there are many methods for animal identification and each method has its pros and cons so it is often advisable to use more than one method to increase the accuracy of identification based on the expected use of the animal.

Key to Dairy Calf Management

Ahlawat A. R., Ghodasara S.N., Odedra M. D. and Savaliya K. B.

College of Veterinary Science & A.H.
Junagadh Agricultural University, Junagadh

The replacement heifers and bulls are crucial for the profitability of dairy farms. Therefore, the success of dairy enterprises depends to a great extent on the proper management and care of the calves. Well-managed calf rearing should aim for:

1. Good animal performance with minimal losses from disease and death.
2. Optimum growth rate and feed efficiency.
3. Optimal cost inputs such as feed (milk, concentrates and roughage), animal health (veterinary fees and medicines) and other operating costs (milk feeding equipment, transport, bedding material, etc.) to achieve well-reared calves.
4. Minimum labour requirements.
5. Maximum utilisation of existing facilities such as sheds for rearing and pastures for grazing.

To accomplish these goals, there is need to review the feeding and management practices for dairy calves in light of the new research that illustrates their importance on calf health and future productivity.

Management concept 1: Underfeeding or over feeding the dam does not change the Calf's birth weight.

Reason:

By decreasing the nutrition of the dam, the size of the calf is not changed. Basically, the size of the calf is genetically predetermined. Studies have shown that energy or protein to the dam can decrease the ability of the calf to regulate its body temperature after birth. Thus, underfeeding the dam during the last two months of gestation can increase mortality of the calf within the first two weeks of life. Also, dams with body condition scores at 4 or greater have a higher incidence of dystocia. These calves also have higher mortality rates than those born without calving difficulty. Mineral nutrition of the dam also affects the quality of colostrum available to the calf after calving. Research shows that it is critical to meet the requirements of dry cows for healthy, productive calves.

Management concept 2: Hand feed calves 2-3 litres of colostrum within 1-2 hours of birth.

Reason:

The newborn calf should be fed colostrum during the first few days after birth it reduces health problems and ensures bettergrowth. Calves are born without antibodies against diseases and need to absorb the immunoglobulins found in colostrum to protect against disease. Colostral immunoglobulins (IgG) are absorbed most efficiently within the first 4-

6 hours of life. At 12 hrs of age, absorption of antibodies is approximately one-third of the rate at birth and is essentially zero by 24 hours of age. Several studies have shown that dairy calves that suckle their dam do not receive adequate amounts of colostrum and thus do not receive adequate protection against disease. Calves should receive 2-3 litres of colostrum at the initial feeding after their birth. More recent studies have shown that colostrum supplies additional immune and nutritive factors besides immunoglobulins. Feeding adequate amounts of colostrum also can improve rumen growth and health and absorption of nutrients from the small intestine. The calf may be allowed to suckle the mother's udder or may be pail or bottle fed within one hour of birth. The calf is needed to be trained for pail feeding as follows: At the beginning offer a finger to the calf for suckling and then slowly dip the finger in the milk pail. Subsequently the finger has to be lowered and gradually taken out of the pail till the calf begins to drink directly from the pail.

Management concept 3: A calf's first meal should be colostrum not manure.

Reason:

Both the cow and her calf need to be managed to insure the calf's first meal is clean colostrum not manure-laced. Contaminated colostrum can increase the incidence of diseases which cause scours and might decrease the ability of the calf to absorb immunoglobulins from colostrum. Remove the calf from the cow immediately after the calf has been cleaned to avoid the calf getting "a manure meal" from the calving environment, dirty teats or dirty legs, etc. of the dam. Milk the cow in clean equipment and wash the cow. To quickly cool colostrum, place clean pop/soft drink bottles with frozen water in the milk bucket. .

Management concept 4: Calves need warm, draft-free housing.

Reason:

However, this can require a large investment both financially and in terms of labour. There is long-term recognition of the benefit to dairy calf health of outdoor housing in hutches, especially for the prevention of diarrhoea and respiratory disease. Respiratory disorders frequently occur in non-weaned calves and are regularly associated with housing system. Factors including the number of animals per group, relative animal density, housing facilities and ventilation conditions significantly contribute to transmission in grouped calves. Calves in the first week of life spend 80% of the day lying down. The time spent lying down only deceases to 75% in week 2 of life. Thus, the housing environment where calves lay down is critical to their survival. New-born calves have very little body fat and consequently their comfort zone is between 50 ° F and 78 F. By a month of age, a calf's comfort zone widens and is between 32 F and 73 °F. Thus, during cooler temperatures calves need additional milk for energy and need to be bedded with straw. Straw allows the calf to "nest" into the straw and stay warm.

Management concept 5: By three days of age, calves should be fed a small amount of calf starter and free-choice water in addition to their appropriate amount of milk or milk replacer.

Reason for providing calf starter: Calves only eat small amount of starter the first couple weeks of life, but this small amount is important in rumen development. Studies have shown that more rumen development occurs when starters are textured versus pelleted or ground. Calves should be weaned when they are eating 4-5 lbs of starter for 3 days in a row.

Reason for providing free-choice, clean water:

Providing clean water year round is important for rumen development. Calves provided with water gain 33% more and have less scours. Water needs to be provided separately from milk. Reason for not feeding hay until the calf is at least 2 months of age: Feeding hay to calves before they are consuming 5 lbs of calf starter decreases rumen development. Digestion of starter in the calf's rumen helps develop the rumen papillae that absorb the VFA's that supply energy to the calf. Calves have only a limited ability to digest forages.

Management concept 6: Growth performance

Reason:

The potential for attaining optimum body weight is an important factor that affects the economy and success of a dairy farm. Growth parameters at an early age can be used as one of the important selection criteria. The ideal birth weight of a calf may range between 15 to 35 kg depending on the breed and sex. · The body weight of calves should be recorded at weekly intervals.

Feeding Of Calves For Prevention Of Calf Diseases

Abhey Singh Yadav[1] and Sandeep Kumar Sangwan*[2]

[1]Professor and [2]PhD Scholar
Department of Animal Genetics and Breeding,
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar
*Corresponding Author's email: sangwan36@gmail.com

Healthy young stock is an indicator that how a farm is being run. There are certain diseases which occur in very young animals. Although they are not very serious but may progress in to a serious condition if left un-attended. Most of the calf hood diseases occur due to insanitary conditions and mismanagement of the feeding of the young animals. Some of the important diseases are pneumonia, diarrhea and inflammation of the umbilicus. All these disease are due to mismanagement either in one way or the other. Young animals have very delicate immune system and providing proper feeding and environment is of paramount importance.

Feeding of calves for Prevention of calf diseases

Calf should be given colostrum with in 1 hour after birth because within few hours ability to absorb antibodies through intestinal wall decrease drastically. Feeding colostrum within half hour is highly useful. Colostrum contains antibodies which provide passive immunity to the newly born and protect it from intestinal and systemic infection

- Though calves are not equipped to utilize cellulose however should be given hay and roughage which help in development of rumen. NPN should not be feed to calves because they don't have the ability to utilize them. Calves affect with diarrhea should be allowed restricted intake of milk.

- B-complex in addition to vitamin A & D should be given.

Table 1: Quantity of the colostrum to be feed

Time	Quantity of colostrum
Within 30 min	5-8 % of body wt.
Between 10-12 hrs.	5-8% of body wt.
Daily (up to 4 days)	10% body wt.

- Calf feed should have high TDN and CP and should be less in cellulose content as compared to adults.
- If calf is unable to take milk on its own it should be fed manually using milk at body temperature
- If there is case of excessive diarrhea deworming can be done.
- Disease calves should be separated and should be kept in isolated pans.
- Precaution should be taken just from during the birth of the calf. Sanitary conditions should be maintained in the calving pan.
- Mucus membranes should be removed from the mouth using hard just after birth.
- Naval cord is cut using clean blade and betadine is applied to prevent any type of naval infection.
- Young one should be given colostrum within one hour of birth.
- Young born should not be exposed to inclement weather and should be provided healthy environment.
- If dam is having any disease then calf should not be fed with milk of that dam.
- Regular deworming of the young stock should be carried out.

Table 2: Calf feeding schedule

Age (days)	Colostrum/Milk (kg)	Milk replacers (kg)	Calf Starter (kg)	Hay (kg)
1-5	3	-	-	-
6-7	2.75	-	-	-
8-14	3.25	-	-	*ad lib*
15-21	2.75	1	0.1	*ad lib*
22-28	1.75	2	0.2	*ad lib*
29-35	1	3	0.3	*ad lib*
36-42	½	3.5	0.5	*ad lib*
43-56	-	3.5	1	*ad lib*
57-84	-	2.5	1.25	*ad lib*
85-112	-	½	1.5	*ad lib*
113-140	-	-	1.75	*ad lib*
141-180	-	-	2	*ad lib*

Performance of Murrah Buffaloes

in Hot and Humid Cauvery Delta Region In Tamil Nadu

B. Balasundaram[1], V. Jeichitra[1], P. Devendran[1] and V. Boopathi[2]

[1]*Department of Animal Genetics and Breeding,*
[2]*Department of Livestock Production Management,*
Veterinary College and Research Institute,
Tamil Nadu Veterinary and Animal Sciences University,
Orathanadu-614 625 Tamil Nadu
e-mail: b.balasundaram@tanuvas.org.in

India, the biggest global producer of milk, attained the level of milk production 132.4 million tonnes during the year 2013-14. Buffaloes contributed more than half of the total milk production in the country. The improvement in production performance and the population growth of buffaloes made them as the major contributor to the total milk production. Despite the increasing growth of buffalo population in India by 3.19 per cent, the Tamil Nadu state showed decline by 61.15 per cent for the period from 2007 to 2012 (19th Livestock Census, 2012). India's Murrah buffalo is the most popular buffalo breed in the world. It is considered to be the finest genetic material for the highest milk production among all the breeds of buffaloes. The environmental factors are also important as genetic factors for the performance of buffaloes. Production and reproduction performance of Murrah buffaloes varies among different environmental conditions. The reported average lactation milk yield was ranging from 1618 kg to 2014.00 (Buffalopedia, CIRB) in different locations of the country. The buffalo breeding policy of Tamil Nadu provides that the Murrah buffalo is the breed of choice for the improvement of non-descript buffaloes in different regions of the state including the Cauvery delta region. Climatic condition of the Cauvery delta region is hot and humid. The information about production performance and reproductive problems of the Murrah buffaloes in this region is scarce. Hence, the Murrah buffaloes at an organised farm in hot and humid Cauvery delta region of Tamil Nadu were studied for performance traits and reproduction problems.

MURRAH BUFFALO FARM AND MANAGEMENT

Murrah buffalo farm at Veterinary College and Research Institute, Orathanadu in the hot and humid Cauvery delta region of Tamil Nadu was utilized for the evaluation. Thirty five purbred Murrah buffaloes were maintained in the buffalo farm. A balanced ration of green, dry fodder and concentrates was provided to meet the nutritional requirement of Murrah buffaloes in the farm. All the buffaloes were stall fed. Adult buffaloes were provided with ad-libitum quantity of

green fodder and extra allowance of concentrate ration was provided for pregnant and lactating buffaloes. Buffaloes were maintained in high level of sanitary condition and with adequate veterinary care. Artificial insemination is practiced to impregnate the buffaloes maintained in the farm. Buffaloes were milked two times in a day and proper record was maintained.

PRODUCTION PERFORMANCE OF MURRAH BUFFALOES

Data recorded in the daily milk yield register was utilized to assess the production performance of Murrah buffaloes in hot and humid Cauvery delta region. The production traits considered for the evaluation of Murrah Buffaloes are lactation length, lactation milk yield, 305 days milk yield, average daily milk yield and peak yield.

Table 1. Averages of the production traits in Murrah buffaloes

Trait	Average of the performance	Best animal's performance
Lactation Length (days)	344.35	423
Lactation Milk Yield (kg.)	2312.76	3684.6
305 Days Milk Yield (kg.)	2149.64	3107.8
Average Daily Milk Yield (kg.)	7.04	10.18
Peak yield (kg.)	11.90	16.4

As per the Buffalopedia of Central Institute for Research on Buffaloes (CIRB), Harryana, the average lacatation milk yield of Murrah buffaloes was 1800 kg. The Murrah buffaloes at the hot humid region of Tamil Nadu were recorded with high milk yield than the average of the breed. Lactation length of the buffaloes was higher than the earlier reports (Gajbhiye and Tripathi,1999; and Sethi and Khatkar, 1997). Purebred Murrah buffaloes in the Cauvery delta region showed 7.04 kg as average daily milk yield. The average peak yield of the buffaloes was 11.90 kg and the maximum was 16.400 kg. It was in agreement with the report in Buffalopedia of Central Institute for Research on Buffaloes as minimum peak yield of Murrah buffalo herds is more than 7 kg.

Table 2. Averages of the production traits in Murrah buffaloes - Parity wise

Trait	Fist lactation	Second lactation	Third lactation
Lactation Length (days)	335	338.7	382
Lactation Milk Yield (kg.)	2345.82	2139.28	3147.1
305 Days Milk Yield (kg.)	2256.12	1999.91	2791.85
Average Daily Milk Yield (kg.)	7.39	6.55	9.15
Peak yield (kg.)	13.8	10.94	14.8

The performance of Murrah buffaloes among the first three lactations showed that the lactation length, lactation milk yield, 305 days milk yield, average daily milk yield and peak yield were higher in third lactation. The higher lactation length might be attributed to the cause, silent heat and its consequence as delay in conception. This report on production performance of Murrah buffaloes under hot and humid conditions may promote the farmers in the region to engage in

Murrah buffalo farming or to upgrade their local buffaloes with Murrah.

REPRODUCTIVE PROBLEMS IN MURRAH BUFFALOES

Purebred Murrah buffalo farm in the institute was observed some reproductive problems viz., mastitis, utero-vaginal prolapse, endometritis, anoestrous and repeat breeding. Among the reproductive problems the major issues were silent heat and repeat breeding. Repeat breeding was higher in high yielders and elder animals. These reproductive problems lengthened the lactation period, service period, dry period and calving interval. The major causes of the repeat breeding problems are improper oestrous detection, inadequate semen quality, cow's prior exposure to reproductive problems, endocrine disorders, anatomical defects of the reproductive tract and early embryonic death. These causes of repeat breeding can be overcome by effective management except the early embryonic death due to genetic cause. Silent heat is one of the contributors for the reduction of breeding efficiency in buffaloes. During summer months, the hot and humid climate in the region makes the buffaloes as poor thermoregulators which leads to the animals under constant heat stress. Heat stress causes the suppression of behavioural signs of estrous. The dark skin and sparse hair coat of Murrah animals are considered as major reasons for their high sensitivity to heat stress. Heat stress also affects the production and reproduction performance of the animals. By increasing the frequency of water showering on buffaloes to alleviate the heat stress, the buffaloes may be improved to express estrous signs. The use of efficient heat detection methods and parading of teaser bull in morning and evening hours may ease the problem of silent heat.

CONCLUSION

Murrah buffaloes in hot and humid regions like Cauvery delta region showed the desirable level of performance in traits such as lactation length, lactation milk yield, 305 days milk yield, average daily milk yield and peak yield excluding the reproduction performance. The problems in buffalo farming like repeat breeding and silent heat may be eased by applying right technology and effective management strategies. Even though the population size was small, the results of the study may encourage the farmers in the Cauvery delta region and the other hot and humid regions of the state to involve in Murrah or upgraded Murrah buffalo farming. This may improve the population growth and milk production. The higher milk production of Murrah buffaloes may assist in the economic growth of the farmers in the region.

REFERENCES

Gajbhiye, P. U. and Tripathi, V. N. 1999. Factors affecting persistency index of first four lactations in Murrah buffaloes. Indian J. Anim. Prod. Manag. 15(1):11-13.

http://www.buffalopedia.cirb.res.in/ dated 01.10.2015.

Sethi, R.K. and M.S. Khatkar. 1997. Genetic parameters of production traits in Murrah buffaloes. Indian J. Anim. Sci., 67: 141-142.

19th Livestock Census, 2012. Department of Animal Husbandry, Dairying and Fisheries, Government of India.