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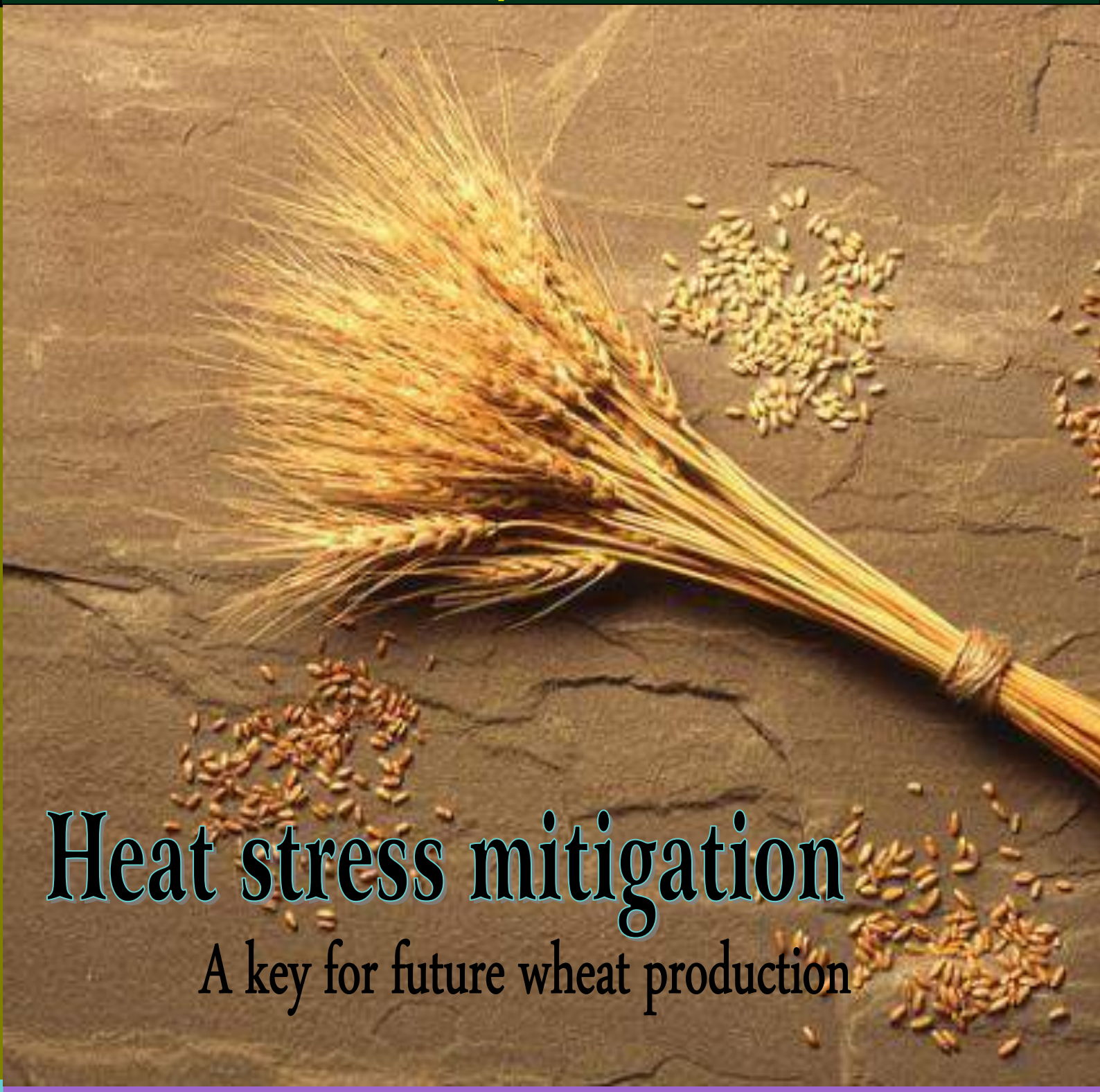

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A brief idea about soil health components, benefits, challenges and management strategies

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ABSTRACT

Soil health refers the capability of the soil to touch its total potentiality and productivity under the envisioned land use. Healthy soils bearingdesirable physical, chemical and biological conditionthat helps to maintain plant health and environment. Healthy soils are needed for healthy plants and animals as a part of food chain that includes healthy humans also. Soil is also a fundamental natural resourcejust like air and water, which helps to maintains diversify ecosystem products and services for the benefit of human. Soils production function was knownfrom long time ago, but the significance of conservation and improvement of ecosystem rendered by soil has been understood only latest years. There is a concern for maintaining soil health rose, as a necessary tool forsustainable managementof water and soil. To know its importance,components, challenges and management strategies are important for farming communities for establishing sustainable agricultural production.

Keywords: Soil health, Soil health management, Soil health benefits.

INTRODUCTION

Soils are dynamic ecosystems that support a range of lives. The main concept ofsoil health is simple and just like that of human health. The key task is to manage soils assuch that it can be used in manyways without degradation and no dangerous effect on environment. A major challenge is to decide which soil functionsshould be taken as more important for assessment and how to determine those properties in possible best way.As the health of all land organisms is tied to the soil, so soilprocesses should be such a way that soil has been considered as anecosystem by itself instead of a component ofecosystem. Soil health concept is still developing along with soil qualitylegislations outlined so far only in a few countries (Filip,2002;Nortcliff, 2002). By considering soil as a finite and living resource, theconcept of soil health can be describe as the constant abilityof soil to function as a vibrant living system, inside ecosystemand physical soil boundaries, to withstand biologicalproductivity, maintain the air andwaterquality, and encourage plant, animal and human health(Doran *et al.,* 1996, 1998; Doran and Zeiss, 2000).Even though soil health has arisen in recentpast, difference in ability of soils to conquer plantdiseases is recognized form many centuries (Janvier*et al.,*2007). According to Baker and Cook (1974) described The

suppressivesoils in which disease cruelty is low,along with the presence of a pathogen, a vulnerable host plant and suitable climatic conditions aredesirable for development of disease. Soil high in organic carbon andnutrients may not be a healthy soil if it harmful to crops or backings enormous parasite populations (Abawi and Widmer, 2000). Soil health determinesagricultural production sustainability and environmental excellence, that jointly regulate plant, animal and human health (Haberern, 1992; Doran, 2002). So, it is important to know about matters associated with soil health for development of healthy sustainable agricultural production structure.

Components of soil health

The main three components of soil health comprise physical soil health, chemical soil health and biological soil health. Physical soil health indicates the friability and hardness of the soil. Soils that are physically healthy generally do not have hard pans or heavy structures on surface. It has good water holding capacity, draining ability and does not limit root growth. Chemical soil health denotes that nutrients are in right proportion and easily available to the crop, normal pH range. Biologically healthy soils have higher soil organisms, high respiration rate and more organic matter than an unhealthy soil of the same type. Soil is directly or indirectly almost our entire source of food. So it is necessary to maintain our soil system sustainable, to provide our needs in the future. While assessing soil health, it is therefore common to know a range of soil physical, chemical, and biological properties. The most important soil stuff determining its health is the soil organic system as it influences soil physical, chemical, and biological properties.For better use of land assessment of all these three components are necessary. It gives idea about limitations and management needs for that land.

Physical components

Soil texture: This term simply refers proportions of sand, silt and clay in soil. This gives knowledge about soil type, limitations and how productive the soil.

Bulk density: define as mass the mass per unit volume of dry soil (total volume of solid and pores). Generally expressed in gm/c.c. (C.G.S. system) and normally range between 1-1.6 gm/c.c. Heavy mineral soils has higher bulk density than the organic matter rich light soil.

Soil hardness: Measure through penetrometer, gives information on strength and hardness of soil. High resistance value means soil is harder and can restrict root growth.

Aggregate stability: It gives idea about soil structure. More aggregated soils are better for plant growth and development. Less aggregated soils easily dispersed in water and nutrient losses occur.

Available water: This indicates water available for plants present in soil. Also a good indicators for water holding capacity of soil, soil porosity and soil structure.

Porosity: Soil volume not occupied by solids (minerals and organic matter), but occupied by air and water. It directly controls presence of air and water in soil, and so indirectly controls plant growth and development.

Infiltration: It means how fast water enters in soil and how fast it drains from soil. Sandy soils has high infiltration rate than clay soils, whereas loamy soils has medium range, which is considered best for crop production.

Biological components

Soil organic matter: It consists of decomposed plant and animal residues present in soil. It indicates fertility and biodiversity status of soil. Act as a nutrient storehouse for plant and soil living organisms.

Soil respiration: It denotes microbial activity in soil. Measured through capturing and quantifying of CO_2 comes out from any soil.

Soil organisms: It includes all living organisms (insects, bacteria, fungi, nematodes etc.) present in soil. Directly indicates biological health of soil.

Chemical Components

pH: It measures the soil is whether acidic or alkaline in nature. Most of the crops grow well in pH range of 6.5-7, but some crops are tolerant to acidic or saline condition.

Cation exchange capacity (CEC): It indicates fertility status of soil. Soil having high CEC is more fertile than the soil having low CEC.

Soil nutrient analysis: Gives idea about all macro and micro nutrients concentration present in soil. Suggest nutrient requirement in that soil.

Exchangeable sodium percentage (ESP) and Electrical conductivity (EC): ESP indicates sodicity and EC indicates salinity. Sodic soil has ESP higher than 6, while saline soil has EC greater than 4 dSm^{-1}.

MAJOR CHALLENGES IN SOIL HEALTH MANAGEMENT

1. Presence of high NaCl or Cl^- causes salinity in soil. It may occur naturally in many arid regions or due to excess use of saline water for irrigation or other improper cultivation practices. This reduces plant growth, root growth and water uptake severely.
2. Excess exchangeable Na leads sodicity. It causes very high pH, which is toxic to many crops.
3. Soils having low pH also referred as acid soil. It may naturally occur in high rainfall areas or due to various imbalance cultural practices including excess use of acidic fertilizers.
4. Alkalinity or high pH may occur due to high limestone presence in soil or improper management of land.
5. Poor structure like soil compaction, waterlogging, deep cracking, surface and sub-surface crusting are major physical soil health problems in some areas. These factors influences by climate as well as human activities.
6. Erosion is another major problem in sloppy land and loose textured soil. Soil particles transported from one place to another place due to action of water or wind. Reduce soil fertility by removing tops soil or leach out nutrients or deposition of sand.
7. Soil-borne pests and diseases are important biological factor which can detoriate soil health. Cause root infection, yield loss and even death of crops severely.

8. Nutrient deficiency is common problem in many regions in India. Among several plant nutrients Zn, Fe, N are most deficient in Indian soil.
9. Low organic matter content in farming soil is another noticeable problem, which also affects all other factors related soil health. Organic matter play great role in soil health management.

SOIL HEALTH MANAGEMENT

To maintain sustainable soil health and to convert unhealthy soil into healthy one, following management techniques should introduce.

1. To increase organic matter content in soil avoid or shorten fallow periods, Zero tillage or minimum tillage, stubble retention, and green manuring, addition of quality manures, use of composts or mulches.
2. For control of salinity draining the field soil with non-saline water, introduce tree system to drain chloride from soil, selection of salt tolerant crops.
3. Sodic or alkaline soil can be manage in a better way by addition of gypsum in required dose, balanced nutrition helps a better growth of crops.
4. Lime application is required to reduce pH level in acid soil.
5. Less tillage activities, rotation with tap-rooted crops, soil amendment application, cover cropping, mulching, proper water management etc. are some soil health management strategies to improve soil physical conditions and poor structure.
6. Apply integrated pest and disease management to control soil-borne pest and diseases.
7. Meet nutrient demand of soil by applying less chemical fertilizers and more organic matter (FYM, compost, vermicompost, azolla etc.).
8. Control of erosion by developing vegetative cover, windbreaks, contour farming and other effective measures.
9. Maintain soil pH at a range of 5-7 to sustain soil living organisms in soil.

BENEFITS OF SOIL HEALTH MANAGEMENT

In healthy soil, it is easy to work, more friable, holds more water and balanced nutrients. It permits for better root growth and healthier crop development. There is less disease and weed presence on healthy soils than soils with health limitations. A healthy soil can saveour exertion and wealth. In practically many time soil health refers to the farming communities to use less agro chemicals, more organic nutrient sources, cover crops, alternative crops, and tillage practices that are planned to provide water storage capacity, increase organic matter in soil, reduce wind and water erosion and maintain sustainable agricultural production. Environmental benefits are only one side of the coin and other side is the economic and sustainability benefits that soil health practices provide to farmers. Comparatively more water stored in the soil profile, which has numerous benefits in water deficit areas. Increase of organic matter enhances biological activities of the soil and increases the availability of nutrients for plants throughout the year. In soil health management there is more dependent on-farm by-products (FYM,

compost etc.) rather than off-farm products (fertilizer, pesticides etc.) and reduce excessive use of heavy equipments for cultural operations. A win-win situation for all as it helps to form pollution-free environment with sustainable farming system.That's the way we can bear agricultural production for our future generation, by maintaining healthy soil for healthy society.

CONCLUSION

Our concern on soil health can bring asustainable production in agriculture, by avoiding soil detoriation. There is still lacking on formation of a universally accepted soil health procedure for all types of soils. In most developing countries to estimate soil quality physical and chemical properties are mainly focusing, whereas without biological properties complete judgment can't be make. More focus needed for popularizing and getting public attention on soil health, as only healthy soil has ability to provide us healthy food.

REFERENCES

Abawi, G.S. and Widmer, T.L. (2000). Impact of soil health management practices on soil borne pathogens, nematodes and root diseases of vegetable crops.*Applied Soil Ecology*, 15: 37-47.

Baker, K.F. and Cook, R.J. (1974). Biological Control of Plant Pathogens.*American Phytopathology Society, San Franscico*, 433 pages.

Doran, J.W. 2002. Soil health and global sustainability: translating science into practice. *Agriculture, Ecosystems and Environment,* 88: 119-127.

Doran, J.W., Liebig, M.A. and Santana, D.P. (1998). Soil health and global sustainability.Proceedings of the 16th World Congress of Soil Science, Montepellier, France.Paper 1923.

Doran, J.W., Sarantonio, M. and Leibig, M. (1996). Soil health and sustainability.*Advances in Agronomy,* 56: 1-54.

Doran, J.W. and Zeiss, M.R. (2000). Soil health and sustainability; managing the biotic component of soil quality. *Applied Soil Ecology*, 15: 2-11.

Filip, Z. (2002). International approach to assessing soil quality by ecologically-related biological parameters.*Agriculture, Ecosystems and Environment,* 88: 169-174.

Haberern, J. (1992). Viewpoint: a soil health index. *Journal of Soil Water Conservation*, 47: 6.

Janvier, C., Villeneuve, F., Alabouvette, C., Edel-Hermann, V., Mateille, T. and Steinberg, C. (2007). Soil health through soil disease suppression: which strategy from descriptors to indicators. *Soil Biology and Biochemistry*, 39: 1-23.

Nortcliff, S. (2002). Standardisation of soil quality attributes. *Agriculture, Ecosystems and Environment,* 88: 161-168.

Multiple use of sorghum

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ABSTRACT

Sorghum, is a genus of flowering plants in the grass family *Poaceae*; and it can be considered fourth most important cereal grains used for human civilization throughout the world after the wheat, rice and pearl millet. . It is an important source of high quality of protein,fat, vitamins and minerals. It is an important part of diet especially for poor people in Africa and Asia. Apart from traditional food, Sorghum is utilized in preparation of bakery preparations like bread, cakes and biscuits also. Researches have also approved the health beneficial effect of Sorghum. The use of sorghum is not restricted as food or medicinal applications only , but use of Sorghum as feed, fodder and biofuel already been acclaimed throughout the world.

Keywords: Sorghum, cake, biscuit, biofuel and fodder

HISTORY

Sorghum, is a genus of flowering plants in the grass family *Poaceae*; it is one of the most important cereal grains used for human consumption worldwide after the wheat, rice and pearl millet. It is assumed that farming of Sorghum was first initiated around B.C. 3000 in Egypt. The production of Sorghum generally observed in tropical, semi-tropical and arid regions of the world.

PRODUCTION

In worldwide scenario, the highest Sorghum producing countries are USA, India, Nigeria, and Mexico. Although in Africa and in India, it is an important food source for common people. In worldwide leading market players of Sorghum exporters are USA, Australia and Argentina.. According to GAIN report total Sorghum production in India in the year 2016-17 was almost 4.8 MMT and three highest Sorghum producing states are Maharashtra, Karnataka and Madhya Pradesh.

PLANT STRUCTURE

Sorghum bicolor (L). Moench is a plant of 1 to 3 meters height that produces of 50 to 70 cm elongate leaves that similar to maize. It produce panicle of flowers and fruits containing seeds that mature in autumn.

Fig 1: Sorghum Plant and Grains

NUTRITIVE VALUE OF SORGHUM

Carbohydrates

Starch is the major carbohydrate in Sorghum that consist of Amylopectin (a branched-chain polymer of glucose) and Amylose (a straight-chain polymer of glucose). It is reported that Amylopectin that is the principal starch (70-80%) present in Sorghum whereas Amylose present only 20-30% of the total starch present in Sorghum. Sorghum is also an excellent source of dietary fiber.

Protein

Protein is considered the second major component in Sorghum. The average values of amino acid composition of Sorghum reported by the researchers are Isoleucine, 245 mg/g; Leucine, 832 mg/g; Lysine, 126 mg/g; Methionine 87 mg/g; Cystine, 94 mg/g; Tyrosine, 167 mg/g; Threonine, 189 mg/g; Tryptophan, 63 mg/g; Valine, 313 mg/g and Phenylalanine, 306 mg/g. (Indira and Naik, 1971). Scientific studies already proved that Sorghum protein is superior than wheat and rice based protein in terms of biological value and digestibility

Lipid

Around 3% of crude fat been reported in Sorghum. Apart from highest proportion of neutral lipid (86.2%) also glycolipid (3.1%) and phospholipid (10.71%) present in Sorghum. Unsaturated fatty acids especially Oleic and Linoleic acids are predominated in Sorghum.

Minerals

The mineral composition of Sorghum depends on the following factors like genetic factors, the environmental conditions where the plant being harvested.

The average values for mineral content of sorghum reported in the literature (Sankara Rao and Deosthale, 1980) on dry weight basis are Potassium, 352 mg/100g; Calcium 15 mg/100g; Magnesium, 171 mg/100g; Iron, 4.2 mg/100g; Zinc, 2.5 mg/100g; Copper, 0.44 mg/100g; Manganese, 1.15 mg/100g; Molybdenum, 0.06 mg/100g and Chromium, 0.017 mg/100g.

Vitamins

Sorghum in general is a rich source of B-complex vitamins. ß-carotene content ranges from 0 to 0.097 mg per 100 g of grain sample. The highest niacin content reported is 9.16 mg per 100 g sorghum (Indira and Naik, 1971). Other B-complex vitamins present in sorghum in significant amounts are vitamin B6 (0.5 mg per 100 g), folacin (0.02 mg),

pantothenic acid (1.25 ma) and biotin (0.042 ma) (Gopalan *et al.,* 2004). Detectable amounts of other fat-soluble vitamins, namely D, E and K are found in sorghum grain. Vitamin C is not detectable in Sorghum.

Table 1: Average Composition of sorghum grain

COMPONENT	PERCENTAGE
Moisture	15.5
Protein	11.2
Fat	3.7
Ash	1.5
Reducing Sugars	1.8
Starch	74.1
Crude Fiber	2.6
Tannin	0.1
Wax	0.3
Pentosans	2.5

Source: Gopalan et al., 2004

USES OF SORGHUM

The uses of sorghum are versatile. Depending on its varieties of Sorghum, it is used for consumption of both human and animals. Sorghum grain and syrup are mainly consumed by human. Sweet sorghum provides sweetening for food.

Food uses of sorghum

Traditional foods from sorghum are mainly breads, porridges, steamed products, boiled products, beverages and snack foods (Rooney and McDonough, 1987). Sorghum is a food crops in several countries, like Nigeria and Sudan. The traditional Sorghum derived foods are as follows: flat breads (fermented and unfermented); thin and thick porridges (fermented and unfermented); steamed and boiled cooked products; alcoholic and nonalcoholic beverages and snack foods (Celiac Sprue Association, USA). Indian roti (unleavened thin flat bread) and tortillas (unfermented bread) of Central America and Mexico are the popular unfermented flat breads, etc. Sorghum grain produces edible oil, starch, dextrose, paste, and alcoholic beverages.

In India the use of Sorghum is very versatile, common foods such as idli, dosa etc are usually prepared from this also some important sun-dried or extruded product from Sorghum are papad, badi and kurdigai. Recently Sorghum are being used for production of cake, biscuit, noodles and pasta. The use of can be puffed, shredded and flaked Sorghum is usually used as ready-to-eat breakfast cereals. Researchers are

adopting different post harvesting and processing technologies for better use of Sorghum for preparation of varieties of snacks and ready to eat products.

Fig 2 Sorghum products (biscuits and pasta)

Animal Feed

Sorghum grain and plant biomass are used as animal feed. In Africa and Asia, Sorghum stalks are used as animal feed in summer (ICRISAT 2015).

Biofuel

The biofuel industry produces ethanol from the sugars accumulated in the stalks of sweet sorghum varieties and the starch in the seeds of grain sorghum (O'Hara et al. 2013). The high starch content of sorghum grain (70% per grain weight) and the ability of sorghum to withstand hot dry cultivation conditions makes it suitable as a feedstock for ethanol production (Almodares & Hadi 2009). USA and China are investing huge amounts of funds for producing of biofuel from sweet Sorghum.

Nutritional and medicinal implications

Sorghums are rich in phenolic compounds, especially 3 – deoxyanthocyanidins and tannins; that helps to stabilize the intestinal microbiota, reduce obesity, oxidative stress and inflammation etc.

NUTRITIONAL INHIBITORS AND TOXIC FACTORS

Certain nutritional inhibitors and toxic substances are associated with sorghum grain. These anti-nutritional factors that present in Sorghums are phytates, and mycotoxins.

Phytate

Phytate represents a complex class of naturally occurring phosphorus compounds that can significantly influence the functional and nutritional properties of foods. Phytic acids are the main phytates that are present in mature seeds of Sorghum. Phytic acid has a strong binding capacity, readily forming complexes with multivalent cations and proteins. Most of the phytate-metal complexes are insoluble at physiological pH. Hence phytate binding renders several minerals biologically unavailable to animals and humans.

Mycotoxins

Like other cereals and grains; Sorghum grains are also susceptible to fungal and mycotoxin production under certain environmental conditions. Mycotoxins not only threaten consumer health but also cause food degradation of food quality that cause a huge economical loss indeed. Various post harvesting technologies been applied for decreasing the anti nutritional components of Sorghum grains.

Promising Strawberry varieties for Himalayan region of India

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The cultivated strawberry (*Fragaria* x *ananassa* Duch.) has resulted from a cross between two wild strawberries: *Fragaria virginiana* (Meadow strawberry) and *Fragaria chiloensis*. Strawberry is one of the most fascinating fruits of the world being rich source of vitamins, minerals and has tantalizing flavour and aroma. The berries are good source of vitamin A (60 IU/100 g of edible fruit), vitamin C (30-120 mg/100g of edible portion), pectin, potassium, calcium and phosphorus (Sharma, 2002). The presence of ellagic acid, which prevents cancer and occurrence of heart diseases and the abundance of anthocyanins have made it a more valuable fruit (Nazir *et al.,* 2012).

It is one of the most important soft fruits of the world, suitable for cultivation under various agro-climatic conditions (Singh *et al.*, 2006). Strawberry fruits are in great demand both for fresh market and as well as in processing industries and are used in preserve and confectioneries. Europe and North America accounts for 50 per cent and 30 per cent of total production, respectively. Among the European countries, France, Italy and Poland are the leading producers of strawberry. The most widely planted cultivars in the world are Chandler and Camarosa (Hancock, 1999).

Strawberry has been grown commercially in several parts of the world for many years but in India, it was introduced in early 1960s (Sharma and Sharma, 2004). It has also become the favorite fruit crop of Indian farmers because of its remunerative prices and higher profitability, which has resulted in a phenomenal increase in the area and production (Singh and Asrey, 2005). The fruit is grown commercially in various parts of India, particularly in Maharashtra, Haryana, Punjab, Uttar Pradesh, Arunachal Pradesh, Uttarakhand, Himachal Pradesh and Jammu and Kashmir. Strawberry grows well under temperate climate. Some cultivars can be grown in sub-tropical climate. Daylight period of 12 hrs. or less and moderate temperature are important for flower-bud formation. Each cultivar has a different day length and temperature requirement. There are a number of commercial varieties. The performances of some varieties had been studied under mid-Himalayan condition and the varieties which performed successfully are as follows.

Some of the improved cultivars for growing under Himalayan conditions are as follows:

1. **Chandler**: The cultivar originated in California. It is a prolific bearer, bearing around 32-38 t/ha under Himalayan condition. The plants are vigorous with average height of 25 cm and spread of 51 cm. The berries are bigger in size and average fruit weight is 14-16 g. Fruit shape is conic and long wedge. The average TSS is 8.7 ^{0} Brix and titratable acidity 0.62%. The total sugar ranges from 6.03 to 5.98 %. Just like all other strawberries, Chandler strawberries, however, are susceptible to root rot and therefore should be properly planted in well-drained soil. It prefers slightly acidic soil with pH about 6, and additional watering is needed when rainfall is not sufficient. The variety is also susceptible to leaf spot, leaf scorch, red stele and anthracnose. It has excellent intense flavour unlike other varieties.

2**. Camarosa**: Camarosa strawberry is a short day, early variety that produces large, firm, deep red fruit. The average fruit yield is 30 t/ha. The individual berry weight ranges between 15-16 g. The average TSS is 8.8 ^{0} Brix and titratable acidity 0.51%. The total sugar ranges from 4.80 to 4.84 % and the berries are rich in anthocyanin content. The fruit shape is long wedge. It has good appearance and is widely adapted, producing fruits even at lower latitudes. It is suitable both for processing as well as for fresh markets. Like cv. Chandler, the plants of Camarosa are vigorous, with average plant height of 25.7 cm and spread of 50.5 cm. The average no. of runners produced under Himalayan condition is 68.

3. **Sweet Charlie:** It is the most popular commercial strawberry variety grown in Florida. It has excellent bearing under Himalayan condition. The fruit yield per plant is around 30-32 t/ha and the individual berry weight is 15-16.5 g. As the name indicates, the berries are very sweet with the total soluble solid contents around 9.86 ^{0} Brix, while the acid content is very low around 0.33 %. The fruits are conical in shape. The fruits are firmer than Chandler variety but less in comparison to cvs. Festival and Camarosa. The fruits are conical in shape. The flowering and fruiting is early in comparison to Chandler, Camarosa and Pajaro. The plants have moderate

vigour under mid-hill conditions of Himachal Pradesh, with an average plant height of 22.7 cm and spread of 45.4 cm.

4. **Festival**: This cultivar originated from a cross between varieties Rosa Linda and Oso Grande. It is a short day cultivar. The plants are vigorous with an average yield of 25 fruits per plant and 32 t/ha. The berries are bigger in size with an average length of 43 mm, diameter of 30 mm and individual berry weight of 16 g. The cultivar recorded the maximum berry firmness and better shelf life. The berries are long wedged shape in appearance. The TSS ranges from 9.4-9.5° Brix, titratable acidity ranges from 0.4-0.5 per cent. The total sugar and reducing sugar content is 5.16 per cent and 3.54 per cent respectively. The plant produces moderate amount of runners under Himalayan condition.

5. **Fortuna**: The cultivar is the leading strawberry variety in Florida and other winter and early spring production regions worldwide, including Queensland, Australia, and southwest Spain. It has resulted from the cross between 'Winter Dawn' (female parent) and FL 99-35 (male parent). The average plant height 17.5 cm and spread is 38 cm. The average no. of runners produced per plant is 45. It is early to flower and produces around 22 t/ha.

5. Selva: It is a day neutral cultivar also referred to as ever-bearing variety. It has originated in United States. It is distinguished by moderately strong growth of plants, with average plant height of 21 cm and plant spread of 44 cm. The average fruit weight with is 11 g and shape globose conic. The epidermis colour is from pale red to orange, with a strong shine, sometimes paler on top of the fruit. It has an average flavor. The average TSS recorded was 8.74 ^{0} Brix, titratable acidity 0.60 %, total sugar 5.94 % and reducing sugar 3.53 %. Plants are not very resistant to root diseases and it easily gets frostbitten. The average yield per plant

under mid-hills of Himachal Pradesh is 108.00 g and productivity is 8.76 t/ha. The fruits have poor firmness and low shelf life.

CONCLUSION

Strawberry is an import fruit crop in processing industries. The fruit has several beneficial values in several confectionery, perfumery and health & beauty related items. Its cultivation is however restricted to fewer pockets of India mostly in cooler and high altitude regions. However, recent advances in strawberry breeding have introduced several day neutral and sub-tropical varieties. Even with climate controlled condition either in a fully automated green house or poly house, its farming can be popularized in subtropical areas of India. Owing to its commercial value, there is a greater scope of expanding its cultivation in many parts of India.

An update on Equine Piroplasmosis: A potential threat to Zoonosis

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ABSTRACT

Equine Piroplasmosis (EP) is a tick-borne disease that affects horses, donkeys, mules and zebras. Ticks ingest blood from the infected equine and transfer the parasite to an uninfected equine by feeding on the host, spreading the disease through blood contact. Because the disease is spread through blood, EP can also be transmitted through blood transfusion when the source of blood is an infected horse, previously used needles or syringes and other skin penetrating instruments that are contaminated with blood and have not been adequately sanitized between horses (i.e. dental, tattoo and surgical equipment). Moreover, EP is very infectious and there is a threat for emergence of new zoonosis. Anti-protozoal drugs are only the hope for clearance of parasite due to unavailability of vaccines. Proper sanitation and testing might reduce some chance of infection.

INTRODUCTION

Equine piroplasmosis (EP) is a tick-borne disease of equines that infects horses, mules, donkeys and zebra. It is caused by the intraerythrocytic protozoan parasites *Babesia caballi* and *Theileria equi* of the Order Piroplasmida. This agent does not survive outside its hosts and can only be transmitted through a tick vector. Infected animals may remain carriers of these blood parasites for long periods and act as sources of infection for other ticks. The introduction of carrier animals into areas where competent tick vectors are prevalent can lead to an epizootic spread of the disease. Blood infected with causative parasites of piroplasmosis and associated vectors (i.e. ticks and mechanical vectors) are the source of infection. Moreover, infected animals may remain carriers of these blood parasites for long periods and act as sources of infection for tick vectors

LIFE CYCLE, TRANSMISSION AND OCCURRENCE

The life cycle of a tick includes four stages (egg, larva, nymph, and adult) and transmission of the parasites can occur in three distinct forms: (1) intrastadially (between two ticks), (2) transtadially (between two life stages of tick), or (3) transovarially (parent to offspring). Babesia sporozoites invade red blood cells (RBCs) and transform into trophozoites which grow and divide into two rounds, oval or pear-shaped merozoites which, in turn, are capable of infecting new RBCs and the division process is then repeated. *Theileria equi* sporozoites inoculated into horses via a tick bite invade the lymphocytes and these intralymphocytic forms undergo development and eventually form Theileria-like schizonts. Further, merozoites released from these

schizonts invade RBCs and transform into trophozoites which grow and divide into pear-shaped tetrad ('Maltese cross') merozoites. Twelve species of Ixodid ticks in the genera *Dermacentor*, *Rhipicephalus* and *Hyalomma* have been identified as transstadial vectors of *B. caballi* and *T. equi,* while eight of these species were also able to transmit *B. caballi* infections transovarially. *Theileria equi* develop in salivary glands of tick vector and not found in other tick organs. It is not transmitted transovarially from egg to larva. Transmission is also possible through mechanical vectors contaminated by infected blood (e.g. contaminated needles).

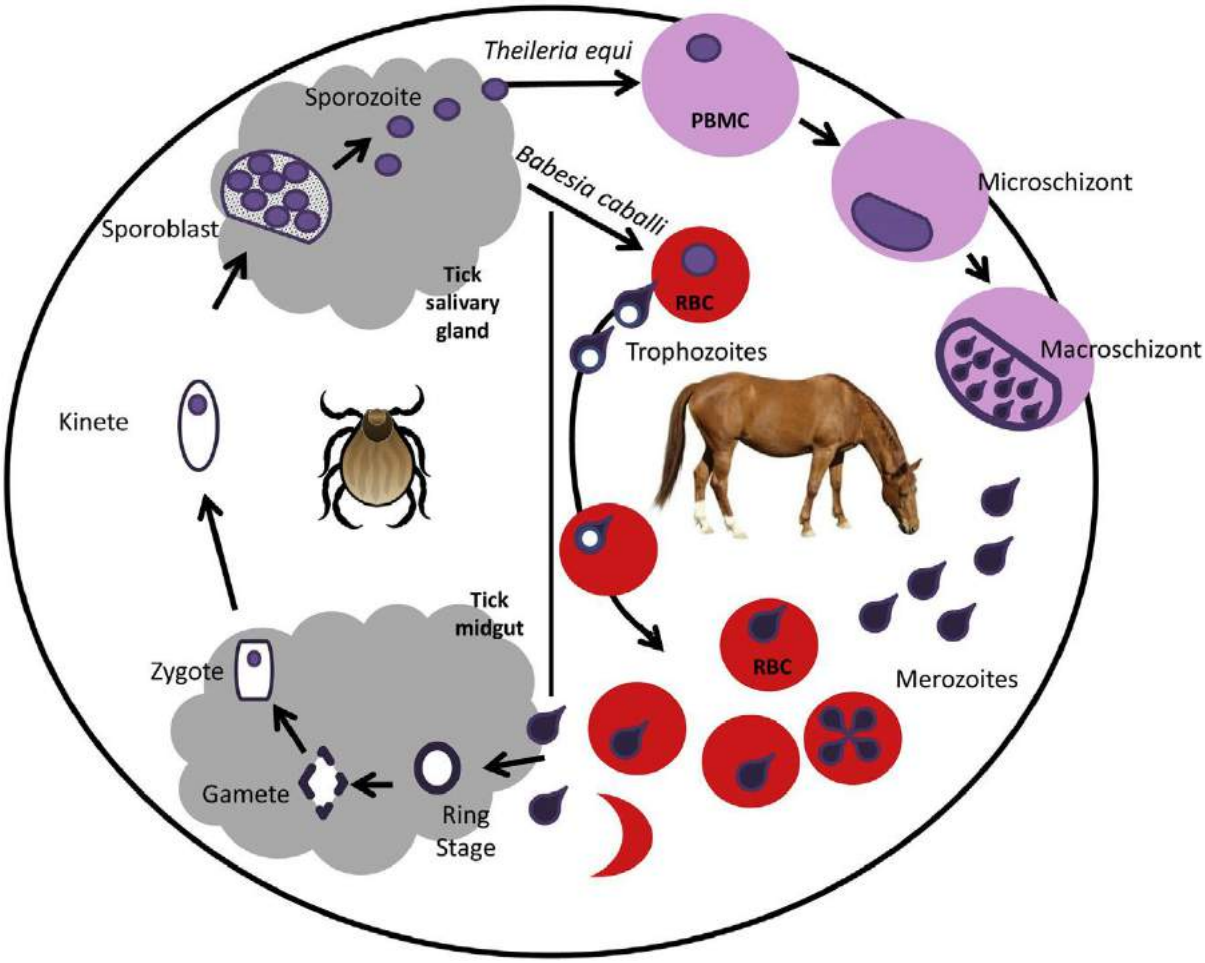

Figure 1 Life cycle of *Babesia caballi* and *Theileria equi* during tick transmission (Wise et al, 2014).

The presence of competent tick vectors and infected horses within the same area does not always lead to further infection or disease. Many factors must be considered including season, climate, host specificity, and the particulars of the competent tick's life cycle. These ticks are found in tropical, subtropical, and some temperate climates. According to the Office International des Epizooties/The World Organization for Animal Health (OIE), most of the equid-inhabited regions of the world are considered endemic for infection and disease.

CLINICAL SIGNS

Incubation period of equine piroplasmosis associated with *T. equi* is 12 to 19 days and approximately 10 to 30 days when caused by *B. caballi.* The clinical signs of equine piroplasmosis are often nonspecific, and the disease can easily be confused with other similar hemolytic conditions presenting fever, anaemia and jaundice. In general, infection with *T. equi* results in more severe clinical disease than *B. caballi* and signs and severity can vary significantly from one region to another. Piroplasmosis can occur in per-acute, acute, subacute and chronic forms. Most animals in endemic areas survive infection. Per-acute form is rare form of disease with only clinical observation in dead animals. Acute form is most common form of disease cases characterised by fever that usually exceeds 40°C, reduced appetite and malaise, elevated respiratory and pulse rates, congestion of mucous membranes, production of a dark red urine, faecal balls that are smaller and drier than normal and affected animals may appear unthrifty, anemic and/or icteric. Subacute form is similar to acute form but accompanied by weight loss in affected animals, intermittent fever, mucous membranes vary from pale pink to pink, or pale yellow to bright yellow; petechiae and/orecchymoses may also be visible on the mucous membranes; normal bowel movements may be slightly depressed and the animals may show signs of mild colic. Chronic cases usually present nonspecific clinical signs such as mild inappetence, poor performance and a drop-in body mass. Mild anaemia may be present and the spleen might be enlarged on rectal palpation (Bruning, 1996).

DIAGNOSIS

Routine laboratory analyses may aid in confirming clinical findings. Most horses regardless of clinical syndrome exhibit some degree of anaemia characterized by decreased packed cell volume, hemoglobin, and erythrocyte count. In these animals, thrombocytopenia is common and clotting times can be prolonged or normal (Zobba et al, 2008). *T. equi* infection in equines can be diagnosed by number of different methods including Giemsa stained blood smears, *in vitro* culture method, ELISA and PCR. Light microscopy can be used to identify the organisms within the erythrocytes during the acute stage of infection. A thin blood smear can reveal organisms, but smears must be thoroughly examined because even during severe infection, the percent parasitemia remains quite low. In cases of chronic or inapparent infection, parasite numbers are too low for reliable detection on blood smears. Several serological tests were developed to increase diagnostic sensitivity especially in those carrier horses exhibiting no clinical signs. These tests include the complement fixation test (CFT), indirect immunofluorescence assay (IFA), Western blot (WB), and competitive enzyme-linked immunosorbent assay (cELISA). The CFT depends on activation of complement during specific interaction of antibody and antigen. Infected horses seroconvert on the CFT approximately 8 to 11 days after infection with titers beginning to decline at 2 to 3 months. The CFT is a very specific test yet lacks sensitivity in chronic or inapparent phases of infection mainly because some antibodies produced during these phases of infection do not fix complement, therefore should only be used in acute cases of

infection. The IFA is considered to be more sensitive than the CFT during chronic infection. However, serum is diluted to improve specificity in IFAT but it results in compromise with decreased sensitivity. Experimentally infected *T. equi* and *B. caballi* horses are positive on the IFA at 3 to 20 days post-infection (Weiland, 1986). The cELISA, which detects antibody responses to Equine merozoite surface antigens (EMA) 1 and 2, is validated for detection of antibodies against numerous isolates of *T.equi* found globally (Knowles et al, 1992). The *B. caballi* cELISA is also routinely used for detection of chronic infection or inapparent carriers (Kappmeyer et al, 1999). A WB test is also under validation to be used as a means of clearance confirmation in *T. equi*–infected horses treated with imidocarb diproprionate (ID). PCR relies on the amplification and detection of parasite DNA isolated from the peripheral blood of an infected horse. It is an exquisitely sensitive test which can detect a positive animal with *T. equi* infection having parasitemia as low as one parasite (Nicolaiewsky, 2001). Because of the sensitivity of PCR, it is currently being used as one of several tests to confirm clearance of *T. equi* horses.

PREVENTION AND CONTROL:

Prevention and control strategies differ tremendously between endemic and non-endemic countries. Prevention is virtually impossible in endemic regions and naivety is not desired because infection provides a degree of protection. In non-endemic countries, the foundation of prevention is supervised on import and testing of horses from endemic areas (by IFA or ELISA as described above). Non-endemic nations that border endemic nations cannot completely prevent introduction of ticks so diligent measures must be taken to reduce horses' contact with ticks by using repellents, acaricides and regular inspection of animals and premises. For controlling and eradication of the tick vector nearby vegetation should be removed that could harbour ticks. Any detected EP-positive animals should be quarantined from surrounding horses and vectors. For the prevention of EP, no vaccine is available currently, therefore antiprotozoal agents can be used for temporary clearance of *T. equi* from carriers.

CONCLUSION

Equine piroplasmosis has a major effect on the horse industry around the world, specially sports industry. If infected horses are allowed in for sporting events, the horses should be examined thoroughly and then carefully monitored and quarantined appropriately. Horse owners are encouraged to ask a veterinarian about the disease and preventive measure. Enhanced control through surveillance of equine and vector populations is of paramount importance. Practicing stringent hygiene reduces opportunities for the transfer of infected blood. Moreover, infected samples should be handled with proper care as it is highly zoonotic disease. By taking some action to combat the disease, it would helpful for achievement of OIE prime goal i.e., '***protecting animals, preserving human future'***.

REFERENCES

Allen PC, Frerichs WM, Holbrook AA. Experimental acute *Babesia caballi* infections. I. Red blood cell dynamics. Exp Parasitol 1975;37:67–77.

Bruning A. Equine piroplasmosis an update on diagnosis, treatment and prevention. Br Vet J 1996;152:139–51.

Kappmeyer LS, Perryman LE, Hines SA, et al. Detection of equine antibodies to Babesia caballi by recombinant B. caballi rhoptry-associated protein 1 in a competitive-inhibition enzyme-linked immunosorbent assay. J Clin Microbiol 1999;37:2285–90.

Knowles DP Jr, Kappmeyer LS, Stiller D, et al. Antibody to a recombinant merozoite protein epitope identifies horses infected with Babesia equi. J Clin Microbiol 1992;30:3122–6.

Nicolaiewsky TB, Richter MF, Lunge VR, et al. Detection of Babesia equi (Laveran, 1901) by nested polymerase chain reaction. Vet Parasitol 2001;101:9–21.

Rosales, R., Rangel-Rivas, A., Escalona, A., Jordan, L. S., Gonzatti, M. I., Aso, P. M., ... & Mijares, A. (2013). Detection of Theileria equi and Babesia caballi infections in Venezuelan horses using Competitive-Inhibition ELISA and PCR. Veterinary parasitology, 196(1-2), 37-43.

Weiland G. Species-specific serodiagnosis of equine piroplasma infections by means of complement fixation test (CFT), immunofluorescence (IIF), and enzyme-linked immunosorbent assay (ELISA). Vet Parasitol 1986;20:43–8.

Wise L. N, Pelzel-McCluskey A. M., Mealey R. H., Knowles D. P.. Equine Piroplasmosis L.Vet Clin Equine -(2014)

Zobba R, Ardu M, Niccolini S, et al. Clinical and laboratory findings in equine piroplasmosis. J Equine Vet Sci 2008;28:301–8.

Al-Saad K. Acute babesiosis in foals. J Anim Vet Adv 2009;8:5.

Immunosuppression due to Mycotoxicoses in Poultry: Control and Prevention

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ABSTRACT

Immunosuppression is a status where the immunity is reduced. Humoral (antibodies) and/or cell immunity may be depressed. The causes of immunosuppression may be infectious agents or non-infectious agents. Each of these must be seriously worked out to prevent consequences of immunosuppression on profitability. Immunosupression may affect both health and performances. Increased mortality, uneven growth, decreased body weight, higher feed conversion, higher medication cost and higher rate of condemnations at slaughter are common findings in immunosuppressed birds. Mycotoxicosis is a disease condition caused by a natural toxin produced by a fungus. Mycotoxins on their own are directly immunosuppressive. The fungi that may contaminate the feed ingradients are typically represented by three genera – aspergillus, pencillium and fusarium. They produce mycotoxins that contaminating feed ingradients employed in the poultry industry. Maize, wheat, rice, peanut meal are most frequently implicated. In poultry, this usually results when toxin-producing fungi grow in grain and feed. Hundreds of mycotoxins have been identified, and many are pathogenic. Problems occur worldwide, but especially climates with high temperature and humidity and where grain is harvested with high water content.

Keywords: Mycotoxins, poultry, immunosuppression, prevention

INTRODUCTION

Mycotoxins are biologically active, toxic metabolites produced by toxigenic fungi mainly belonging to Aspergillus, Fusarium and Penicillium species, which invade crops in the field and may grow on foods during storage under favorable conditions of temperature and humidity. Mycotoxins may have additive or synergistic effects with other natural toxins, infectious agents and nutritional deficiencies.

Mycotoxins cause a wide range of diseases due to immunosuppression, damage of vital organs and interferences with laying capacity is often greater than the impact caused clinical acute symptoms or mortality due to mycotoxin poisoning. Immunosuppression in chickens can be caused by several different factors. Consumption of mycotoxins, at rather low levels that do not cause clinical

mycotoxicosis, suppresses immune functions and may decrease resistance to infectious disease.

In India, the economy of poultry industry is heavily affected due to wide mycotoxin exposure or contamination of various agricultural commodities. The economic losses are primarily due to the decreased growth rate, feed conversion efficacy, carcass yield, carcass quality and increased susceptibility to other diseases caused due to their immunosuppressive effects among the affected birds. Out of more than 350 mycotoxins identified in nature, aflatoxins, citrinins, fumonisins, ochratoxins and tricothecenes are the most common and important in poultry. Toxicological spectrum of various mycotoxins is very wide encompassing different kind of toxicities viz. acute and chronic toxicities, carcinogenicity, genotoxicity, immunotoxicity, mutagenicity and teratogenicity in animals and poultry.

Mechanism of immunosuppression by various mycotoxins

i) Decreases T or B lymphocytes activity
ii) Suppressed immunoglobulin and antibody production
iii) Reduced antibody titers and serum concentration of antibodies
iv) Impaired macrophage-effector cell function
v) Reduced complement of interferon activity

AFLATOXICOSIS (AFLATOXIN B1)

The aflatoxins are toxic and carcinogenic metabolites of *Aspergillus flavus*, *A parasiticus* and others. Aflatoxins B1 (AFB1) is the most common. Aflatoxin B1 (produced by aspergillus) has been shown to impair the immune cells function by reducing the amount of antibodies following infection or vaccination, and by reducing the activity of phagocytic cells. Aflatoxin is also responsible for lymphoid depletion and necrosis in the bursa of Fabricius, spleen and thymus.

Aflatoxicosis in poultry primarily affects the liver but can involve immunologic, digestive and hematopoietic functions. Aflatoxin can adversely affect weight gain, feed intake, feed conversion efficiency, pigmentation, processing yield, egg production, male and female fertility and hatchability. Some effects are directly attributable to toxins, whereas others are indirect, such as reduced feed intake. Susceptibility to aflatoxins varies, but in general, ducklings, turkeys, and pheasants are susceptible, while chickens, Japanese quail, and guinea fowl are relatively resistant. Aflatoxins causing immunosuppression due to damage of thymus and bursa of Fabricius make the birds susceptible to other infection like colibacillosis, chronic respiratory disease and Ranikhet disease.

Clinical signs vary from general unthriftiness to high morbidity and mortality. In layers, the aflatoxin cause drop in egg production and poor hatchability. At necropsy the lesions are found mainly in the liver. In chronic aflatoxicosis, the liver becomes yellow to gray due to lipid accumulation and atrophied. The aflatoxins are carcinogenic, but tumor formation is rare with the natural disease, probably because the birds do not live long enough for this to occur. The significant microscopic lesions

include bile duct epithelium hyperplasia, degenerative and necrotic changes in hepatocytes, nodular hyperplasia of liver parenchyma with infiltration of polymorphonuclear lymphocyte cells in portal tracts, besides considerable changes in kidneys.

CITRININ TOXICOSIS

Citrinin, a nephrotoxic mycotoxin produced by *Penicillium citrinum* and has been implicated as a causal factor for endemic nephropathy in poultry species. This mycotoxin is a natural contaminant of corn, rice, and other cereal grains. Citrinin causes a diuresis that results in watery fecal droppings and reductions in weight gain. At necropsy, lesions are generally mild and involve the kidney. The kidney appears to be the primary site of action of CIT and produced degenerative and necrotic changes in the renal tubular epithelial cells. The enlargement in size and the increase in the relative weight of the liver during CIT toxicity in poultry might be due to hepatic degeneration and sinusoidal congestion.

OCHRATOXICOSIS

Ochratoxins are quite toxic to poultry. These nephrotoxins are produced chiefly by *Penicillium viridicatum* and *Aspergillus ochraceus* in grains and feed. Ochratoxicosis causes primarily renal disease but also affects the liver, immune system, and bone marrow. Severe intoxication causes reduced spontaneous activity, huddling, hypothermia, diarrhea, rapid weight loss, and death. Moderate intoxication impairs weight gain, feed conversion, pigmentation, carcass yield, egg production, fertility, and hatchability. OTA is a carcinogenic mycotoxin.

Grossly, a dry and firm gizzard sometimes with mucosal erosions, catarrhal enteritis, dehydration, emaciated carcass, and proventricular mucosal haemorrhages have been observed. Kidneys become enlarged, pale and swollen and change in color from the normal mahogany to tan. Liver is enlarged, friable or haemorrhagic and pale. Extensive accumulation of urates occurs on the serosal surface of several organs. Swelling and color changes of the kidneys have been reported as one of the most consistent lesion of ochratoxicosis in chicken.

Histopathologically in kidney, degenerative changes are most pronounced in proximal convoluted tubules (PCT) than in the distal tubules. Severe distension, enlargement and hypertrophy of the renal PCTs and thickening of the glomerular basement membrane are seen commonly. Liver revealed increased accumulation of cytoplasmic glycogen in the hepatocytes.

TRICHOTHECENES (T-2 toxin)

Trichothecens also called fusariotoxins (T-2 toxin), are produced by a number of species of the genus *Fusarium*. They are strong tissue irritants and alter mucosal membranes integrity. Secondly, they inhibit protein synthesis and consequently interfere with antibody production. The rapidly proliferating tissues such as skin and mucosa, as well as lymphocytic and hematopoietic tissues are primarily affected by these mycotoxins. The primary effect of T-2 toxicosis in young broiler chicks is buccal-

oral ulcerations and affects body weight gain in growing chicks. It is generally regarded that the presence of oral lesions in poultry is the primary means of diagnosing trichothecenes toxicosis in the field. The main effects of trichothecenes on the immune system of poultry are: i) inhibition of lymphocyte proliferation ii) lymphopenia and lymphatic necrosis iii) increased mortality to pathogenic bacterial challenge iv) alteration in interleukin metabolism

Diagnosis of mycotoxicoses

Mycotoxicosis should be suspected when the history, signs and lesions are suggestive of feed intoxication, and especially when moldy ingredients or feed are evident. Impaired production can be a clue to a mycotoxin problem, as can improvement because of correction of feed management deficiencies. Definitive diagnosis involves detection and quantitation of the specific toxin(s). Feed and also birds that are sick or recently dead should be submitted for testing. A necropsy and related diagnostic tests should accompany feed analysis if mycotoxicosis is suspected. Feed and ingredient samples should be properly collected and promptly submitted for analysis. Multiple samples taken from different sites increase the likelihood of confirming a mycotoxin formation zone. Samples of 500g should be collected and submitted in separate containers.

PREVENTION AND CONTROL

A continuous control of the immune suppression causes is of paramount importance to protect the integrity and the function of the immune system. This will, in turn, give better flock health, better performances and a better response to any vaccination or infection. Detoxification as well as routine analysis of feed ingredients and feed stuffs for mycotoxin contamination before the formulation of poultry ration is an important step in a control programme at field level. Monitoring and control of moisture is critical in the prevention of fungal growth and mycotoxin production. Bulk storage bins of grains must be well ventilated, and the materials must be protected from rain and wide fluctuations of temperatures.

Ventilation of poultry houses to avoid high relative humidity also decreases the moisture available for fungal growth and toxin formation in the feed. Antifungal agents added to feeds to prevent fungal growth have no effect on toxin already formed but may be cost-effective in conjunction with other feed management practices. Organic acids (e.g. propionic acid @ 500–1,500 ppm) are effective inhibitors of mycotoxins, but the effectiveness may be reduced by the particle size of feed ingredients and the buffering effect of certain ingredients.

CONCLUSION

The problem of mycotoxicosis is not so easy to solve and requires constant attention throughout the entire process of grain harvest, storage, feed manufacturing and its formulation. It is important to realize that the effects of mycotoxins on the immune system may severely affect the health status of the entire farm by not only increasing the susceptibility of the animals to disease, but also by lowering the efficacy of

vaccination programs. The possible presence of toxic residues in the poultry products (egg, meat) which enters into the food chain may have potential risk by their detrimental effects on human health. There is an urgent need to implement effective mycotoxin counteracting strategy to protect animal health and increase economic growth of poultry industry.

REFERENCES

Anilkumar P, Satyanarayana ML, Vijaysarathi SK, Sreeniwasgowda RN and Rao S. 2003. Pathology of lymphoid organs in aflatoxicosis and ochratoxicosis and mmunomodulatory effect of vitamin E and selenium in boiler chicken. *Indian Journal of Veterinary Pathology* 27: 102-106.

Bailey CA, Gibson RM, Kubena LF, Huff WF and Harvey RB. 1989. Ochratoxin A and dietary protein. 2. Effects on hematology and various clinical chemistry measurements. *Poultry Science* 68: 1664-1671.

Dwivedi P and Burns RB. 1984a. Pathology of ochratoxin A in young broiler chicks. *Research in Veterinary Science* 36: 92-103.

Hoehler D and Marquardt RR. 1996. Influence of vitamins E and C on the toxic effects of ochratoxin A and T2 toxin in chicks. *Poultry Science* 75: 1508-1515.

Raju MVLN and Reddy MR. 2000. Prevention and control of mycotoxins in poultry diets. *Poultry Punch* Oct: 36-63.

Yiannikouris A and Jouany J (2002). Mycotoxins in feeds and their fate in animals: a review. *Animal Research* 51: 81-99.

Zain ME (2011). Impact of mycotoxins on humans and animals. *Journal of Saudi Chemical Society* 15: 129-144.

Budget's MSP Hike

Can prop up rural economy

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The Minimum Support Prices were announced by the Government of India for the first time in 1966-67 for wheat in the wake of the Green Revolution and extended harvest, to save the farmers from depleting profits. Since then, the MSP regime has been expanded to many crops. Minimum Support Price is the price at which government purchases crops from the farmers, whatever may be the price for the crops. Finance minister, in his budget-2018 speech announced that the government will fix minimum support prices (MSP) for crops at 50% over costs. Following consecutive years of low crop prices which led to farmer protests in several states, finance minister announced that the government will fix minimum support prices (MSP) at 50% over costs ceding to a major demand of farmer organizations. It will prove an important step towards doubling the income of our farmers," FM said in his budget speech. Going a step ahead the finance minister also said that the government will ensure that farmers reap the benefits of higher MSP, either via direct procurement of crops or by paying them the difference between MSP and market prices. The budget directed government think tank NITI Aayog "to put in place a foolproof mechanism so that farmers get an adequate price for their produce".

Crops Covered

The MSP is announced by the Government of India for 25 crops currently at the beginning of each season viz. Rabi and Kharif. Following are the 25 crops covered by MSP:

CROPS COVERD UNDER MSP			
1	Paddy	15	Wheat
2	Jowar	16	Barley
3	Bajra	17	Gram
4	Maize	18	Masur (Lentil)
5	Ragi	19	Rapeseed/Mustard
6	Arhar(Tur)	20	Safflower
7	Moong	21	Toria
8	Urad	**Other Crops**	
9	Cotton	22	Copra

10	Groundnut	23	De-Husked Coconut
11	Sunflower Seed	24	Jute
12	Soyabeen Black	25	Sugarcane
13	Sesamum		
14	Nigerseed		

Rationale behind MSP

If there is a fall in the prices of the crops, after a bumper harvest, the government purchases at the MSP and this is the reason that the priced cannot go below MSP. So this directly helps the farmers.

How MSP is decided?

The government decides the support prices for various agricultural commodities after taking into account the following:

1. Recommendations of Commission for Agricultural Costs and Prices(CACP)
2. Views of State Governments
3. Views of Ministries
4. Other relevant factors.

VARIOUS ISSUES ON MSP

The major issues around the Minimum Support Price Scheme are as follows:

1. **The Crop production is still unviable despite of so many years of crop production:** Even after so many years of operation, the crop production is still increasingly unviable. The support prices that are being provided do not increase at par with increase in cost of production. A rating agency, CRISIL pointed out that the increase in MSP has indeed fallen in the years between 2014-17. While in the years 2009-13, the annual growth of MSP was around 19.3%, it has become only 3.6% in 2014-17. It has been observed that this decrease in MSP has contributed further to the acceleration of distress of farmers. This deceleration in rates especially at a time when agricultural prices in domestic market have become equivalent to the international prices, leading to rise in competition from low cost imports.
2. **MSPs have unequal access:** This problem has been in existence since the creation of this scheme. The benefits of this scheme do not reach all farmers and for all crops. There are many regions of the country like the north-eastern region where the implementation is too weak.
3. **Effects of Inflation:** There are instances of procurement below MSP as procurement is tardy and trade and other policies sometimes reduce the market prices during good harvest years also. It has an impact on inflation. Lower the market price; lower the MSP and eventually market prices become dependent on MSP due to market intervention measure.
4. **Disadvantages of procurement**: Almost 2/3rd of the total cereal production is taken through the route of MSP, leaving only 1/3rdfor open market. As a result, a farmer who chooses the MSP route cannot take advantage of beneficial market

prices and has to depend solely on the MSP. It prevents earning of profit by producers. This has created shortage of crops in the open market also which has a serious impact on consumption pattern. It has shifted consumption towards non-cereal foods (that are available more in open market relatively), but production has not risen simultaneously, causing a production-demand gap.

5. **Excess storage:** This kind of procurement without sufficient storage has resulted in huge piling of stocks in the warehouses. The stock has now become double the requirements under the schemes of PDS, Buffer stock etc. So, many grains have rotten in the storages.
6. **Issues in WTO:** India's MSP scheme for many crops has been challenged by many countries in the WTO. For example, Australia has complained of the MSP on wheat, US and EU complained of sugarcane and pulses MSP. They have been claimed to be highly trade-distorting by its method of calculation. If the current process continues, the country will face international criticism for breaching the 10 per cent norm for subsidy on farm production set by the WTO.

Important Measures:

There are several rectifying measures that the government has adopted / can adopt for achieving desired objectives of MSP. These are as follows:

1. **Recent budget initiatives:** In latest budget, states have been allowed to intervene in the agricultural markets to ensure that the prices do not fall sharply. The Centre will be bearing 40% of the losses that the states suffer. In case of northeastern states the Centre will bear the loss upto a limit of 50%. The coverage will be of every commodity except rice and wheat. This scheme has been named as 'Market Assurance Scheme'.
2. **WTO negotiations:** India has been able to gain some time by pushing for inclusion of a peace clause in the 2013 Bali Conference wherein every country agreed not to charge another country for its subsidy scheme until a permanent solution is drawn. Although the solution is yet to be drawn, the deadline for its activities are nearing, requiring immediate efforts.
3. **Priority based procurement:** The procurement must be done on priority basis for the states or farmers who are more in distress and require immediate assistance. It should be ensured that the MSP does not cause fall in prices due to the interventionist measures.

MSP and Budget 2018-19:

In the recent budget, the government has declared that the MSP for kharif will be above the production cost. However the production cost is calculated in three different manners by the CACP which creates huge difference in the final MSP calculated. Three production costs are:

1. A2 which is the actual paid out cost. It includes expenditure done on seeds, fertilizers, hired laborers, leased land, hired machinery etc.
2. A2+FL which is actual paid cost plus the value of family labour.

3. C2 which is the comprehensive cost which includes rent of own land and interest on own capital.

So, it is called as misleading announcement as there is no clarification regarding which production cost will be taken. Speculations are rife that the government has done announced it above A2 and A2+FL. Whereas it has been a long demand of the farmers to consider the cost of production-C2.The same has been recommended by National Commission on Farmers in 2006 headed by M.S. Swaminanthan. Further, there are other concerns of the farmers as follows:

1. For the last 10 years MSP for kharif crops is already above A2 and A2+FL. But MSP declared currently does not give them enough or reasonable returns over the cost incurred by the farmers. At the same time experts are of the view that it is unlikely that the government will consider C2 as the cost of production because of increase burden of money that the government will have to shelved out of the their pockets.
2. Cost of factors of production has been fixed and it does not take into account the changing cost due to inflation etc.
3. Ensuring high MSP is not the panacea for increasing farmer's income. Apart from current 25 crops, MSP for fruits and vegetables should also be announced.
4. Procurement system of the government needs to be streamlined. This is because many times the government does not procure on time leading to distress selling by farmers.

Price Support Scheme (PSS) for Oil seeds and Pulses:

The Department of Agriculture and Cooperation implements the Price Support Scheme for Oil Seeds and Pulses through the National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED). NAFED is the nodal procurement agency for Oilseeds and pulses, apart from the Cotton Corporation of India. So, when the prices of oilseeds, pulses and cotton fall below MSP, NAFED purchases them from the farmers.

CONCLUSION

Even after so much of criticism, it is undoubted that the scheme is a necessity in times of distress. There is a need to consolidate and relook into the scheme and ensure that it is properly implemented. To help farmers receive better prices for their harvest, the budget also promised to create an "institutional mechanism" which will forecast future prices and demand, develop policies for use of futures and options, expand use of warehouse depository systems and take decisions relating to exports and imports.

Introduction of commercial drones into Indian agriculture: An analysis

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Labour shortage in Indian agriculture is a growing problem. This is because, in any country, when a considerable amount of progress is made in industrial and service sectors which were relatively more productive sectors than agriculture in terms of monetary outcomes, there will be a shift of the people eking their livelihood from agricultural works to the these secondary and tertiary sectors gradually. It is the case even with our country too. In addition to this, increased literacy levels, enhanced nonfarm employment skills etc were leading to a problem of labour shortage in the farm sector in India. In this situation, one of the prominent solutions for meeting the labour shortage problem in agriculture at present and in future course of time seems to be the introduction and usage of full pledged and advanced farm mechanization.

Usage of Farm Robots, Unmanned Aerial Vehicles (UAVs)/ Drones is the advanced version of traditional farm mechanization in which manual tractors, harvesters, seed cum fertilizer drills, irrigation pump sets, manual sprayers, milking machines etc. were used.

Aerial drones as well as terrestrial moving robots, other immovable machinery etc were needed for complete mechanization of farming.

In this article an attempt has been made to know the pros and cons in introduction of advanced drones in agriculture in India.

In India, Civil Aviation Ministry released the rules and regulations introduction of drones on commercial basis and accordingly the licenses will be issued to the drones manufacturing firms. Worldwide, the aerial drones were classified on the basis of their weight.

They are 1. Nano Drones - Less than or equal to 250 gm
2. Micro Drones - 250 grams to 2 kg
3. Mini Drones - 2 kg to 25 kg
4. Small Drones - 25 kg to 150 kg
5. Large Drones - Greater than 150 kg

Factors favouring the promotion of Drones usage in Indian agriculture

- As the cost of labour component is exceeding more than 50% in total cost of cultivation now a day in India. Usage of labour for certain farm operations as far as possible will reduce the total cost of cultivation over years.

- With the advancement of new technologies, cost of production and cost of operation of drones is getting lower day by day.
- More close supervision of the crop, water requirement, other pest incidence etc can be done with good accuracy.
- Government too wants to encourage advanced technology in farming and other sectors and accordingly making the changes in rules and regulations governing the drones usage in various sectors.
- Drastic changes in the climatic conditions worldwide are going to create a need for precision farming in which drones usage will have enormous importance.
- There is a growth in the number of companies manufacturing farm operation wise, customized, ready to use and user friendly drones.
- Cost of operation of these drones also will come down when used in large scale and for longer period.
- This efficient and precision usage will minimize the valuable chemical (pesticide/fertilizer) wastage and so the national resources.
- Better farm management decisions are possible which will minimize the cost and maximize the profits.
- As all the factors/resources are getting scarce like soil fertility, water availability, cost of electricity, seeds, manual labour cost etc., it is very important to use each drop of water and each unit of resource with utmost accuracy. For this usage of drones is going to act as one of the promising strategy.

Factors adversely affecting the promotion of drones usage in Indian agriculture

- Small scale holdings in India will discourage the farmers to go for costly/advanced technology like usage of drones.
- Low literacy rate of the farmers and lack of skills to operate this kind of advanced machinery.
- Drones in particular can't be used for all kinds of operations in farming, again resorting to other kinds of labour usage will add up to the total cost of cultivation.
- Improper usage of these drones may lead to accidents because of lack of operational skills.
- Scope for misusing the drones is always remain as a threat to security, privacy breach and raise ethical issues.
- Lack of sufficient capital to investment will be one reason which will hinder the introduction at large scale.
- As of today strict ban on usage of the drones is in force in India at the moment.

Advantages with the usage of drones in agriculture

- Resource use efficiency will be enhanced; there will be no wastage of valuable resources.
- Precision farming will get good support and which have tremendous scope in the future because of the result of natural resource depletion over years.
- Effectively measures the crop condition, nutrition status, water availability level against required level and micro climate of the crop etc.
- The information gathered through done cameras will be of high accuracy and farm management decisions made on this information will become apt decisions.
- As the day to day average farm holding size is shrinking, precision farming seems to be the hope of future and which will be supported by this kind of aerial drones, terrestrial farm robots.
- Automation of harvesting through drones in crops like coconut orchards, cacao etc. in addition to this, maintenance, harvesting and detection of pests / diseases in various crops using surveillance drones with appropriate softwares will be most economical.
- Apart from usage to the farmers, governments too can use them in a most efficient way for collecting the data at aggregate level on cropping area, diseases outbreak, forest coverage, water bodies etc. Well documentation of the data is possible and maintenance of the farm. It will be of very important usage in future planning and decision making. Very beneficial for the government to estimate the indemnities in case of crop loss for insured crops, livestock etc.

Strategies for enhancing the usage of drones in Indian agriculture

- Manufacturing the drones in safe and efficient manner, particularly to be used by semi skilled people in rural India.
- Applications for processing the collected data and revealing the simplified outcomes will be required for the usage of these drones at large scale by the farming community, hence development of such apps is needed.
- Preparation of software and equipments to use the drones incompliance with the rules and regulations of Indian Civil Aviation Ministry is needed.
- Manufacturers of farm drones must get acquaint with all the rules, regulations and guidelines in production, marketing and issuing license to the individual users.
- Government subsidies for buying and usage of such farm drones will enhance the usage of drones in farming.
- Need to calculate investment to returns ratios in farming and accordingly economic level of production of drones is required for large scale usage of drones in agriculture. This will boost for the usage of modern technology in farming.

- Identifying the areas of operations/tasks that can be done by drones, from sowing to harvesting, including, moisture estimation, soil status, cropping area, cropping pattern, total production etc. for estimating the potential impact of drones in agriculture.

The usage of drones will be helpful for collecting information about the existing situation and so it will facilitate to develop a prefect strategies and efficient implementation in national level planning by the government. University of agricultural sciences, Dharwad, Karnataka is leading in the research of application of drones in agriculture in India along with few IITs and some scientific organizations. Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana is going to take up this concept shortly.

Towards meeting the ever growing need of the increased population, definitely there is need for continuous and sufficient production of food grains within the country. In addition to this, for meeting the problem of decreased farm labour availability, depleting natural resources etc. usage of this technology may become inevitable in future course of time.

REFERENCES

www.eenadu.net.
www.uasd.edu.
https://www.thebetterindia.com/122313/karnataka-farmers-drones-fungicide.
https://www.thehindu.com/news/national/karnataka/agricultural-sector-needs-technological-intervention-to-face-challenges/article7166263.ece.
https://pigeonis.in/solution/agricultural-applications.
http://www.newindianexpress.com/states/odisha/2018/jul/07/drones-to-be-used-in-farm-sector-1839649.html.

Therapeutic potentials of Goat milk

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ABSTRACT

Goat milk is an excellent source of well-balanced nutrients and also exhibits a wide range of biological activities that influence digestion, metabolic responses to absorbed nutrients, growth and development of specific organs, and resistance to diseases. The beneficial effects on health may be classified as antioxidative, antithrombotic, anti-hypertensive and immunomodulatory. Goat milk proteins are also an important source of bioactive Angiotensin Converting Enzyme (ACE) inhibitory peptides and antihypertensive peptides which reduce hypertension and blood pressure in human beings thus making goat milk a potential therapeutic agent.

Keywords: Goat milk, Antioxidant, Anti-lactose intolerance, anti-hypertensive

INTRODUCTION

Goats have been associated with man for centuries, and are considered to be the oldest of domesticated farm animals. India stands first in goat milk production in the world, with annual production of about 4 million metric tons. Top ten countries in goat milk production, number of dairy goats and milk produced per doe has been listed in Table-1. As it is said that "goat is poor man's cow" so in most of the developing countries like India, goat milk is mostly consumed by rural people and its demand is increasing with growing population (Hanlein, 2004). Its chemical structure is almost similar to mother's milk. It is a complete food that contains all the essential amino acids without the heavy fat content as in buffalo and cow milk.

Table 1: Top ten countries in goat milk production, number of dairy goats and milk produced per doe (FAOSTAT, 2008)

Country	Goat Milk Production (million MT)	Number of dairy goats (million)	Milk produced per dairy doe (kg)
India	4.0	30.2	132.5
Bangladesh	2.2	27.1	80.0
Sudan	1.5	-	-
Pakistan	0.7	4.9	141.9

Spain	0.6	1.4	422.3
France	0.6	0.8	703.8
Greece	0.5	4.1	123.9
Iran	0.4	13.7	29.9
Somalia	0.4	6.6	59.7
China	0.3	1.4	194.8

COMPOSITIONAL AND NUTRITIONAL CHARACTERISTICS OF GOAT MILK

The chemical composition of goat milk in comparison with cow milk has a higher content of total solids, proteins, fats and mineral (Park et al., 2007). In case of fatty acid content goat milk has much higher butyric, caproic, caprylic, capric, lauric, myristic, palmitic, lineolic but lower stearic and oleic acid in comparison to cow milk. There is presence of higher amount of medium chain triglycerides and presence of least size fat globules leading to high digestibility. Five principal proteins of goat milk, α-lactalbumin, β-lactoglobulin, κ-casein, β-casein, and αs2-casein, closely resemble their homologs in cow milk. Goat milk lacks a homolog of bovine βs1-casein, the most abundant protein in cow milk. Activities of ribonuclease, lipase, and xanthine oxidase are less in goat than in cow milk. Goat milk contains more potassium and chloride but less orotic acid, N-acetyl neuraminic acid, folate, vitamin B6, and vitamin B12 than cow milk (Jenness, 1980).

THERAPEUTIC PROPERTIES OF GOAT MILK

1. Easy digestibility property:
   - Goat's milk has smaller fat globules as well as higher levels of medium chain fatty acids, making them easier for the body to assimilate. These smaller fat molecules are suspended throughout goat milk, making it "naturally homogenized," while cow milk contains larger fat molecules that naturally separate and form the thick layer of cream found on top of non-homogenized milk. The smaller the fat molecule, the easier they are digested, which gives goat milk a digestive edge (Park, 1994).
   - Goat milk contains slightly lesser lactose than cow milk which may give it a mild advantage when it comes to digestion.
2. Antioxidant property:
   - Goat milk proteins have many biological activities due to the presence of bioactive peptides released from parent protein by digestive enzymes.
   - Antioxidative peptides can prevent oxidation and deterioration of foods and prolong the shelf life.
   - Goat milk from Prisca goat breed has highest Total Antioxidant Capacity (TAC) which was reported by some scientists after conducting several *in vitro* trials with the milk of different species such as goat, donkey and cow (Simos et al., 2011).

3. Anti-lactose intolerance property
   - All milk contains certain levels of lactose which is also known as 'milk sugar.' A relatively large portion of the population suffers from a deficiency (not an absence) of an enzyme known as lactase which is used to digest lactose. This deficiency results in a condition known as lactose intolerance which is a fairly common ailment.
   - Goat's milk contains less lactose than cow's milk (4.1 percent vs. 4.7 percent) and therefore is easier to digest for those suffering from lactose intolerance (Zenebe et al., 2014).
4. Anti-pro-inflammatory property:
   - Scientists from several studies found that goat whey improves the symptoms of intestinal inflammation, by decreasing the disease activity index, colonic weight/length, and leukocyte infiltration. Moreover, goat whey was found to inhibit NF-κB p65 and p38 MAPK signaling pathways and consequently down-regulate the gene expression of various pro-inflammatory markers such as IL-1β, IL-6, IL-17, TNF-α, iNOS, MMP-9, ICAM. Also, goat whey increases the expression of proteins such as mucins, occludin and other cytokine signaling suppressor proteins (Araújo et al., 2017).
5. Anti-hypertensive property:
   - Angiotensin-I Converting Enzyme (ACE) converts Angiotensin-I to Angiotensin-II. This Angiotensin-II is a potent vasoconstrictor which acts as a hypertensive agent and causes hypertension in humans. Scientists from Department of Pharmacology, University of Granada, Spain, have found new inhibitory peptides of Angiotensin-I Converting Enzyme (ACE) from goat milk which inhibits ACE and thus reduces hypertension and blood pressure in humans (Geerlings et al., 2006).
6. Anti-allergic property:
   - All types of milk contain casein proteins, but the composition of these proteins can vary greatly between different animal species. The allergic reaction in cow milk can be blamed on a protein allergen known as Alpha s1 Casein found at a high level in cow milk. The levels of Alpha s1 Casein in goat milk is about 89% lesser than cow milk providing a far lesser allergenic food (Zenebe et al., 2014).
7. Prevents Dengue Fever:
   - Dengue has become a major health problem in India. It is mainly transmitted to humans by Aedes aegypti mosquito, which constitutes the etiological agents of the disease. Deficiency of Selenium and decrease in platelet count are the main complications of dengue fever. As goat milk is highly rich in selenium (Se), it prevents platelet aggregation, thereby preventing dengue fever. So, for treating this disease, goat milk and its products are most preferred (Mahendru et al., 2011).

CONCLUSION

The nutritional composition of goat milk is comparatively higher than that of cow milk particularly in terms of total solids, proteins, fats, minerals and many important fatty acids which makes it superior to cow milk. But the foremost beneficial property of goat milk is its tremendous potential in the field of therapeutics which includes easy digestibility, anti-lactose intolerance, anti-inflammatory, anti-allergic, anti-hypertensive, antioxidant property and prevention from dengue fever.

REFERENCES

Araújo, D. F., Guerra, G. C., Pintado, M. M. E., Sousa, Y. R., Algieri, F., Rodriguez-Nogales, A., ... & Rodriguez-Cabezas, M. E. (2017). Intestinal anti-inflammatory effects of goat whey on DNBS-induced colitis in mice. *PloS one*, *12*(9), e0185382.

FAOSTAT (2008): http://faostat.fao.org/default.aspx

Geerlings, A., Villar, I. C., Zarco, F. H., Sánchez, M., Vera, R., Gomez, A. Z., ... & Duarte, J. (2006). Identification and characterization of novel angiotensin-converting enzyme inhibitors obtained from goat milk. *Journal of dairy science*, *89*(9), 3326-3335.

Haenlein, G. F. W. (2004). Goat milk in human nutrition. *Small Ruminant Research*, *51*(2), 155-163.

Jenness, R. (1980). Composition and characteristics of goat milk: Review 1968–19791. *Journal of Dairy Science*, *63*(10), 1605-1630.

Mahendru, G., Sharma, P. K., Garg, V. K., Singh, A. K., & Mondal, S. C. (2011). Role of goat milk and milk products in dengue fever. *Journal of Pharmaceutical and Biomedical Sciences (JPBMS)*, *8*(08).

Park, Y. W. (1994). Nutrient and mineral composition of commercial US goat milk yogurts. *Small Ruminant Research*, *13*(1), 63-70.

Park, Y. W., Juárez, M., Ramos, M., & Haenlein, G. F. W. (2007). Physico-chemical characteristics of goat and sheep milk. *Small ruminant research*, *68*(1-2), 88-113.

Simos, Y., Metsios, A., Verginadis, I., D'Alessandro, A. G., Loiudice, P., Jirillo, E., ... & Karkabounas, S. (2011). Antioxidant and anti-platelet properties of milk from goat, donkey and cow: An in vitro, ex vivo and in vivo study. *International dairy journal*, *21*(11), 901-906.

Zenebe, T., Ahmed, N., Kabeta, T., & Kebede, G. (2014). Review on medicinal and nutritional values of goat milk. *Academic Journal of Nutrition*, *3*(3), 30-39.

Embryo-endometrial crosstalk during peri-implantation period in ruminants

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In dairy animals, milk production and reproductive efficiency has been found to have a negative correlation. One of the most important causes of poor reproductive efficiency in cattle and buffalo is early embryonic mortality. Fertilization occurs in almost 85-90% of inseminated animals while calving occurs only in 40% animals. Approximately 40-50% of embryonic loss occurs during 8 to 17 days of pregnancy due to asynchrony between embryo–endometrium interactions (Wolf *et al.*, 2003). Embryonic genomic activation and uterine receptivity is important for a successful establishment of pregnancy during peri-implantation period. After embryonic genomic activation, embryos start secreting interferon-tau (IFN-τ), which suppress the up-regulation of estradiol receptor and oxytocin receptor in endometrium and thus blocks the conversion of arachidonic acid to prostaglandin F2-alpha ($PGF_{2\alpha}$) and prevents luteolysis (Spencer and Bazer, 1996) thereby maintaining the pregnancy. IFN-τ causes up regulation of prostaglandin E synthases (PGES) expression and prostaglandin E2 (PGE_2) production. Uterine endometrium secretes histrotroph (uterine milk) which contains growth factors, cytokines, chemokines, cell adhesion molecules (CAMs), extracellular matrix (ECMs) and other nutrients. Nowadays, researchers are trying to understand the exact embryo endometrium crosstalk in *in vitro*. Therefore, the present article is to describe about the crosstalk between embryo and endometrium during peri-implantation period in ruminants.

SIGNIFICANCE OF EMBRYO IN CROSSTALK

In cattle, embryo reaches uterus after 3-4 days of fertilization, that time maternal RNAs and proteins stored in the oocyte are gradually degraded and transcription of the embryonic genome is activated. Transcriptional activation of embryonic genome occurs at four or eight cell stages depends on species and starts responding to even proteins secreted by the oviduct, suggesting that embryo-maternal communication is already established at this stage. Embryo starts secreting signal molecules that acts on

endometrium which indicates their presence in uterus. These signalling molecules are important for the maintenance of the corpus luteum. Bovine embryo starts secreting IFN-τ on day 7 - 8 of pregnancy, increase in production on day 14, peaks on days 15-17 of pregnancy and then declines after the attachment of embryo to the endometrium. Hatching of blastocyst and initiation of elongation of conceptus occurs on days 9 and 12 respectively. Conceptus elongation and attachment requires growth factors, cytokines, chemokines, CAMs, ECM and other factors, which are present in uterine secretions (Bazer *et al*., 2011). Recent study in cattle revealed that embryo as early as on 8th day induces expression of interferon stimulated genes (ISGs) viz., MX1, MX2, OAS1, ISG15, RSAD2 on the endometrium which are important for signaling of IFN-τ expression (Austin *et al*., 2004).

Significance of maternal endometrium in crosstalk

During the luteal phase (5th - 18th day of oestrus cycle) and in pregnancy condition, there is increase in progesterone (P_4) concentration. Under P_4 dominance, uterine endometrium secretes histrotroph (uterine milk) which is important for the early development of embryo. Uterine histrotroph comprises of growth factors, cytokines, chemokines, cell adhesion molecules (CAMs), ECM and other factors. P_4 dominance causes down regulation of Muc-1 (anti-adhesive) molecules and up regulation in the expression of adhesion molecules such as integrins, osteopontin, selectins, glyCAMs and galectins. Immunoreactive, Muc-1(anti-adhesive molecules) is highly expressed at the apical surfaces of uterine luminal (LE) and glandular epithelium (GE) in both cycling and pregnant ewes but decreased dramatically on LE by day 9 and was nearly undetectable by day 17 of pregnancy when intimate contact between LE and trophoblast begins. Integrins are present on both endometrium and trophectoderm of foetus. Osteopontin is important for attachment of the embryo, probably by linking integrins heterodimers which are expressed by trophectoderm cells and by the luminal epithelium of the endometrium.

Mechanisms of maternal recognition of pregnancy in ruminants

In ruminants, IFNs is important embryonic pregnancy recognition signal. IFNs is encoded by multiple genes and is expressed and secreted by trophectoderm cells of blastocysts. Secretion of IFNs by bovine blastocysts occurs from 7th - 8th day of pregnancy and highest level is between days 15 and 17. IFN-τ reduces the expression of estradiol receptor and oxytocin receptor in endometrium and thus blocks the conversion of arachidonic acid to $PGF_{2\alpha}$ and prevents luteolysis. Type-1 interferon, IFN-τ induces signal transduction through the JAK-STAT pathway. IFNs induces the expression of a number of genes, such as STAT (signal transducer and activator of transcription) 1 and 2, β_2 micro-globulin**,** IFN-regulatory factor 1 (IRF-1), ubiquitin cross-reactive protein, Mx protein, granulocyte-chemo tactic protein-2, granulocyte-macrophage colony-stimulating factor, a cytokine with putative positive effects on the Conceptus, in stroma cells of the endometrium. Other effects of IFNs in endometrium cells include a reduction

of oxytocin-induced cyclooxygenase-2 and prostaglandin F-synthetase expression. Thus, IFNs supports the maintenance of a pregnancy via multiple mechanisms.

Adhesion molecules

Adhesion molecules in uterine secretions are integrins, osteopontin, fibronectin, vitronectin, GlyCAMs, selectins, tenascin and von Willebrand's factor. Integrin subunits α_v, α_4, α_5, β_1, β_3 and β_5 are expressed on conceptus trophoblast and at the apical surface of uterine LE and GE in both cyclic and early pregnant ewes. The αVβ3 integrin expression in the human endometrium is regulated both positively by EGF and HB-EGF, and negatively by estrogen. Osteopontin (OPN; also known as Secreted Phosphoprotein 1, SPP1) is a secreted extra-cellular matrix (ECM) protein that binds to a variety of cell surface integrins to stimulate cell-cell and cell-ECM adhesion and communication. OPN then binds to αvβ6 integrin receptors on trophectoderm and the αvβ3 integrin receptors on uterine LE to bridge conceptus attachment to uterine LE for implantation in pigs.

Growth factors

In bovine endometrium, the expression of epidermal growth factor (EGF), transforming growth factor-α (TGF-α) and epidermal growth factor-R (EGF-R) were detected on day 13 of pregnancy. In cattle, insulin like growth factor binding protein 1 (IGFBP1) has higher expression in the uterus on day 16 of pregnancy compared to a non-pregnant cow. Thus, IGFBP1 in sheep and cows mostly regulates conceptus by stimulating migration and attachment of the trophectoderm. TGF-α is expressed in the luminal epithelium throughout the uterus during pre-implantation. β-cellulin (BTC), epiregulin (Er) and neudifferentiating factors (NDFs) share an expression pattern and are first expressed in the luminal epithelium and underlying stroma at the site of blastocyst attachment. Heparin binding – epidermal growth factor (HB-EGF) peaks at the window of implantation and ErbB4 is expressed in the trophectoderm in peri-implantation human blastocysts.

Cytokines

Many cytokines are expressed during the peri-implantation window, but only a few are required for embryonic implantation, such as Leukemia inhibitory factor (LIF), Interleukin-6 (IL-6), and Interleukin-11 (IL-11). LIF undergoes a biphasic expression change in early pregnancy of mice. On day 1 of pregnancy, LIF is expressed in the glandular epithelium of the endometrium, with declining expression until day 3 and on day 4, LIF is again strongly expressed in the glandular epithelial cells then with the onset of blastocyst attachment at midnight, the expression of glandular LIF disappears. Differential expression showed the necessity of LIF in different stages of implantation. Other animal models (rabbit, pig, cow, sheep, and non-human primates) show similar biphasic regulation. IL-6 is weakly expressed during the proliferative phase, but strong epithelial immunoreactivity is present during the midsecretory phase when the implantation window opens in human endometrium. Furthermore, IL-6 secretion by endometrial stromal cells is enhanced by interferon-γ. IL-11 and its receptor (IL-11Rα) have recently been demonstrated in implantation process. Although all the major cell

types in endometrium expressed IL-11 with cyclical variation, the most prominent immunoreactivity and mRNA expression is in the decidualized stromal cells late in the menstrual cycle in primates.

CONCLUSION

In conclusion, most of the embryonic losses occur during the peri-implantation period in ruminants. So, in order to reduce these embryonic losses, it is very necessary to understand the embryo-endometrium crosstalk before the completion of the implantation process.

REFERENCES

Austin, K.J., Carr, L., Pru, J.K., Hearne, C.E., George, E.L., Belden, E.L and Hansen, T.R. 2004. Localization of ISG15 and conjugated proteins in bovine endometrium using immunohistochemistry and electron microscopy. *Endocrinology*, **145**:967–975.

Bazer, F.W., Spencer, T.E., Johnson, G.A and Burghardt, R.C. 2011. Uterine receptivity to implantation of blastocysts in mammals. *Front Biosci (Schol Ed)*, **3**(2):745-767.

Spencer, T. E and Bazer, F. W. 1996. Ovine interferon tau suppresses transcription of the estrogen receptor and oxytocin receptor genes in the ovine endometrium. *Endocrinology*, **137**(3)**:**1144-1147.

Wolf, E., Arnold, G.J., Bauersachs, S., Beier, H.M., Blum, H and Einspanier, R. 2003. Embryo-maternal communication in bovine strategies for deciphering a complex cross-talk. *Reproduction in Domestic Animals*, **38**:276–289.

Bio-prospecting: A Systematic Search

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ABSTRACT

A tool for survival and a source of inspiration and innovation. It is a search forgenes, natural compounds, designs, and whole organisms in wild life with a potential for product development by biological observation and biophysical, biochemical, and genetic methods, without disruption to nature. In this context, bioprospecting programs at the national level can help to develop national capacity and provide economic returns to conservation projects if investments are made in science, technology, and market research. However, this may not be sufficient to achieve sustainable development: communities inside or bordering protected areas must participate in conservation and must benefit from bioprospecting activities in their own regions.

INTRODUCTION

Biodiversity prospecting is the exploration, extraction and screening of biological diversity and indigenous knowledge for commercially valuable genetic and biochemical resources. While it is true that biodiversity prospecting does not always involve the use of indigenous knowledge, it is clear that valuable chemical compounds derived from plants, animals and microorganisms are more easily identified and of greatest commercial value when collected with indigenous knowledge and/or found in territories traditionally inhabited by indigenous peoples. The development of new innovation drugs through bioprospecting refers to activities undertaken by a small number of commercial sectors. As a result, and because this type of bioprospecting usually involves taking small samples of material, its impact on the environment is usually minimal. However, it is important to ensure that bioprospecting is done in a sustainable and ethical manner and results in fair benefits for the country and local people from which the genetic resources are prospected. To be effective as an element of conservation, bioprospecting must contribute to the generation of wealth through R&D and must also alleviate poverty in biodiversity-rich regions. Recent studies in science and technology have provided substitutes for some biological products: nylon,

polyacryl, and polyester instead of cotton and wool; aniline dyes instead of natural colorants; and organophosphates or carbamates instead of plant-derived natural pesticides like rotenone, nicotine, and ryanodine. Yet human ingenuity still depends in great part on inspirations from wild life-forms to create these substitutes. In contrast to our forest-dwelling bioprospecting ancestors, we no longer need to use the biological original to create a final product; rather, through the study of these originals we are able to discover and unveil the principle of a biological function and then develop novel products on this basis. Modern science and technology have provided substitutes for some biological products: nylon, polyacryl, and polyester instead of cotton and wool; aniline dyes instead of natural colorants; and organophosphates or carbamates instead of plant-derived natural pesticides like rotenone, nicotine, and ryanodine. Yet human ingenuity still depends in great part on inspirations from wild life-forms to create these substitutes. In contrast to our forest-dwelling bioprospecting ancestors, we no longer need to use the biological original to create a final product; rather, through the study of these originals we are able to discover and unveil the principle of a biological function and then develop novel products on this basis.

Bioprospecting and Biodiversity

Bioprospecting is the method of discovering and developing recent merchandise of chemical compounds,genes, micro-organisms, macro-organisms supported by biological resources whereas Biodiversity is the presence of different kinds of species in an ecosystem.The need to protect biodiversity and to promote fairness in the use of genetic resources and associated traditional knowledge has engendered one of the most contentious debates of the 21st century between developed and developing countries. This debate has fundamental implications for the way in which basic and applied research on genetic resources and biodiversity is conducted and its results are made available between and within peoples and societies. Therefore, the regulation of bioprospecting –i.e. "the search for plant and animal species from which medicinal drugs and other commercially valuable compounds can be obtained

Agricultural prospecting

It has resulted in the assembling of government, international, and private gene collections, however, the viability of these resources, mostly in tropical countries, has decreased over time.Some estimates suggest that over 70% of all germplasm collected since 1940 is no longer viable or the associated knowledge has been lost. *In situ* conservation, therefore, has become an attractive proposition to protect and utilize the remaining genetic resources.

In recent times, agronomists and professionals from related sciences have done considerable agricultural prospecting looking for landraces having agronomic advantages, particularly higher yields, pest and disease resistance, and adaptation to specific microhabitats. Gene prospecting of the resources managed, nurtured, and selected over centuries by indigenous communities has yielded considerable benefits to the world in terms of improved crop varieties and hybrids. Traditional plant breeding

has slowed down in tropical countries due to lower research investment and unsuitable intellectual property protection, and this could diminish the opportunity of using the tools of the new biotechnologies.

Gene Prospecting: Modern Proespecting

Search for genes in wild living plants, animals, and microorganisms for the breeding or genetic engineering of plants, animals, and microorganisms in agriculture, fermentation, and cell culture for agricultural and industrial production. lants are responsible for a significant part of food supply for the entire world, and through agriculture they play an extremely important socio-economic role for the mankind. Therefore, the development of genetically improved crops becomes even more relevant for it aims at an everlasting enhancement of agronomic traits of interest. For many years, plant genetic improvement program has been based in empiric selection of the target traits; however, significant advances were obtained in the last years. Many tools, allowing crops to be improved with greater optimization of the time needed to reach the necessary modifications, are currently available. Regarding the methods used in the genetic improvement, molecular studies have been essential to identify which genes are important for each specific agronomic trait, such as those related to tolerance to abiotic stress. Such studies contribute not only to a better understanding of the endogenous defense mechanisms of plants at molecular level by which these organisms adapt when facing hostile conditions, but also contribute to the generation of stress tolerant crops by genetic engineering. These programs aim a significant productivity and sustainability that can be reached through soil preservation that is directly related to less necessity of farm inputs. Better adapted crop cultivars make it possible, as well as better use and decontamination of water resources. At present, agricultural systems are under immense pressure to fulfill the increasing demand of food and feed in the context of global climate change with expanding populations. It is an established fact that the global temperature is likely to increase in upcoming decades resulting in the alteration of the edaphic attributes. The change in the edaphic factors due to climatic variations such as annual rainfall, events of drought and flood results in the decrease in soil fertility with water salinization which ultimately results in the reduction of crop yield. Hence in the contemporary era of scientific advancement, it is of central significance to develop mitigation strategies using analytical and forward looking concepts to fulfill the rapidly increasing food demands with ecological sustainability. In recent years, transgenic technology has proven to be very effective in terms of developing stress tolerant crops and use of microbes. This is a relatively simple alternative in terms of cost, unique properties, and ease of handling for broad-spectrum resistance/tolerance against combination of different stresses. Thus, the emphasis is now shifted to the bioprospecting of microbiota to explore the molecular and biochemical potential of microbes towards stress alleviation in crop plants. This book chapter includes an updated progress in microbial gene prospecting and their contemporary use in different plants to enhance their stress tolerance potential. Moreover, the chapter also emphasizes the different metabolic pathways which were

previously targeted towards the development of stress tolerant plants and simultaneously proposed theoretical perspective and a baseline knowledge which could be further harnessed in future research towards sustainable agriculture and ecosystem.

Bioprospecting and Conservation

Bioprospecting is the search among living organisms for compounds that have commercial value as active ingredients in pharmaceuticals, pesticides, and other products. Natural products, derived from plants and animals, remain a basic source of many pharmaceuticals. In addition to providing raw materials for medicines, natural products also provide information for pharmaceutical development: the molecular structures of natural products serve as blueprints or as leads in developing compounds. Millions of years of evolution have led to molecules organic chemists would not dream of producing. These molecules often have novel mechanisms of action against diseases. With advances in biotechnology, the scope for using this genetic information to develop new medicines has increased. Wildlands, where species reside, have an option value as a potential source of genetic materials and information. Biodiversity as a source of medical breakthroughs has drawn considerable attention from the medical and environmental communities. The Earth's biodiversity may be thought of as a vast, unexplored library with information leading to many possible medical breakthroughs. The total number of species on the planet is unknown, and only a small number have been screened for medical activity. Further, the medical screening process has improved over time, so compounds thought to be of little value at one time may turn out to be quite important later. Based on sheer numbers, areas rich in biodiversity, such as tropical rainforests, appear promising for exploration of new drugs. Biologists estimate that the tropics are home to most of the world's plant and animal species, with the tropical forests especially rich in species.

To summarize thus far, biologists and conservationists suggest bioprospecting contracts can simultaneously find new medical breakthroughs and provide developing countries with economic incentives to conserve genetic resources. Advances in biotechnology and changing definitions of intellectual property rights over biological innovations have spurred a number of bioprospecting arrangements. These arrangements, however, are multi-faceted and complex. We turn now to economic assessments of the potential for bioprospecting contracts to encourage biodiversity conservation.

REFERENCES

D.D. Soejarto & N.R. Farnsworth, Tropical Rainforests: Potential Sources of New Drugs, 32 PERSP. BIOLOGY & MED. 244, 246 (1989).

Christopher Costello & Michael Ward, Search, Bioprospecting, and Biodiversity Conservation, 52 J. ENVTL. ECON. & MGMT. 615, 616–25. (2006).

Stuart Pimm & Peter Raven, Extinction by Numbers, 403 NATURE 843, 844 (2000); E.O. Wilson, The Current State of Biological Diversity, in BIODIVERSITY 8 (E.O. Wilson ed., 1988).

Wink, M. (1993). Production and application of phytochemicals from an agricultural perspective. In *Phytochemistry and Agriculture* (T. A. Beek and H. Breteler, eds.), pp. 171–213. Clarendon Press, Oxford, United Kingdom.

Zakrzewski P. A., Bioprospecting or Biopiracy? The Pharmaceutical Industry's Use of Indigenous Medicinal Plants as a Source of Potential Drug Candidates. *University of Toronto Medical Journal* 79(3) (2002) 252-254.

Pregnancy Diagnosis in bovines

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ABSTRACT

Pregnancy diagnosis is an important aspect for better reproductive management in livestock species like cows and buffaloes. It is crucial for shortening the calving interval. It can enable farmers to identify non-pregnant animals so as to treat or rebreed them at the earliest opportunity. For the implementation of any reproductive management program, it requires accurate pregnancy detection with estrous synchronization. Re-synchronization protocol is normally performed at 28-56 day after first insemination (i.e., a 4-8 week interval). Before the re-synchronization animal must require an accurate, reliable and confirmatory pregnancy test because this involves Prostaglandin F2α (PGF2α) hormonal injection which is responsible for abortion in animals. There are many methods of direct pregnancy diagnosis like direct palpation methods, ultrasound and indirect methods which depend on concentrations of chemicals and hormones. To conclude, pregnancy diagnosis will be very helpful for improving production efficiency of the dairy animals.

INTRODUCTION

Pregnancy Diagnosis:

Pregnancy diagnosis is a prerequisite for more and life-time production in dairy animals. An early and precise pregnancy diagnosis is need of the hour for improving reproductive efficiency in livestock. This can act as key to shorten the calving interval through early identification of non-pregnant animals and their timely treatment and rebreeding so as to maintain a postpartum barren interval close to 60 days. Several methods of pregnancy diagnoses are being practiced in bovine species, which are widely available and can be direct or indirect as described below:

DIRECT METHOD

There are number of methods which can detect pregnancy in bovines. These methods are routinely followed for diagnosis of pregnant animal.

Per Rectal Palpation:

Per rectal palpation of the uterus served as a best method for pregnancy diagnosis in bovines from centuries. It is also most widely practiced method for pregnancy diagnosis in large dairy animals even today. After day 28 of gestation onwards, the veterinary

practitioners normally rely on the palpation of the amniotic vesicle and slipping of the chorioallantoic membranes between the thumb and forefinger. It is the cheapest and easy to done pregnancy diagnosis method. However, several studies have suggested that examining pregnant animals early in gestation by transrectal palpation increases the risk of iatrogenic embryonic mortality. Therefore, this method must be done with proper care of pregnant animals (Franco *et al.,* 1987).

Ultrasonography:

The discovery of ultrasonography has made pregnancy diagnosis possible as early as day 28 after insemination/conception. Ultrasound has an advantage of providing information on ovarian structures, identification of twins, and determination of fetal viability, age and sex. It is a minimal invasive, accurate and highly efficient technique for early pregnancy diagnosis and may minimize the incidence of palpation-induced abortions. Transrectal ultrasonography is direct and accurate method for pregnancy diagnosis. But this method requires skilled and experienced person for diagnosis of pregnancy. Veterinary grade ultrasound machines equipped with a rectal transducer are expensive in developing countries. Therefore, the high initial cost of this technology partly limits its practical implementation in the field of pregnancy diagnosis.

INDIRECT METHOD

These methods do not directly depend on fetus detection and based on various chemical changes which occur during pregnancy and are used in pregnancy detection.

Progesterone assay:

The difference in peripheral plasma progesterone levels at day 19 after insemination between pregnant and non-pregnant animal can form the basis for a very early pregnancy test. Measurement of progesterone has been used as indirect method for pregnancy diagnosis in many livestock species including cattle, buffaloes, sheep, and goats. Conception extends the life of the corpus luteum (CL) by preventing the luteolytic mechanism from being triggered, thus prolonging and maintaining its functional characteristics, ensuring continued high progesterone levels. Progesterone maintains the uterine endometrium in a state which supports embryonic development, implantation and foetoplacental development. Progesterone concentrations vary with the stage of the estrous cycle which makes it one of the most commonly studied reproductive hormones in bovine ruminants for pregnancy detection (Kaneko *et al.,* 2008).

The advantages of progesterone assay for pregnancy diagnosis include non-invasive collection of milk sample and the feasibility to conduct the test on the farm using commercially available cow-side milk progesterone test kits. However, both sensitivity and specificity are compromised with progesterone based assay kits due to its secretion in other reproductive disorders also.

Estrone Sulphate assay:

Estrone sulphate is a conjugated steroid product of estrone, present predominantly in the bovine placentomes. It is the major estrone present in the fetal (allantoic and amniotic) fluids and maternal peripheral plasma with measurable quantities detectable by day 52 onwards till the end of gestation. Its concentration increases from day 60 and plateau around day 150 after insemination. However, reliable pregnancy detection is possible with Estrone sulphate only after day 100 of gestation and therefore, this test can be detected late pregnant animal only.

Early Conception Factor (ECF)/ Early pregnancy factor (EPF):

EPF is a 10.84 kDa protein, which is present in the serum of pregnant dam and detectable within 6 to 24 hours of fertilization. It disappears within 24 to 48 after death or removal of the embryo. However, EPF is present in the serum up to two-thirds of the gestation. EPF is the earliest benchmark protein for identification of successful conception.

Antibodies raised against a cow serum glycoprotein were used to detect EPF leading to development of a lab method, which has been commercialized in the USA as Early Conception Factor (ECF) test (Concepto Diagnostics, Knoxville, TN). This kit claims detection within 48 hours of artificial insemination. Different studies were conducted to measure effectiveness of the commercial ECF test for diagnosing non-pregnant animal which has revealed a high degree of non reliability of the test. According to study conducted by Gandy *et al.* (2001) only 44.4% and 55.6% of the confirmed non-pregnant heifers were identified correctly by serum ECF analysis at days 1 to 3 and days 7 to 9 after AI, respectively. Although EPF is secreted in early pregnancy, it is not strictly pregnancy specific because of its secretion from non-placental sources such as tumors and transformed cells, which makes it an erroneous pregnancy detection method.

Pregnancy Associated Glycoproteins (PAGs):

The pregnancy associated glycoproteins (PAGs) are secretory products from the mono and binucleated trophoblastic cells in bovine placentomes. Relocation of the extra embryonic trophoblastic cell layers to the endometrium between days 20 to 28 and secretions from the conceptus lead to successful implantation and continuation of pregnancy in ruminant species. Among these glycoproteins, two pregnancy-specific proteins were found in the sera of pregnant cows, a 65-70 kDa and a 47-53 kDa protein of pI 4.6-4.8 and 4.0-4.4, respectively. These PAGs has been used in development of ELISA which can detect bovine PAG in maternal serum by the fourth week of pregnancy. However, recently it has been observed that placental defects are complemented by unusually high plasma levels of PAGs, probably due to diminished clearance of these proteins which limits its use for early pregnancy detection (Constant *et al.,* 2011).

Interferon-tau (IFNt):

Pregnancy brings about numerous physiological changes in the dam body through secretion/altered secretion of various biomolecules, which often are proteins or their metabolites which can act as the candidate molecules for pregnancy detection. With the advancement of biotechnological tools, HCG based pregnancy diagnosis has become the simplest, cheapest, and most commonly practised test for humans to diagnose pregnancy as early as 8-10 days after conception. Homologous to the human protein, only higher primates produce a chorionic gonadotropin (CG) for maintaining luteal activity during early pregnancy, while ruminants produce type I interferon as an antiluteolytic factor during this period. Godkin *et al.* (1984) purified ovine Trophoblastic Protein-1 (oTP-1); an early secretory protein of the sheep blastocyst, from *in vitro* cultured day's 14-16 conceptuses. They revealed that oTP-1 acts on the maternal endometrium thereby eliciting maternal responses which contribute to the maintenance of pregnancy. Green *et al.* (2010) also measured different interferon-tau (IFNt) stimulated genes (ISGs) expression in circulatory leukocytes and diagnosed pregnancy within 18 days after insemination. Based on microarray results, they selected three genes [2, 5- oligoadenylate synthetase 1(OAS1), myxovirus resistance gene 2 (Mx2), and interferon-stimulated gene 15 kDa protein (ISG15)] because they were known to be interferon-stimulated genes (ISGs). Their results indicated that ISGs expression (Mx2, ISG15 and OAS1) was greater in pregnant compared with non-pregnant cows on day 18 and 20 that could be used for a reliable pregnancy test. There are many reports related to up regulation of ISGs during 18-21 days pregnancy (Thakur *et al.,* 2017; Batra *et al.,* 2018a, b) but still this technology has not reached to field level and still is in infancy stage.

CONCLUSION

Pregnancy diagnosis is an important aspect for optimizing production of dairy industry. Dairy farmers will be very much benefitted by recognizing non-pregnant animal at the earliest opportunity so as to rebreed the animal at the very next opportunity. The detection test on the same lines as the human quadruple test needs to be explore further.

REFERENCES

Batra, K., Nanda, T., Kumar, A., Gupta, A.K., Kumari, R., Kumar, V., Sheoran, N. and Maan, S. (2018a). Molecular cloning and characterization of Mx2 for early pregnancy diagnosis in *Bubalus bubalis. Proc. Natl. Acad. Sci. India, Sect. B Biol. Sci*., https://doi.org/10.1007/s40011-018-0993-x.

Batra, K., Kumar, A., Maan, S., Kumar, V., Kumari, R. and Nanda, T. (2018b). Recombinant interferon stimulated protein 15 (rISG15) as a molecular marker for detection of early pregnancy in *Bubalus bubalis. Anim. Reprod. Sci*., https://doi.org/10.1016/j.anireprosci.2018.08.018.

Constant, F., Camous, S., Chavatte-Palmer, P., Heyman, Y., Sousa, N., Richard, C., Beckers, J.F. and Guillomot, M. (2011). Altered secretion of pregnancy-associated glycoproteins during gestation in bovine somatic clones. *Theriogenology*, **76**: 1006-1021.

Franco, O.J., Drost, M., Thatcher, M.J., Shille, V.M. and Thatcher, W.W. (1987). Fetal survival in the cow after pregnancy diagnosis by palpation per rectum. *Theriogenology,* **27(4)**: 631-644.

Gandy, B., Tucker, W., Ryan, P., Williams, A., Tucker, A., Moore, A., Godfrey, R. and Willard S. (2001). Evaluation of the early conception factor (ECFŮ) test for the detection of nonpregnancy in dairy cattle. *Theriogenology,* **56(4)**: 637-647.

Godkin, J.D., Bazer, F.W. and Roberts, R.M. (1984). Ovine trophoblast protein 1, an early secreted blastocyst protein, binds specifically to uterine endometrium and affects protein synthesis. *Endocrinology,* **114(1)**:120-130.

Green, J.C., Okamura, C.S., Poock, S.E. and Lucy, M.C. (2010). Measurement of interferon-tau (IFN-tau) stimulated gene expression in blood leukocytes for pregnancy diagnosis within 18-20d after insemination in dairy cattle. *Anim. Reprod. Sci*., **121:** 24-33.

Kaneko, J.J., Harvey, J.W. and. Bruss, M.L. (2008). Clinical Biochemistry of Domestic Animals, Academic Press,Amsterdam, The Netherlands.

Thakur, N., Singh, G., Paul, A., Bharati, J., Rajesh, G., Gm, V., Chouhan, V.S., Bhure, S.K., Maurya, V.P., Singh, G. and Sarkar, M. (2017). Expression and molecular cloning of interferon stimulated genes in buffalo (*Bubalus bubalis*). *Theriogenology,* **15(100):** 50-58.

Importance of A1 and A2 milk and its impact on Human Health

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India is the largest milk producer in the world. Milk production in the country is 165.4 million tonnes during 2016- 2017 and it's estimated to have increased by 6.6 percent to 176.35 million tonnes during last financial year 2017- 2018. Hence it contributes up to 24 percent of total GDP of agriculture allied fields. Milk is a complete food for newborn animals and also for human beings. It is the sole food during the early stage of growth and development of human health as well as for the animals. The major source of milk production in our country are cow, buffalo, goat and sheep contributing nearly 85%, 11%, 2%, 1.4%, respectively. In early 19th century some of the researchers found that some substance in milk from cow is causing problems to the human beings. Later in the end of 19th century some other researchers found that milk is of various categories and among them A1 and A2 is commonly observed and are mostly consumed by people. In developing countries like India the people consume milk according to their needs. In recent studies it has been found that A2 milk is harmless whereas A1 milk is harmful for health. Hence, our future breeding policies must be done for dairy animals in a systematic manner and keeping in view of clean and healthy A2 milk production in our country.

BASICS OF A1 AND A2 MILK

Milk contains about 85% of the water. The remaining 15% is the lactose, protein, fat and minerals. Beta-casein is about 30% of the total protein in milk. A2 milk is the milk that contains only the A2 type of beta-casein whereas, A1 milk contains only A1 beta casein or A1A2 type variant. Mostly A2 milch breed cows like Sahiwal, Gir, Red Sindhi, Tharparkar which are found mainly in South East Asia especially in India and few countries of African region. The A1 type breeds like Holstein Friesian, Brown Swiss, and Jersey found in the European, American and some other countries. When the A2 milk is taken it breaks down into proteins and the A1 milk causes sudden infant death syndrome mainly in children and

also some others chronic disease whereas the A2 milk which does not causes these diseases. The composition of milk differs widely in different species (Table 1) and amongst all, the cow's milk has been regarded as natures perfect food providing an important source of nutrients including proteins, carbohydrates and minerals and vitamins which shows the severe adverse effects like gastrointestinal problems, cardiac problems and some other life threatening effects in human being but not all categories of milk causes harmful effect based on genetic variation of the milk.

Table1. Milk composition analysis of milk from different sources per 100grams

Composition	Cow	Buffalo	Sheep	Goat
Water (g)	87.8	81.1	83	88.9
Protein (g)	3.2	4.5	5.4	3.1
Fat(g)	3.9	8.0	6.0	3.5
SFA	2.4	4.2	3.8	2.3
MUSFA	1.1	1.7	1.5	0.8
PUSFA	0.1	0.2	0.3	0.1
Carbohydrate(g)	4.8	4.9	5.1	4.4
Cholesterol(mg)	14	8.0	11	10
Calcium(mg)	120	195	170	100
Energy(kcal)	66	110	95	60

GENETICS OF A1 AND A2 MILK

The cow milk (A1/A2) is determined by a pair of genes present on the sixth chromosome. The type of milk a cow will produce depends on the gene and genotype frequency. There are two major alleles of the gene i.e. A1 and A2 beta-casein alleles. The cow can carry either of A2A2 (homozygous), A1A2 (heterozygous) or A1A1 (homozygous) alleles. Neither allele is dominant over the other rather; they are co-dominant i.e. additive in their effect. Therefore, an A1A2 cow will produce equal amount of A1 and A2 beta-casein. An A2A2 cow will produce only A2 beta-casein and an A1A1 cow will only produce A1 beta-casein. The Northern European breeds of cow likes Friesian and Holstein carries equal levels of A1 and A2 alleles. The Southern European breeds like Jersey carries 2/3 of A2 allele remaining 1/3 is A1 allele. Exceptionally, Guernsey breed appears to carry the A1 allele at less than 10% and the Scottish Ayrshire breed appears to be well over 50%. In addition, individual herds may carry the allele at levels that are quite different to the average for the breed. If a cow is A2A2 genotype then she passes on the A2 allele to her progeny. Similarly, an A1A1 cow is guaranteed to pass on the A1 allele to her progeny.

Table 2. Allelic and genotypic frequency in various Indian cattle breeds

		Allele frequency		Genotype Frequency		
S.No	**Cattle breeds**	**A1**	**A2**	**A1A1**	**A1A2**	**A2A2**
1	Sahiwal	0	1	0	0	1
2	Red sindhi	0	1	0	0	1
3	Tharparkar	0	1	0	0	1
4	Gir	0	1	0	0	1
5	Kangayam	0	1	0	0	1
6	Nimari	0	1	0	0	1
7	Red kandhari	0	1	0	0	1
8	Amrit mahal	0	1	0	0	1
9	Malvi	0	1	0	0	1
10	Kankrej	0	1	0	0	1
11	Hariana	0	1	0	0	1
12	Rathi	0	1	0	0	1
13	Mewathi	0	1	0	0	1
14	Malnad Gidda	0.096	0.904	0	0.191	0.809
15	Kherigarh	0.109	0.891	0	0.218	0.783

ß-casein variants on human health

ß-casein is a major protein and also having 209 amino acids chain. Amongst 12 known variants of ß-casein, A1, and A2 are the most common forms found in cow's milk. In recent years, keen interest shown by many researchers on these two variants stems from the hypothesis that high consumption of A1 ß-casein milk increases the risk for a range of human diseases. The A1 and A2 variants differ at amino acid position 67 with Histidine in A1and Proline in A2 variant. A1: C**A**T; Histidine and A2: C**C**T; Proline

This polymorphism leads to a key conformational change in the secondary structure of expressed ß-casein protein. Variant of A1 ß-casein gene produces beta-casomorphin 7 (BCM-7), a bioactive peptide opioid during the gastrointestinal digestion of raw or processed milk. BCM-7 has been suggested to be associated as a risk factor for human health hazards. Histidine in variant A1 has a weak hold on BCM-7 and allows it to get into the milk, and thereby affect the people consuming A1 milk. On the other hand, presence of proline in A2 variant cows has a strong bond to BCM-7 that helps keep it out of the milk.

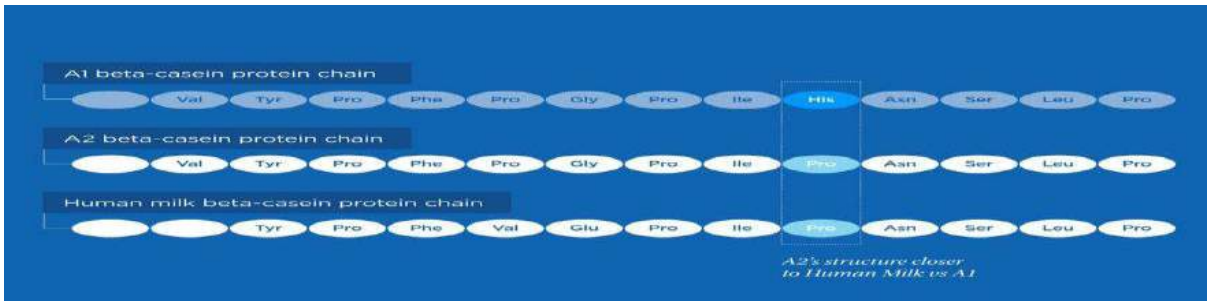

Fig1: Changes in A1, A2 milk and human in that comparison A2 and humans are same

Intracellular digestion studies of ß-casein from A1and A2 variants

Several epidemiological studies have indicated that long term consumption of milk with A1 allele increases the risk for a range of human diseases. On the contrary A2 milk is considered safe for human consumption. It may be necessary to monitor the status of A1/ A2 allele in dairy animals as a cautionary measure because of the fact that high consumption of A1 milk might be a risk factor for the following important diseases.

- Type 1 diabetes mellitus
- Coronary heart disease
- Arteriosclerosis
- Sudden infant death syndrome
- Neurological impairment, including autistic and schizophrenic changes

IMPACT OF A1 AND A2 MILK ON HUMAN HEALTH

Milk from dairy cows is providing a high quality source of protein and essential micronutrients like energy, calcium, magnesium and phosphorus to human beings. Genetic variants in bovine β-casein gene (A1 and A2) release a bioactive peptide, β-casomorphin-7(BCM-7) upon digestion, responsible for many human disorders. We are able to get only about 700 mg of calcium per day, which comes primarily from dairy products. This amount is against the recommended amount of 1,000 – 1,500 mg. Calcium content of milk, may reduce the risk of osteoporosis and colon cancer. The A1 milk's ratio is 10:1. By relying on A1 cow's milk for calcium, we will have magnesium deficiency and imbalance, but A2 milk does not cause such imbalances. Magnesium is required for the body to produce and store energy. So, A2 milk having high magnesium levels than the A1 milk. The inflammation from A1 milk casein causes lymphatic congestion and metabolic suppression. A1 milk worsens acne, eczema, upper respiratory infections, asthma and allergies. It causes digestive problems, not because of the lactose but because of massive histamine release from casomorphin and ear infections, bronchitis, tonsillitis are driven by A1 β-casein.

CONCLUSION

Indian breeds of cows represent the world's largest A2 milk producing herd. Moreover it brings new insights into our conservation programme and could be an instrument to ensure better sustainability and also more research is required to prove the reality of the hypothesis of A1 and A2 milk.

Fig. 1: Photo was taken from NDRI Karnal

Fig.2: Photo was taken from NDRI Karnal Farm

Fig. 3: Photo was taken from NDRI Karnal Farm

Mitigation strategy of Poor Quality Irrigation Water for Crop Production

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Water is limited on the Earth surface. At the global scale 689 million acres of agricultural land was equipped with irrigation infrastructure around the year 2000. About 68 per cent of area equipped for irrigation is located in Asia. In India, the total irrigation potential from surface and groundwater sources would be about 139.9 mha (CWC, 2008). As supplies of good-quality irrigation water are expected to decrease in several regions due to increased municipal–industrial–agricultural competition, available freshwater supplies need to be used more efficiently. The problem of food insecurity is arises in the world because food grain production increases with decreasing rate and world population increases at increasing rate. There may be several reasons for less food production, might be due to Climate change, pest interferences, poor soil health, urbanization and last but not the least i.e. poor quality irrigation water. We will need to grow more food and we will need to grow it more efficiently. But today, irrigation quality is deteriorating it is declining across Asia and in most part of Africa. So, efficient utilization of poor quality irrigation water across these continents is the key to ensuring future food security and soil health. Inadequate supply of good quality irrigation water or the high cost of water so that we have to look for alternatives such as poor quality irrigation water.

Poor Quality of Water

1. Sewage water: Sewage water is basically very rich in organic matter and their fertility is very high. It is quietly suitable for irrigation
2. Sodic water or alkali water: Sodic water containing higher residual sodium carbonate and, unfit for irrigation.
3. Saline water: Saline water is that water which is usually contains high amount of soluble salts (Chloride and sulfate type) and sodium adsorption ratio.
4. Industrial wastes water: The direct use of industrial effluent water in agriculture may raise problem like salinity, alkalinity and /or toxicity in the soil as a result of long-term irrigation with such waste water. Ex: Sugar factory effluent, Paper mill effluent, Distillery effluent, Chemical effluent, Refinery effluent.

Management Practices for Efficient Utilization of Saline Irrigation Water

1. Crop management- selection of crops - a) Tolerant crops, mono-cropping, crop cultivars.
2. Water management - a) frequent saline irrigation, drip and sprinkler irrigation system.
3. Conjunctive Use of Saline and Canal Water
4. Nutrient management- a) Additional doses of nitrogenous fertilizers are recommended to compensate for volatilization losses.
1. b) Soils irrigated with chloride rich water respond to higher phosphate application, because the chloride ions reduce availability of soil phosphorus to plants.
5. FYM and organic amendments
    a) Influences leaching of salts and reduce their accumulation in the root zone. Reducing the volatilization losses and enhancing the nitrogen-use efficiency.
    b) Retention of nutrients in organic forms for longer periods also guards against leaching and other losses.
6. Cultural practices a) Using higher seed rate. b) Post sowing irrigation. c) For large seeded crop seed can be planted in furrow.
7. Tree Species and Medicinal Plants Management Options for use of Alkali Water Crop selection: In low annual rainfall areas (< 400 mm) - fields fallow during kharif season. During rabi, only tolerant and semi-tolerant crops such as barley, wheat and mustard should be grown. For areas having rainfall >400 mm per annum, jowar-wheat, guar-wheat, bajra -wheat and cotton- wheat rotations can be practiced. For areas having annual rainfall >600 mm in the rice-wheat belt of alluvial plains, rice-wheat, rice-mustard, sorghum- mustard, and dhaincha (green manure) - wheat rotations can be practiced with gypsum application.

Use of amendments

Method and time of gypsum application Gypsum are normally applied by broadcasting and then incorporated with the soil by disking or ploughing. Gypsum mixed with the surface 15 cm was more effective in the removal of exchangeable sodium, than gypsum applied on the soil surface. The best time for application of gypsum is after the harvest of rabi crops, preferably in the month of May or June, if some rain has occurred.

Irrigation management

Conjunctive use of alkali and canal water also helps in bringing more area under protective irrigation and also in controlling rise in ground water table and associated problems. Canal water should preferably be applied during initial stages including pre-sowing irrigation to boost establishment of crops. The mobilization of Ca2+ during decomposition of organic materials, the quantity of gypsum required for controlling the harmful effects of sodic water irrigation can be considerably decreased. Nutrient management: Application of 25%

extra nitrogen is needed as compared to the normal conditions. Zinc sulphate @ 25 kg per ha should be added, particularly for the rabi crops. Phosphorus, potassium and other limiting nutrients may also be applied on the basis of soil test valu

CONCLUSION

- ✓ Irrigation water quality has a significant role in crop production and has profound impacts on physical, chemical and biological properties of soil.
- ✓ Salinity can be reduced by appropriate leaching with suitable irrigation water is an effective tool to manage soils of arid region.
- ✓ Application of gypsum can improve physical and chemical soil properties.
- ✓ Chemical and organic amendments in conjunction with judicious fertilizer use is the most effective strategy for maintaining soil productivity, prevent nutrient losses from the root zone and sustaining crop yields with poor quality water irrigation.

REFERENCES

Central Ground Water Board (2008). Ministry of Water Resources, Government of India. Ayers,

R.S. and Westcot, D.W. (1985). Water Quality for Agriculture, FAO Irrigation and Rome.

Heat stress mitigation: A key for future wheat production

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Global warming as a result of climate change cause heat stress, which is a major determinant of wheat productivity. Ten years ago, India's yield of wheat was increasing. At present, it is stagnant. It has been predicted by intergovernmental panel on climate change (IPCC) that, by 2050, average temperatures will be 5 per cent higher than present. This is a wake-up call for the South Asian countries including India. According to Directorate of Economics and Statistics, India, Wheat production of India is 97.4 million tonnes from 30.2 million hectares area with productivity of 3.2 tonnes per hectare during 2016-17. It accounts for about 36 per cent of country's total food grain production as per the third advance estimate. The country further required 100 million tonnes of wheat by the year 2030 to fulfill the demands of the growing population which poses a major challenge in the background of prevailing climatic conditions. Wheat production in India is less than its potential mainly due to several factors including socio economic and management factor as well as crop exposure to various biotic and abiotic stresses. Among various abiotic stresses Indian wheat cultivation faces major future threat is heat stress results from global warming and strongly affects wheat productivity. Current estimate indicates that in India 10 mha area of the total area under wheat cultivation in India prone to terminal heat stress. In southern zone, India faces heat stress during the early stages of its life but in North West India which is main wheat growing area (wheat bowl of India), experiences the heat stress during the grain filling period. Higher temperature during the grain filling, also called as terminal heat stress is one of the major constraints in decreasing productivity of wheat in tropical countries including India. To meet the food demand of ever growing population, there is need to reduce yield losses due to heat stress.

CURRENT AND FUTURE POTENTIAL WHEAT MEGA-ENVIRONMENTS

Series of wheat"mega-environments" (MEs) delineated by CIMMYT (Fig1). There are two main wheat environments in the Indo-Ganges: mega-environment 1 is a favorable, irrigated, low rainfall environment with high yield potential whereas mega-environment 5

is a heat-stressed environment (early and late season heat stress) with available irrigation but in its humid and hot areas.

CURRENT FUTURE (2050)

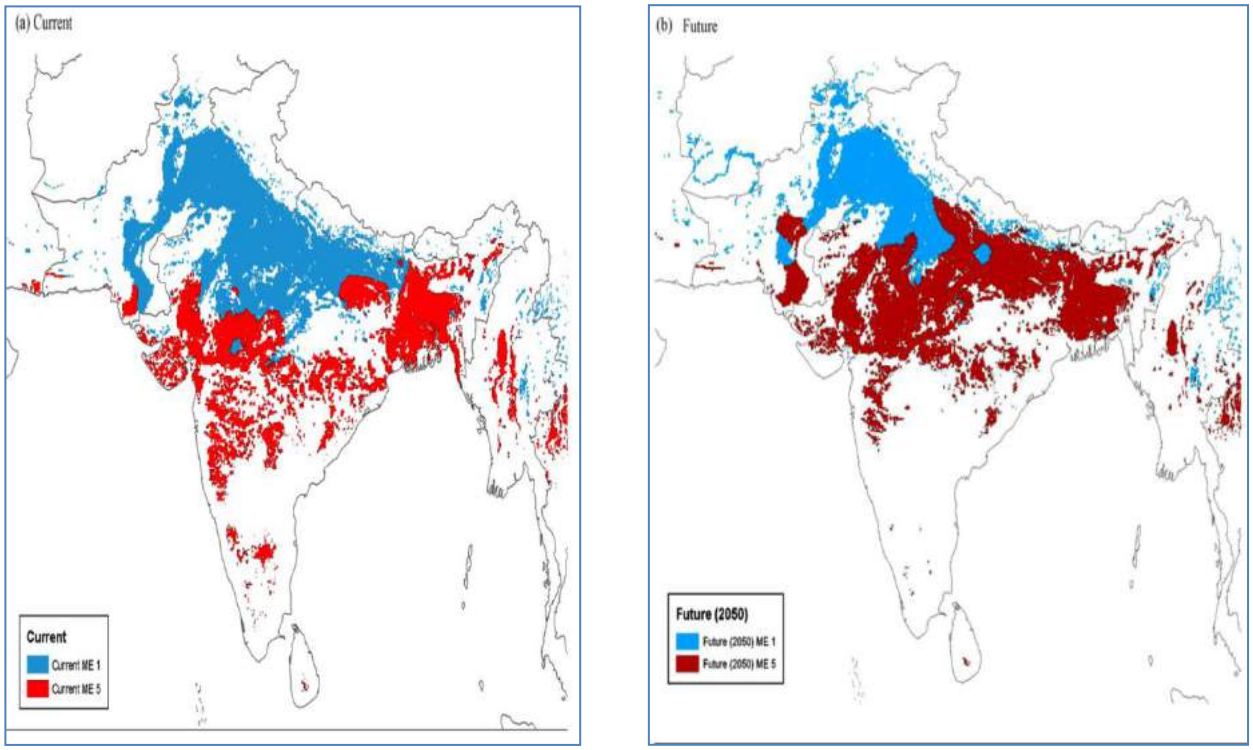

Fig1: by 2050, as a result of possible climate shifts in the Indo-Gangetic Plains (IGPs) – currently part of the favorable, high potential, irrigated, low rainfall mega-environment1 (Blue colour), which accounts for 15% of global wheat production – as much as 51% of its area might be reclassified as a heat-stressed, irrigated, short-season production mega-environment 5 (Red colour). This shift would also represent a significant reduction in wheat yields, unless appropriate cultivars and crop management practices were offered to and adopted by farmers.

Heat stress

Heat stress is defined as the rise in temperature beyond a threshold level for a period of time sufficient to cause irreversible damage to plant growth and development. For instance when temperature is 5°C above 20°C reduced the grain filling duration (Terminal heat stress) by 12 days in wheat which cause greater reduction in wheat grain yield.

CAUSE OF HEAT STRESS IN WHEAT:

Current estimate indicates that in India around 13.5 mha of wheat is heat stressed. Ten million hectare area of the total area under wheat cultivation in India prone to terminal heat stress.There are two major cause of heat stress in wheat are as following-

a) Global warming:

According to a report of the Intergovernmental Panel on Climatic Change (IPCC), global mean temperature will rise 0.3°C per decade and reaching to approximately 1 and 3°C above the present value by years 2025 and 2100, respectively, and leading to global warming. Rising temperatures due to increased levels of greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), ozone (O_3), nitrous oxide (N_2O) and chlorofluoro carbons (CFCs) which may lead to altered geographical distribution and growing season of agricultural crops by allowing the threshold temperature for the start of the season and crop maturity to reach earlier.

b) Delayed sowing:

In major wheat growing zone of India particularly north-western plain zone compulsion of various cropping systems such as long duration variety of rice-wheat, cotton-wheat, sugarcane-wheat, potato-wheat, vegetable pea-wheat, etc. In these cropping systems, late harvest of preceding crops makes wheat cultivation delayed which expose wheat plant to heat stress during early vegetative and reproductive stage. It has been reported that delay in sowing beyond 15 December, resulted in yield reduction of 50 kg grain/day/ha.

Effect of heat stress on wheat

Heat stress causes various changes in plant at morphological, phenological, physiological and molecular level (Fig 2).these responses result drastic reduction in economic yield of wheat plant. However some changes like osmotic adjustments, closing of stomata, production of heat shock protein may result in increase tolerance to heat stress.

appropriate management practices followed by farmer to mitigate its adverse effect of heat stress. There are different management practices in wheat which are as following:

1. **Relay seeding for timely planting:** Date of planting play an important role in productivity of wheat because it avoid expose of wheat plant to heat stress environment during vegetative and reproductive stage. Optimum time of sowing of wheat is first fortnight of November at which all the yield attributes and grain yield of wheat performed better than sowing on beyond 25 November. As a result delay vacant of field by preceeding crop, it is difficult to go for timely sowing of wheat. In such situation we have to go for adoption of some improved management practices like relay seeding one of an innovative technology for enhancing productivity and profitability of wheat.

A two-wheel self propelled relay seeder was developed in 2008 by the Cereal Systems initiative for South Asia (CSISA)-CIMMYT team in collaboration with Amar Agro Industries ,Ludhiana, India (Fig 3). The relay seeder has the capability of opening

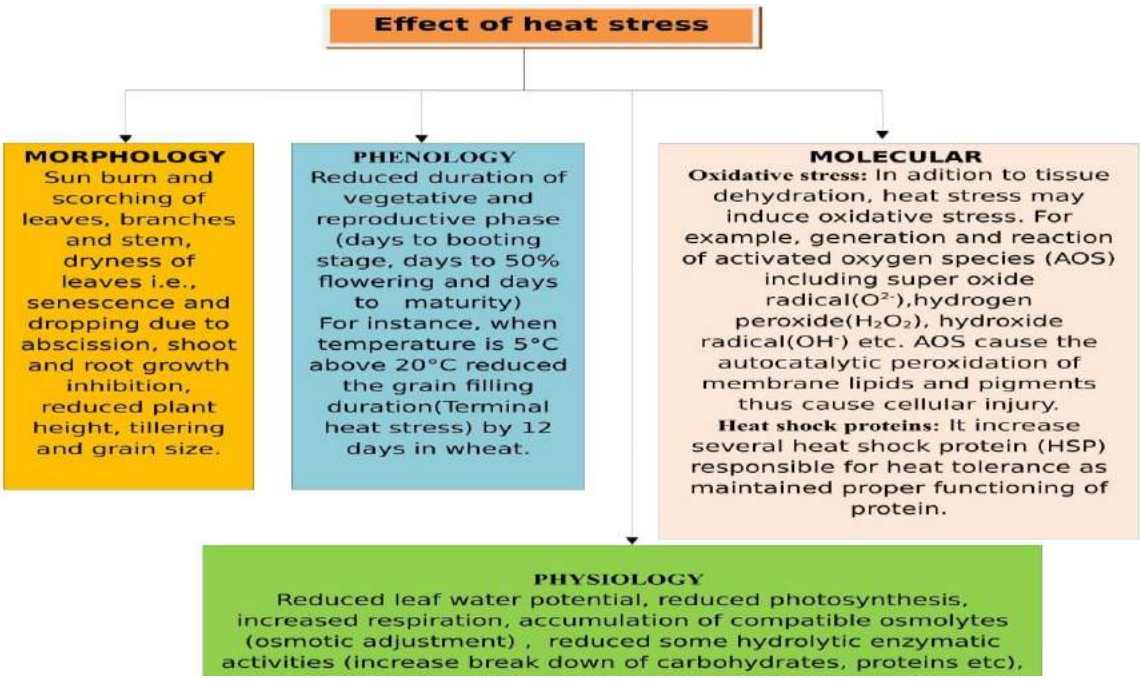

Fig 2. Effect of heat stress on wheat plant at morphological, phenological, physiological and molecular level

narrow strip (25-30mm) using straight steel blades mounted on a rotor in front of zero till furrow opener to facilitate placement of seed and fertilizer and help in keeping the machine in straight position.

Heat stress mitigation practices

Heat stress responsible for significant reduction in wheat yield as rise in temperature reduces grain yield. It increases potential to food insecurity and poverty unless the

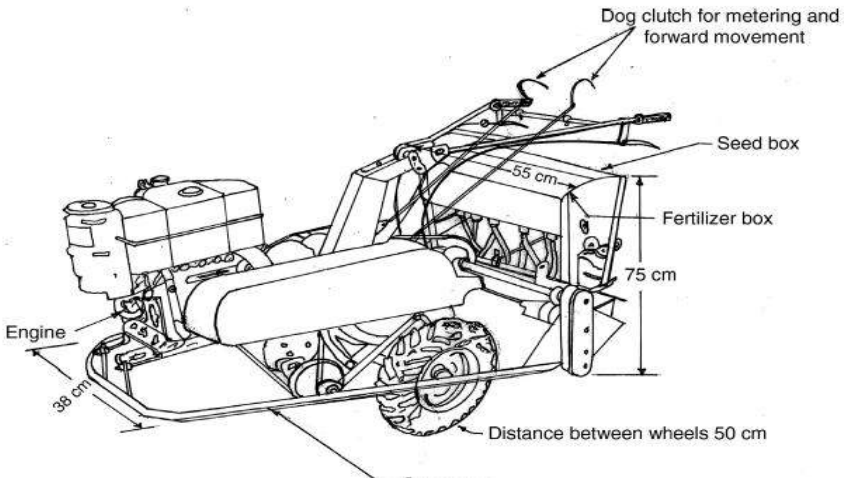

Fig 3. Line sketch of a two-wheel drive self-propelled relay seeder

This self-propelled walk-behind seeder can seed three rows at 18-cm spacing between in two row of standing crop like cotton along with fertilizer application, and can be easily controlled by an operator. Relay seeding of wheat using self propelled relay seeder in the cotton-wheat system of north-western india showed increase yield attributes and grain yield of wheat due to early sowing of wheat by about 30 days under relay seeding compared with conventional planting after cotton harvest.

2. **Cultivar choices:** We must go for selection of such type of cultivar which can withstand in heat stress environment i.e., Heat tolerant cultivars like DBW 14, HD 2864, Raj 4083, WH 1021, HD 3040, DBW 71 etc. Recently, the variety DBW 71, has been developed by the Crop Improvement division of the Directorate of Wheat Research, Karnal for commercial cultivation under irrigated, late sown conditions of the North Western Plains Zone (NWPZ) of the country, especially for farmers of western UP and other parts of NWPZ where sugarcane- wheat rotation is followed.

3. **Zero tillage and stubble retention:** High temperature mainly increases the transpiration of the plant. So the plants do not suffer from the heat stress as long as they meet the demand of increased transpiration. Thus sufficient availability of moisture in the field is important to mitigate the adverse impact of high temperature. Sufficient available soil moisture content which can be ensured by irrigation or by stubble retention. These practices reduce unproductive loss of water, storage and available of water to plant for longer period up to maturity. There is cooling effect during grain filling period due to water available for transpiration, mitigate terminal heat stress (Fig 4).

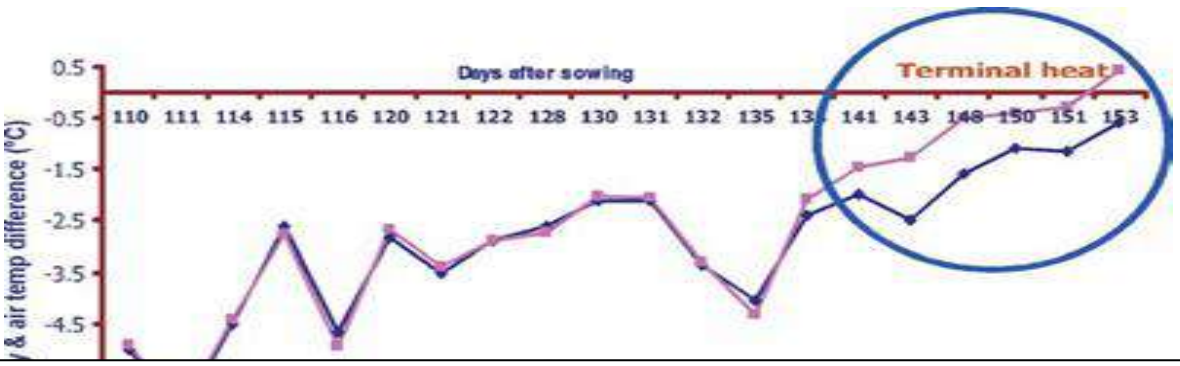

Fig 4: Effect of surface residue retention (mulch) in zero tillage on canopy temperature in wheat at reproductive, grain filling and maturity stages (110 to 153 DAS) **(Source: Jat *et al*., 2009)**

Happy seeder: The use of new-generation planters (Happy seeder) will lead to wider adoption of conservation agriculture. The Happy seeder works well for direct drilling in standing as well as loose residues, provided the residues are spread uniformly (Fig 5).

Fig 5. Happy seeder sowing wheat into rice residue after uniform distribution of residue

4. **Seed invigoration:** Primed seeds are better able to complete the process of germination within a short period and cope with environmental stresses. This results in uniformed stand establishment and enables the crop to complete other phenological events in the crop ontogeny well in time. Seed invigoration done by various methods viz., hydropriming, osmohardening with inorganic salt and other chemicals, hormopriming results to improve seed germination rate, seedling vigour and improve uniformity of seedling emergence by controlling the water available in the seed.

5. **Foliar spray of nutrients and growth regulators:** Foliar application of nutrients and plant growth regulators such as potassium, calcium, zinc, arginine, 1- MCP (1-Methylcyclopropene) may help to alleviate the adverse effect of heat stress. Especially post flowering foliar application of various nutrients give encouraging result. Foliar application of Calcium (Ca++) helps to protect the photosynthetic system of wheat leaves from oxidative damage induced by the heat stress thereby caused tolerance to heat stress. Potassium plays an important role in carbohydrate formation, maintaining water balance in leaves and regulates stomata closing, which have a direct effect on stress resistance of the plant and its water use efficiency, resulted in producing maximum yield and yield attributes. Also, spray of zinc increased the growth and yield attributes under heat stress conditions as it provides thermotolerance to the

photosynthetic apparatus of wheat. This may also be attributed to the increased activity of superoxide dismutase which helps in maintaining membrane thermostability by scavenging the free radicals. Foliar spray of 1- MCP (1-Methylcyclopropene a growth regulator) increases the suppression of the action of stress induced ethylene during heat stress.

CONCLUSION

While recognizing the fact that there is availability of heat tolerant varieties, stress should be laid to do research on different technologies compatible for heat stress environment such as conservation agriculture, seed invigoration, foliar feeding etc as research on these aspect is inadequate in different environments. Simultaneously farmers also need to be educated about available technologies to tackle heat stress.

REFERENCES

Butter,G.S., Sidhu,H.S., Singh,V., Jat,M.L., Gupta,R., Singh,Y. and Singh,B. 2012. Relay planting of wheat in cotton: An innovative technology for enhancing productivity and profitability of wheat in cotton-wheat production system of south Asia. Expl agric. Volume 49(1),pp,19-30.

Ortiz, R., Sayre, K. D., Govaerts, B., Gupta, R., Subbarao, G.V., Ban, T. and Reynolds, M. 2008.Climate change: Can wheat beat the heat? Agriculture, Ecosystems & Environment 126(1): 46-58.

Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, GOI,3rd_Adv_Estimates 2016-17.

Exploration and future potential of Faba bean (*Vicia faba L.*) for nourishment and wellbeing

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Faba bean (*Vicia faba* L.) is third most important food grain legume, after soybean and pea in area and production. It is a major food legume in northern Africa, china and Europe. It is a good source of lysine rich proteins and also a strategic crop due to its income contribution to the farmers and its significance in the intensification of wheat-based system. The broad bean is also known by other names around the world such as the fava bean, field bean, bell bean, horse bean or tic bean**.** In hindi it is known as *Kala matar* and *Bakala* as well. It was originated in Eurasia, and archaeological evidence indicates it was known to various ancient Western civilizations. The faba bean seed has high protein content (25%) and has played a key role in human nutrition, being used in the green, immature state or dried and stored for future use. A cool-season plant, the faba bean does not thrive in hot and dry summers. The optimal temperature for plant growth is 15-20°C, especially during the reproductive phases of flower and pod development. Each pod contains 3-8 beans. It enhances soil fertility by virtue of its nitrogen fixation properties. It also tolerates acidic soil (5.5-9.0) and water logging better than other grain legumes. Faba bean is tolerant to frost and it is better compared to other grain legumes in frost tolerance. The crop requires an average annual rainfall of 400 mm or areas with irrigation. There have been growing instances of plant diseases and weed infestation due to rising temperatures and changing precipitation patterns. High costs and limited availability of quality seeds accompanied by low marketable prices for faba bean contributes to its low production.

Description

It is an erect plant with stout stems reaching upto1.8 m. The leaves are 10–25 cm long, pinnate with 2–7 leaflets, and of a distinct glaucous grey-green color. The flowers are 1–2.5 cm long, with five petals, the standard, wing and keel petal white, but wing petals also have a black spot. Crimson-flowered broad beans also exist but it is rare. The flowers have

a strong and sweet scent and it is attractive to bees and other pollinators. The fruit is a broad, leathery pod, green maturing to blackish-brown, with a densely downy surface; in the wild species, the pods are 5–10 cm long and 1 cm diameter, but many modern cultivars developed for food use have pods 15–25 cm long and 2–3 cm thick.

PLANT RAISING & ESTABLISHMENT

Faba bean is an annual herb growing to a height of 0.3 to 2 m tall. Broad bean seeds should be sown at 6-10cm below the surface, with a narrow row spacing of 25cm. The seed rate is 160Kg/ha. The soil pH should be 6.5 - 7.00 to ensure maximum nitrogen fixation as well as good supplies of calcium and magnesium. The plant completes its lifecycle 88 to 99 days. Brassica crops are also a good choice to follow broad beans.

Crop management

More than 70 insect species is known to infest faba bean worldwide. Out of 70 insects black bean aphid, *Aphis craccivora* and *Acyrthosiphon pisum* is a key pest, as it feeds on phloem and transmits many viral diseases. It infests from the apical growing tips to green pods. Severe infestations can significantly reduce yields, and cause pod discoloration and reduce their marketability. Dense planting, wet weather and water logging favours incidence of chocolate spot and aschochyta. Faba bean rust is a fungal pathogen commonly affecting broad bean plants at maturity, causing small orange dots with yellow halos on the leaves, which may merge to form an orange lawn on both leaf surfaces. Beans are also attacked by chocolate spot fungus that reduces the yield.

NOURISHMENT FACTORS FOUND IN FABA BEAN

Broad beans are extremely nutritious, containing large amounts of potassium and phosphorus, as well as vitamins, particularly vitamin A. The green pods contain 9% protein and 18% carbohydrates.

Table.1. Mineral and vitamin content of Faba bean

Minerals	Amount	% DV
Iron, Fe	1.5 mg	18.75%
Manganese, Mn	0.261 mg	11.35%
Phosphorus, P	73 mg	10.43%
Magnesium, Mg	31 mg	7.38%
Copper, Cu	0.06 mg	6.67%
Zinc, Zn	0.47 mg	4.27%
Potassium, K	193 mg	4.11%

Sodium, Na	41 mg	2.73%
Selenium, Se	1 µg	1.82%
Calcium, Ca	18 mg	1.80%
Vitamins	**Amount**	**% DV**
Water soluble Vitamins		
Vitamin B9 (Folate, Folic acid)	58 µg	14.50%
Vitamin B1 (Thiamin)	0.128 mg	10.67%
Vitamin B3 (Niacin)	1.2 mg	7.50%
Vitamin B2 (Riboflavin)	0.09 mg	6.92%
Vitamin B6 (Pyridoxine)	0.029 mg	2.23%
Vitamin B5 (Pantothenic acid)	0.066 mg	1.32%
Vitamin C (Ascorbic acid)	19.8 mg	22.00%
Fat soluble Vitamins		
Vitamin A	14 µg	2.00%

Table.2. Lipid content of faba bean

Lipids	Amount	% DV
Fatty acids, total saturated	0.142 g	0.22%
Fatty acids, total polyunsaturated	0.303 g	1.78%
Palmitic acid 16:00 (Hexadecanoic acid)	0.121 g	N/D
Stearic acid 18:00 (Octadecanoic acid)	0.02 g	N/D
Fatty acids, total monounsaturated	0.02 g	N/D
Oleic acid 18:1 (octadecenoic acid)	0.02 g	N/D
Linoleic acid 18:2 (octadecadienoic acid)	0.121 g	N/D
Linolenic acid 18:3 (Octadecatrienoic acid)	0.182 g	N/D

Table.3. Aminoacid content in Faba bean

Aminoacids	**Amount**	**% DV**
Isoleucine	0.215 g	12.86%
Valine	0.235 g	11.13%
Tryptophan	0.048 g	10.91%
Threonine	0.178 g	10.11%
Leucine	0.37 g	10.01%
Lysine	0.313 g	9.36%
Histidine	0.115 g	9.33%
Phenylalanine	0.195 g	6.71%
Methionine	0.037 g	2.21%
Cystine	0.066 g	N/D
Tyrosine	0.168 g	N/D
Arginine	0.397 g	N/D
Alanine	0.195 g	N/D
Aspartic acid	0.541 g	N/D
Glutamic acid	0.733 g	N/D
Glycine	0.197 g	N/D
Proline	0.216 g	N/D
Serine	0.21 g	N/D
Flavonoids	**Amount**	**% DV**
(+)-Catechin	8.2 mg	N/D
(-)-Epigallocatechin	4.6 mg	N/D
(-)-Epicatechin	7.8 mg	N/D

SOURCES OF HEALTH BENEFITS

Broad beans are rich in protein and energy as in any other beans and lentils. Hundred grams of beans provide 341 calories. Besides, they also provide plentiful of health-

benefiting antioxidants, vitamins, minerals, and plant sterols. The beans are a very rich source of dietary fibre (66% per100g RDA) which acts as a bulk laxative. Dietary fibre helps to protect the colon mucosa by decreasing its exposure time to toxic substances as well as by binding to cancer-causing chemicals in the colon. Dietary fibre has also been shown to reduce blood cholesterol levels by decreasing re-absorption of cholesterol binding bile acids in the colon. Broad beans are rich in phytonutrients such as isoflavone and plant sterols such as genistein, daidzein and ß-sitosterol respectively. The isoflavone have been found to prevent breast cancer in laboratory animals while phytosterols lower cholesterol levels in the body.

Faba beans contain 3,4-Dihydroxyphenylalanine (Levo-dopamine or L-dopa), a precursor of neuro-chemicals in the brain such as dopamine, epinephrine and nor-epinephrine. In the brain, dopamine is associated with the smooth, coordinated functioning of body movements. Thus, consumption of adequate amounts of fava beans in the everyday diet may help prevent Parkinson's disease and dopamine-responsive dystonia disorders. Fresh faba beans are an excellent source of folates (423 µg/ 100 g). Folate along with vitamin B-12 is one of the essential components of DNA synthesis and cell division. Adequate folate in the diet around conception, and during pregnancy may help prevent neural-tube defects in the newborn baby. They also contain good amounts of vitamin-B6 (pyridoxine), thiamin (vitamin B-1), riboflavin and niacin. These vitamins function as coenzymes in cellular metabolism of carbohydrate, protein, and fat. Besides, broad beans are one of the finest sources of minerals like iron, copper, manganese, calcium and magnesium. Faba is one of the highest plant sources of potassium. Potassium electrolyte is an integral component of cell and body fluids. It helps counter pressing effects of sodium on heart and blood pressure. Young, tender, faba leaves or top greens and shoots of faba plant are also found favor in the kitchen as spring season delicacies for their incredibly nutritious values.

PHARMACOLOGICAL PROPERTIES OF FABA BEAN

Faba beans being rich in vitamin B, helps in the prevention of heart disease. Researchers in Japan found that eating more foods containing vitamin B may reduce the risk of heart failure in men and lowers the risk of death from stroke and heart disease for women. In addition, these beans are rich in plant sterols and phytonutrients, which have been shown to have a direct correlation with health promotion and disease prevention. Proteins are part of every cell, tissue, and organ in our bodies. These proteins are always in the process of being broken down and replaced. One cup of beans contains 12.9 g of protein, which is 26% of the recommended daily value. The amino acids phenylalanine, tyrosine, tryptophan, and methionine are helpful in treating depression. These beans contain L-dopa, a precursor of neurochemicals in the brain such as dopamine, norepinephrine, and epinephrine. Faba beans, being rich in dopamine, can do wonders in improving mood and help in alleviating

depressive conditions. Dopamine in the brain is linked to the smooth functioning of body movements. Thus, consumption of adequate amounts of fava beans in daily diet may help prevent Parkinson's disease and dopamine-responsive dystonia disorders. In a study reported by the Department of Neurology, Israel established that *Vicia faba* ingestion produces a substantial increase in L-dopa plasma levels.

Copper is the 3rd most prevalent mineral within the physical body, however, it cannot be produced by the body itself and must be obtained through nutrition. This mineral is essential for bone strength, infant growth, iron transport, white and red blood cell maturation, glucose and cholesterol metabolism, brain development, and heart muscle contraction. Furthermore, it is also known to help in the production of new cells and enhance your immune system. A deficiency in this mineral may lead to osteoporosis, an increased risk of infection, compromised growth, and impaired neurological function. One cup of these beans contains 49 percent of the daily recommended value of copper.

Manganese, a trace mineral which is present in the human body in very small amounts, is an active component of the enzyme manganese superoxide dismutase, that is required for the proper absorption of nutrients, functioning of enzymes, development of bones in the body and wound healing. More importantly, manganese can help reduce bone loss, particularly in older and sedentary women who are more inclined to bone fractures. One cup of these beans contains 31 percent of the daily recommended value of manganese. They are a great weight loss food as they are low in calories, but high in dietary fiber. One cup of boiled broad beans contains just 187 calories, but they provide 36 percent of your daily fiber requirement.

DISADVANTAGES OF FAVISM:

Unlike most legumes faba bean also contains raffinose series oligosaccharides, phytates, lectins, protease inhibitors and tannins. However, the average trypsin/chymotrypsin inhibitor level in faba bean varieties is 10% of levels in soybean. Raw faba beans contain the alkaloids – convicine and vicine, which can induce haemolytic anaemia in patients with the hereditary condition glucose-6-phosphate dehydrogenase deficiency. G6PD – Glucose-6-phosphate dehydrogenase is a cytoplasmic enzyme that is distributed in all cells. The symptoms are vomiting, bloody urine, dizziness, or even jaundice. This condition is called favism, occurring on the basis of a congenital defect and should be treated in time. Physician can perform a blood test for G6PD to determine whether you are at risk. Broad beans are rich in thyamine, hence should be avoided by those taking monoamine oxidase inhibitors. Also, the plant contains levodopa, which interferes with your body's ability to metabolize vitamin B6. The high amounts of Levo-dopa contained in these beans can result in a vitamin B6 deficiency. These antinutritional factors limit its expansion as a food grain legume.

EXPLORATION AND FUTURE POTENTIAL ON FABA BEAN

Keeping the tremendous pharmacological activities, *fava bean* may be utilized to alleviate the symptoms of variety of diseases as evident from the literature. Faba bean has numerous medical applications which can be developed as a natural medicine for clinical research. The availability and cultivation of faba bean in India is less which makes it for further clinical research.

Genetic resources and variety of faba bean

The largest gene bank collection of faba bean is held by ICARDA (>9000 germplasms), Australian Grains Gene bank, The Leibniz Institute of Plant Genetics and Crop Plant Research in Germany and N.I.Vavilov Research Institute of Plant Industry in Russia.

CONCLUSION

Faba bean is a sustainable grain legume crop often referred to as "king of biological nitrogen fixation". The faba bean is one of food grain legume rich in L-dopa and hence can be used in molecular pharming. The faba bean by virtue of it's of pharmacological properties used in treatment of parkinsons disease is a highly nutritious grain legume. It is a valuable source of lysine rich proteins. By reducing antinutritional elements such as vicine and convicine content especially the acceptability among the humans will increase drastically. Also efforts have to be taken to develop varieties possessing seeds with low tannins, cyanogens, favogens, oligosachhride and lectin. As it is a cold hardy crop and grown as rainfed crop, it is having potential to expand in *Rabi* season provided the antinutritional factors were reduced by breeding or molecular breeding approaches.

Goat Nutrition

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Goat is an excellent browser by nature which feeds leaves and soft shoots of high growing generally woody plants such as shrubs. Goats belong to the class of small ruminants which has four chambered stomach namely rumen, reticulum, omasum and abomasum. Rumen is the largest among them. Goats are able to digest large amount of roughages with the help of bacteria's and protozoa's present in its stomach. Goats are having better crude fibre digestibility compared to sheep. Food is broken down to volatile fatty acids in the stomach along with vitamins and amino acids. Goats need dry matter intake of about 5-6% of their body weight. Feed intake is influenced by body weight, dry matter present in the food taken, palatability and physiological state of the animal. Most important factors affecting the nutrient requirements of goat include the productivity of animal and the animal biotype. Weight of the animal, sex, maturity and body condition also affect the requirements.

ESSENTIAL NUTRIENTS

Essential nutrients include water, energy, protein, fat, vitamins and minerals. Water is the cheapest nutrient but the most essential one. Mature goats consume 3 to 6 litres of water every day. According to Giger – Reverden and Gihad (1991), the factors influencing water metabolism and free water intake in goats include dry matter intake (water intake is about 3 times dry matter intake), composition of feeds and especially their water, salt and mineral contents; taste factors, live weight, level of milk production (water required is 1.28 kg/kg of milk), physiological status (maintenance water intake is 107 g/kg0.75 for a dry and non-pregnant goat, 140 g/kg0.75 at mid-pregnancy and 165 g/kg0.75 at mid-lactation) and environmental factors. On hot days the water consumption may increase up to 9 litres. Salinity of water had a control over the feed intake of goats. Goats prefer saline water with up to 12,500 mg/l TDS compared with fresh water. Higher TDS in water results in lower feed intake. Goat shows higher tolerance of acceptance towards sweet and salt tastes compared to sour and bitter tastes.

Sugars, starch and cellulose are broken down to volatile fatty acids by rumen micro flora. Goat diet contains higher amount of cellulose compared to sugar and starch because of browsing nature. If the diet of goat contains higher amount of easily digestible carbohydrates it will lead to digestive problems. So it is better to have 12% crude fibre in

goat diet. Energy requirements for goats during different stages of life like growth, gestation and lactation vary. High energy is required at the time of late gestation and lactation. But the maintenance requirement remains the same for most of the goats. Various authors had recommended different values for maintenance requirement of goats. Rindsig (1977) had given maintenance energy requirement of lactating goats as 43.04 TDN g/kg $W^{0.75}$. Kurar and Mudgal (1980) had given value for dry goats as 34.55 TDN g/kg $W^{0.75}$.

Proteins are broken down to amino acids and got absorbed in the small intestine. Also proteins got degraded in the rumen by bacterial fermentation to form bacterial protein. Proteins are required for normal functions of the body like maintenance, growth, reproduction, lactation etc. Dietary protein requirements are higher for growth, reproduction and lactation. Percent protein requirement is lower for large animals compared to young ones but total protein requirement is high. Different protein sources influence amount of protein required in the diet. For maintenance of a mature animal a minimum of 7% crude protein is needed in the diet. Diets fortified with legumes and protein supplements are required for lactating, growing, sick animals. Internal parasites can be controlled to an extent by feeding slightly higher amounts of protein in the diet.

Fats can act as a source of energy when the animal is in extra need, but supplying fat in goat ration is not cost effective during commercial goat farming. Rumen can produce enough vitamin B complex but fat soluble vitamins like A, D, E and K should be supplied through the diet. Macro minerals like Ca, P, Mg, S, Na, K should be included in percentages and micro minerals like Fe, Cu, Co, Mn, Zn, Se had to be included in ppm quantities. Ca requirement is more for high producing goats. Legumes are good sources of Ca. P deficiency results in lower growth and appetite. Longer periods of P deficiency results in decline of milk production by about 50%. Ca, P ratio maintenance is an important factor. It should be maintained at around 2: 1 ratio. Alteration in this ratio results in urinary calculi. Mg deficiency is less common in grazing goats. Over consumption of salt results in poor appetite. Forages are rich in K, so a deficiency of K is rare in grazing goats. Fe deficiency is seen only in kids. I deficiency results in poor growth, reproductive ability and enlarged thyroid. Around 10 ppm of Zn in diet reduces risk of Zn deficiency. Cu deficiency causes anemia, poor growth and infertility. Cu deficiency in a diet may be caused by inadequate intake, a lowered Cu- Mo ratio, or excessive dietary S. Cu should be included in goat diet at about 10 – 80 ppm as goat had a tendency to become Cu deficient. Se (0.3 ppm) is another important trace mineral which helps in boosting immunity.

Rotational grazing is a method used in grazing goats for successful management of commercial goat rearing. This practice includes dividing pasture area into smaller regions and controlling goat movement to these smaller units across time. Normally grazing durations of 5-7 days were allowed for grazing of 10 - 50 goats/acre.

NUTRITION OF KIDS

Within 2-3 hrs after birth the kids should consume colostrum at a minimum rate of 10-20% of their body weight. Colostrum contains large quantities of vitamins and immunoglobulin's that improve the health and immunity. Moreover the colostrum absorption capacity of kids are very high during the first 24-36 hours of birth. In case of triplets extra colostrum had to be fed. Colostrum can be collected from does having dead kids and can be kept in deep freezer. No need to heat it up, just thaw and can be fed. Cow colostrum can also be fed to kids. Kids will start their grass feeding from about 15 days of age. Creep feed can be introduced at the same time. Creep feed can be fed up to age of 2-3 months. Creep feed should contain high protein (22%) for kid's rapid growth. Around 50-100g/animal/day can be fed.

FEEDING OF GOATS DURING DIFFERENT STAGES

Ideal thing to do is to allow the animal to graze for about 6-8 hours per day. Concentrate feed can be given at the rate of 100-200 g/animal/day. Protein content of concentrate feed should be about 16-18 percent. If the availability of pasture is adequate, then there is no need for concentrate supplementation. If the availability of pasture is less then there is need for supplementation of concentrate feed at around 200-300 g/animal/day. During pregnancy animal should be fed with good quality pasture (5 kg/animal/day). Animal also should be provided with concentrate mixture. High energy feed had to be given since 60% of fetal growth occurs in the last month of pregnancy. Light feed had to be provided during the day of kidding. Soon after kidding animal can be given with warm water. Laxative foods had to be introduced in the ration during the first few days. Lactating does can be fed with around 10 kg of fodder and 500g of concentrate feed per day.

REFERENCE

Giger-Reverdin, S., Gihad, E.A., 1991. Water metabolism and intake in goats. Chapter 4 in "Goat nutrition". Ed. Morand-Fehr, P pp.37-45.

Kurar, C.K. and Mudgal, V,D. 1980. Effect of plane of nutrition on the utilization of feed nutrients in dry beetal goats. Indian J, Dairy Sci, 33 : 276.

Rindsig, R. B. 1977. Practical dairy goat feeding. Dairy Goat Journal, Upper Darby, v. 55, n. 1, p. 12-19.

Alternative technologies used for Anatomy Education

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ABSTRACT

Use of animals for teaching is inevitable. Animals may be handled for anatomical demonstration, surgical procedure, experiments for various researches, pharmacology, physiology. To meet the purpose of learning and taking care of ethical issues in animals there is a need of an alternative way for teaching anatomy education which can stimulate students to conceptualize and develop easy understanding and learning of the topics. Earlier teaching of anatomy was thought to be "essential hands-on" that allowed students to engage all senses including the handling of instruments that allowed for the development of psychomotor skills, and the visualisation of structures. Visualisation in anatomy teaching is associated with a deep approach to learning. This approach is taken to next level by using various new techniques which have proven to be less traumatic to animals and have comparatively good shelf life.

INTRODUCTION

The term anatomy is originated from the Greek word, 'anatemnein' where *ana*, means "separate, apart from" and *temnein* means "to cut up, cut open".Whereas the meaning of the term anatomy is 'Dissection' in Latin.The traditional approach for teaching anatomy included use of dissection and large amount of cadavers but in due course of time the teaching and learning methods have evolved and changed. This includes use of various new technologies which have been launched in recent times to ease the understanding and learning of students. Such innovative technologies includes use of Veterinary anatomical term learning media, Surgical simulators, Visible Animal Project, Non-invasive methods such as Magnetic Resonance Imaging (MRI) and Computed Tomography (CT), 3D reconstruction of anatomical region of interest etc.These techniques use modern technology and virtual reconstructions for giving a realistic idea to the viewers.

The dissection of cadaver had been gold standard of anatomy teaching and learning for a long time. Dissection requires an enormous number of cadavers, which puts a lot of strain on any source.But the computer-assisted learning, simulation-based training, using

true-to plastic anatomical models, manikins, plastination are being used in recent times for both time and training costs advantages and to ensure healthy laboratory conditions.

One of the reason of importance of anatomy as a subject for the veterinary education is that the knowledge of the combination of all subsystems of the body is required by the physicians so as to understand if there is a pathology in any part of the body or not. Various drawings of the internal organs of animals as well as external images on the walls are found on historical tracing of anatomical teaching process.

Now-a-days the use of animals for teaching is minimized due to concern of suffering to the animals and more and more emphasis is given on the use of alternatives. Alternatives used for teaching and demonstration are durable, economical and does not involve killing or harming of living organisms. The alternatives become cost effective with due course of usage and time even if initially they are expensive. Few of the alternatives which are currently being used are discussed below.

PLASTINATION

It involves the infiltration of specimens with synthetic materials and makes them of high durability. The water and fat of the body are replaced by certain polymers such as silicone resins or epoxy polymers.This method is used for long term preservation of the biological tissues with completely visible surface. The plastinates obtained after plastination retain properties of the original sample and avoids the decay of the specimen.These can be remodeled if misused.

FLASH BASED MODULES

These are designed to enhance the learning ability of the students and hones their learning skills.These help to refresh the knowledge on interdisciplinary anatomical features. The main advantage of use of modular teaching will be decreased usage of formalin, phenol, glycerol which are otherwise used for embalming and for storage of specimens. Other advantage is reduction in number of cadavers used for dissection. Being electronic in nature they provide chance of continuous revision of the topic thus leading to more memorization amongst the students as well as be useful to the practitioners or surgeons before going for any surgical intervention or operation so as to minimize the chances of error.

MODELS

Anatomical models are a great educational tool to study and explain the internal and external structure of the body. It refers to a smaller or larger physical copy of any live animal or organ system. Such models offer a three dimensional view to the observer and gives a realistic idea about the location and structure of certain organs. They can be made up from multiple materials ranging from rubber, plastic, POP, fiber, wooden and cemented.

All of the models have advantage that they are resistant to wear and tear and can be used for teaching and demonstration purpose for a good amount of time.

MANIKINS

It refers to the virtual patient which resembles the animal/ patient and can be used in the teaching and demonstration of CPR, first aid, tracheal intubation etc. it is also known as dummy/ mannequin/ life sized-dolls.

SIMULATORS

In simulators the visual components of the procedure are reproduced by computer graphic techniques. There is use of 3D CT or MRI scans of the patient data to enhance the realism inmedical simulators whereas the other web based simulations and procedural simulations can be viewed by the help of standard web browsers.

CONCLUSION

Traditional methods need to be replaced by the new technologies for veterinary anatomy teaching by using Plastination, Flash based modules, models, manikins and simulators which not only take care of animal welfare issues but also not let the purpose of learning to diminish. These approaches are cost effective and aids in better learning. Thus the use of new technologies in the field of anatomy education can be summarized by stating that the four R's which comprise of Replacement, Reduction, Refinement and Rehabilitation should be used. Therefore,measures such as to minimize the number of animals used by altering the experimental design, reduction in the degree of experimental insult and substituting one species for another (replacing higher animals from the lower animals) should be taken.

Nutritional benefits and value added products of Ash gourd

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Ash gourd (*Benincasa hispida*) is a tender annual vine grown for its very large fruit. It belongs to family Cucurbitacae and genus *Benincasa* and is believed to have originated in Java. The immature ash gourd fruit is covered by thick white flesh and is fuzzy in appearance. It is also known as wax gourd as the fruit loses its hair and develops a waxy coating by maturity. The well matured ash gourd fruits are round, waxy, greyish in color and are about 8-12 cm in length and 3-5 kg in weight. Ash gourd also referred as winter melon is extensively *Ayurvedic* medicine because of its medicinal properties.

Nutritional Composition

Ash gourd contains moisture (96.50 per cent), protein (0.40 g/100g), fat (0.1g/100g), carbohydrates (1.9 g/100g), ascorbic acid (1mg/100g), fiber (0.80 g/100g), ash (0.39 g/100g), iron (0.8 mg), calcium (30 mg/100 g). Ash gourd exhibits low calorific value of 10 Kcal/ 100gm of edible portion (Musale *et al*. 2017).

Health benefits of Ash gourd: (Kapaleshwar and Kulkarni, 2014)

- Because of its low calorific value it is highly useful for diabetic and obese people. It prevents conversion of sugars into fat.
- Because of its antacid action/alkaline nature it regulates body pH and neutralize the acidity created in the stomach thereby aids in proper digestion
- It exhibits diuretic and laxative properties. It promotes fluid intake and urine output thereby detoxifying the body.

Processing of Ash gourd fruit

The cut opened fruits are highly perishable and being bigger in size, it is not possible to consume whole fruit in short span of time. The processing of ash gourd fruit into various value added products minimises post harvest losses providing benefits to the growers. At the same time the processed ash gourd products will provide nutritional and therapeutic benefits to the consumers. Some of the value added products from ash gourd are:

I. Petha

Petha is a dessert, rectangular or cylindrical in shape made from ash gourd vegetable termed as winter melon or white pumpkin. Its place of origin is Agra.

Flow chart for ash gourd "Petha" sweet manufacturing process

Mature Ash gourd
↓
Washing
↓
Cutting longitudinally into long piece
↓
Remove peel, seed and fluffy portion
↓
Pricking with stainless steel forks
↓
Cutting into suitable size
↓
Soaking in lime water (2 %) for 90- 100 minutes
↓
Thoroughly wash with running water (5-10 min)
↓
Dipping in chilled water (5-7°C for 60 minutes)
↓
Cooking of ash gourd slices in boiling water 100°C for 5 min)
↓
Boil in sugar syrup (68° Brix)
↓
Cooling in vessel
↓
Packaging in air tight containers

(Singh *et al*. 2011)

II. Indian heritage product (*Sandga*)

Ash gourd pulp in combination with pulses (bengal gram, green gram and black gram) is utilized in the preparation of a heritage product called *sandga*. It is a highly nutritious food having longer shelf life.

Flow sheet for preparation of Indian heritage product (*Sandga*)

Coarse grinding of pulses (Bengal gram, Green gram and Black gram)
↓
Mixing thoroughly in bowl
↓
Addition of Ash gourd pulp
↓

Addition of Spice mix (Chilli powder, turmeric powder, cumin seed, ajwain, sesame seed, coriander leaves, garlic/ ginger paste)

↓

Addition of sufficient amount of water

↓

Preparation of Dough

↓

Cutting dough into small pieces

↓

Spread for sun drying/ Cabinet drying

↓

Air Tight Packaging of product

↓

Storage

(Musale *et al*. 2017)

III. **Ash gourd *kulfi*:**

Flow chart for preparation of ash gourd pulp *kulfi*:

Selection of ash gourd fruits

↓

Washing and cutting of fruits into two halves

↓

Peel the fruit and separate seeds and fluffy portion

↓

Boil the desired portion in water till soft

↓

Drain out the excess water

↓

Grind the remaining in the grinder for uniform quality of pulp

↓

Add milk and sugar to the pulp (13 % by weight of milk)

↓

Cool and fill in the *kulfi* cones

↓

Freezing the cones at -20^{o}C for 4-6 hours.

(Dodake *et al.* 2015)

IV. Preparation of Ash gourd juice

Ash gourd

↓

Washing, cutting into cubes

↓

Removal of seed, skin and pith

↓

Blanching at 80°C for 3-4 minutes

↓

Cooling

↓

Homogenization

↓

Filtering through Muslin cloth

↓

Pasteurization (80°C, 20 minutes)

↓

Hot filling

↓

Crown Corking

↓

Labelling

↓

Storage

(Kapaleshwar, G. 2010)

V. **Kashi Halwa:**

Kashi halwa a sweet delicacy is popular product in India. It is prepared from ash gourd pulp by cooking grated gourd in sugar and *ghee* followed by addition of *khoa* in final stages. It has posses distinct gourd flavour blended with sweetness of sugar and flavor of *ghee* and *khoa*.

General flow diagram for preparation of *Kashi halwa*

Washing, peeling and pitting ash gourd

(Round variety, fully matured with wax coating)

↓

Cutting and grating of ash gourd

↓

Addition of Sugar and Ghee

↓

Cooking till semisolid consistency

(Evaporate free moisture until white crease in stirring appears)

↓

Addition of khoa

↓

Cool to room temperature

↓

Kashi Halwa

(Neelvrat, 2009)

CONCLUSION

Ash gourd (*Benincasa hisipida*) an annual vine produces large fleshy, succulent and densely hairy fruits. The less available processing techniques make it an underutilized crop. The immense nutritional and medicinal values of ash gourd necessitate its processing into various value added products. Furthermore exploitation of fruit into various value added products will minimize post harvest losses thereby providing remunerable returns to the growers.

REFERENCES

Dodake, S. R., Talekar, S. S. and Thombre B. M. (2015). Sensory properties of *kulfi* blended with ash guard pulp. *The International Journal of Tropical Agriculture*, 33 **(2)**: 313-316.

Kapaleshwar, G. (2010). Standardization and characterization of value added ash gourd. Thesis submitted to Dharwad university of agricultural sciences, Dharwad.

Kapaleshwar, G. and Kulkarni, U. N. (2014). Utility of ash gourd (*Benincasa hispida*) in Dharwad, Karnataka state. *International Journal of Farm Sciences*, 4(**4**): 205-211.

Musale, S. V., More, D. R. and Syed, I. H. (2017). Standardization of process for preparation of Indian heritage food *Sandga* using pulses and ash gourd. *Journal of Pharmacognosy and Phytochemistry*, **6**(5): 571-573.

Singh, S., Kumar, U. and Ashutosh Rai. A. (2011). Process optimization for the manufacture of *angoori petha*. *Journal of Food Science Technology*, 51(**5**): 892–899.

Neelvrat, (2009). Standardization of technology for production of *Kashi Halwa*. Thesis submitted to NDRI (Deemed university), Karnal.

Software in horse management

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Record keeping and financial management have come a long, long way in the past 20 years. Here's a look at several software programs designed especially for the equine world.

It's no secret that there's lots of record keeping involved in owning and running a horse facility. This encompasses horse health records, lesson schedules, tack care, horse purchase and sales, breeding, showing, bookkeeping, invoicing, and more. The good news is that there is a variety of software options that help keep your records in one place and ultimately save your time. Time is money, and in this economy, improving efficiency is on everyone's mind.

1. The Jockey Club Information Systems

The Jockey Club Information Systems 'Horse Farm Management System (HFMS) is a management tool designed to assist farm personnel at all levels in managing information for more efficient day to day operations.

Information such as Horse Inventory, Breeding and Health Record Information, Billing and Accounts Receivable Information for Board and much more are easily accessed.

Software can*:*

- Store detailed information on all horses (Owners, Sire, Dam, etc)
- Store booking, breeding, and foaling information about all broodmares for each year
- Maintain health and teasing records
- Automatically calculate board and allocate charges to the appropriate owner(s) for billing and accounts receivable

2. Ranch Manager : Equine Edition Software

Use Ranch Manager Equine software to improve your equine record keeping (horse/donkey) for your ranching operation. Horse record keeping features include adding horse pictures, detailed health and maintenance records, recording income and expenses, picture pedigree, recording horse traits and more. Ranch Manager allows you to record breeding in a handy breeding chart where you have a complete year's worth of breeding data on one easy to use screen. Track heat cycles, foaling dates, and other breeding data. Ranch Manager tracks horse identification and important events such as breeding, show and training records, veterinary care, worming, hoof trimming, dental checkups, and feedings. Ranch Manager is designed to maintain a complete history of your horse operation. Ranch Manager Software for your desktop is available in Windows and Macintosh platforms, including Windows 10 and Mac OS X.

3. Triple Crown: by ImproMed

Ambulatory Applications

Triple Crown Equine Practice Management Software operates easily in a hospital setting or in ambulatory Practices

Treatment Plans

Specifically designed for equine patients to quickly “check the boxes” to administer treatments, which updates the medical record and places appropriate charges on the client invoice. This saves time and eliminates missed charges.

Efficient use of data

Enter data once and your information instantly populates throughout the entire system. Within a matter of seconds, every networked computer will show the same information.

4. TLore: by TLore.net

TLore is a well organized, extremely detailed website which can be customized to individual stables, and yet it is easy to use and maintain. Use this site as a tool to save your valuable time. Through the use of the global Internet, keep your clients and associates instantly informed.

TLore is a leading management system among trainers, owners, racing partnerships and training centers since 2003.

5. **Horse Count:** by animalcount BV

Horsecount is a management system and a market & meeting place for horse-keepers on the web and mobile. It is your one stop resource, offering more features, more access, awareness, and opportunities for you and your horses than any other!

Horsecount is also an online community of people just like you who share a passion for horses, and where you can share stories, photos and pedigrees

6. **Paddock Pro:** by Alua Software

Paddock Pro equine management software helps horse farms organize and make more efficient use of time. Paddock Pro handles all of your horse business software needs such as board, vet, farrier, breeding, sales prep and billing in a fast, accurate, and easy to use system. Streamline your processes and increase your efficiency.

7. **Crio Online:** by CRIO Equine Software

Breeding Facilities, Horse Trainers, Breeders, Horse Ranchs and used by veterinarians in those equine busines. Affordable online equine management system to automate breeding sales and animal locations etc.

8. **EquineGenie:** by GenieCo

Integrated Horse Business Management Software. Includes Horse Care and Management, Business Operations with inventory management, Customer Care and Support with invoicing and billing management, Financial Management with financial analysis and accounting, Administrative Support that includes Address Book, Appointment and Contact Management, Business Calendars, Task management, Automatic Reminders for horse care, supply reorder, financial, appointments, etc.

9. **Stable Manager:** by Lazy Bayou

Horse boarding, stable management and billing system.

10. **HorseWorks:** by Equivision

Horse management software with record keeping, veterinary, farrier, breeding and financial data tracking.

11. Ardex Premier: by Ardex Technology

Ardex Technology produces horse racing software, horse breeding software, horse management software and vet solutions.

12. EquineM: by EquineM

Digital stable management is an online software solution that enables you to run your stable more efficiently.

13. HorseLogs.com: by Equine Data Services

Online Horse Management Software. Easily and accurately record basic horse records online from anywhere.

14. HiMark$: by HiMark$

Income management, horse health management, breeding management, competition and training management.

15. MyBarn: by Collective BE

MyBarn is for anyone, ranging from horses owners, trainers, investors, equestrians who want to place their stable/horses on the internet and have a world class website without the hassle.Create and manage your equine business website without the hassle by adding horses, pages, menu links, and plugins.

16. BarnPro: by Rainier Myst Software

Horse management and cattle management software for Windows with integrated accounting and invoicing.

17. Equi-Journal: by Equi-Journal

Complete horse record keeping system used by many large and small ranches, AI centers, training and boarding facilities.

18. Equifacts: by The Russell Meerdink Co.

Horse Management Software that integrates accounting and invoicing with the record keeping aspects of tracking horses under your care.

19. Equisoft Assistant: by Equisoft

Software designed specifically for equine professionals -Veterinarian, Breeding Farm, Boarding Facility or Trainer.

20. Equisoft Live: by Equisoft Live

A tool for keeping horse records, reporting, ledger, automatic creation of invoices.

21. EZ Show Win: by Data System Solutions

An application for managing horse shows with reporting,High Point and customer bills calculations.

22. GaitKeeper: by Equussoft

A horse show management program for Windows with MOS Scoring, calculating, invoicing and reporting features.

23. General Horse Show Software: by Charlie Horse Ranch Timing Systems

A general purpose software package that will organize and report on any horse show that requires timing or scoring.

24. Horse Cents: by Horse Cents Software Company

Farm and stable management software.

25. Horse Farm Management System: by The Jockey Club Information Systems

A management tool for keeping horse inventory, billing and accounts receivable information for board, breeding and health records.

26. HorseBiz: by OCA Technologies

HorseBiz is an horse management software program that allows you to manage breeding activities, training costs, feed purchases, farrier visits, show records and awards, veterinarian visits, pedigree history for 5 generations, miscellaneous activities, inventory items and much more.

27. HSS: by TimeSlice Technologies

A program for professional horse show management featuring document scanning, scoring, invoicing and reporting. Starts at $395.00.

28. Lion Edge Equine Software: by Lion Edge Technologies

Who Uses This Software? Livestock producers, schools, ranch operations.

Use Ranch Manager Equine software to improve equine recordkeeping (horse/donkey) for your ranch operation. Horse recordkeeping: add horse pictures, health records, income/expenses, picture pedigree, traits. A breed chart to complete a year's worth of breeding data on one easy to use screen. Track heat cycles, foaling dates, track horse ID, breeding, show and training records, vet. care, worming, hoof trimming, dental checkups and feedings. Maintain a complete history of your operation. PC & Mac

29. NTHorse: by NTSoft

With NTHorse you do not need additional software for management your Horse Farm, Horse Ranch, Equine Equestrian Center, Horse Boarding Stable, Mare and Stallion Reproduction and Horse Training.

30. Show Secretary: by Perfected Technology Systems

A tool for running horse shows with breed management, financial reports, performance tracking and billing capabilities.

31. ShowPro Horse Show Software: by Sport Data

Horse show management software with accounting integration and class management functionality that supports multiple breed types.

32. Wise Option: by Wise Option

A horse management tool for keeping records and invoicing; available in three versions: training, reproduction, hospital.

CONCLUSION

Stable management especially race horse management is prime important practice for their owner. Several things are done before and after race day to help the horse perform to their highest potential. So the individual person is unable to remember each thing about the horse. With advancement of technology, Software systems of horse management is only way to take care them and make them potent to win races.

Stillbirths in Pig and its managements

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Stillbirths are usually recorded as such when they are found dead behind the sows. A good target level for stillbirths is 5 % of total piglets born. At this level there is no point in carrying out investigations because it is unlikely that external inputs can alter the situation. However once the level reaches beyond 7 to 10% it is worthwhile carrying out an investigation by records and post-mortem examinations for infectious diseases.

Types of stillbirths are of 3 types:

1. Pre partum deaths: the piglets die before the end of gestation. The cause may be different infection. A pig herd with more then 7-10 % stillbirth may be suspected to be affected by infectious disease (*i.e* Enteroviruses,Circovirus,Parvovirus,PRSS ,Leptospirosis etc).
2. Intra-partum deaths: these piglets die during the process of parturition. May be due to non-specific causes and may be influences by duration of farrowing, litter size etc
3. Post-partum death: A piglets that dies just after the farrowing.

Causes of stillbirth in pigs:

1. Infections:
    a) Aujeszky's disease.
    b) Enteroviruses.
    c) Eperythrozoonosis (*Mycoplsma suis*).
    d) Erysipelas.
    e) Leptospirosis.
    f) Mycotoxicosis(mainly zearalenone).
    g) Parvovirus (sequential to the delivery a mummified pig).
    h) PRRS.
    i) Circovirus (PCV2)
    j) Toxoplasmosis
    k) Reovirus
    l) Swine influenza virus

m) Streptococcal infections also have been implicated as a cause of stillbirth.
n) Japanese encephalitis

2. Anaemia (Sow's with Hb content of 9mg/100ml blood farrows more stillbirth)
3. Malnutrition's
3. Mismanagement
4. Poisoning
5. Prolonged farrowing

Risk factors associated with stillbirth piglets: These factors can be categorized as genetic, maternal, piglet and environmental factor but also interactions exist between several factors (Vanderhaeghe *et al*.,2013).

The following factors need to be considered as causal or contributory factors to the stillbirth:

1. Stillbirths increase with the increasing age of the sow and beyond 5th parity may reach 20%.
2. Stillbirths occur more in larger litters then smaller litter size. Johnson *et al*.(1999) concluded that selection for sows with larger litters will increase the number of still births piglets per litter.
3. They are more common in pure breeds then crossbred. there is a small but significant genetic influence on stillbirth(knoll *et al*., 2002)
4. The mean interval between two piglets birth is 12-15 minutes and normal time may vary from 2-5 hours (Bazer and First.1983). Sows that have prolonged farrowing will have a higher number of stillbirths.
5. Farrowing house temperatures above 30ºC during days 102-110 of gestation increase the risk of stillbirths (Sprecher *et al,.*1974).
6. Sows with uterine inertia produce high numbers of stillbirths.
7. Sow associated with calcium deficiency produce high numbers of stillbirths.
8. Anoxia and high carbon monoxide levels in the air associated with faulty gas heaters can raise stillbirth rates significantly.
9. Piglets found dead behind the sow after birth related to hypothermia.
10. Lack of exercise may have an effect on the stillbirth rates in pig farm.
11. Diseases of the sow such as fever, mastitis, septicaemia, acute stress or haemorrhage also produce high stillborn piglets.

Clinical signs:

Stillborn piglets are found dead in the membrane behind sow or delivered dead as a result of assistance at farrowing or uterine inertia during prolong farrowing. The cause of death may be congenital and the piglet may be malformed or very small to be viable. Culture or demonstration of infectious agents may suggest a cause. Animals which are die for carbon monoxide poisoning is often cherry red colour. Oversize foetuses may delay parturition and

are often born dead. Presence of dead piglet or a mummy in front of the piglet concerned and the delay caused can deprive it of oxygen and kill it.

Post-mortem lesions:

If the pig dies before farrowing, then depending on how long before, it will show varying degrees of post mortem or degenerative changes including discoloration of the skin and loss of fluids. If death occurs in the early stages of pregnancy a fully-formed mummified pig will be seen. A pig that dies during the process of farrowing or immediately afterwards will be fresh and normal. Stillborn piglets have a fleshy cord, membrane on the skin and cartilaginous curled up tips to the toes (Fig.1).

The piglets stillborn can be differentiated easily by post mortem examination.

1. The chest is opened and the lungs and the trachea examined to determine whether the pig had breathed, i.e. born alive and then died.
2. The lungs of the true stillborn pig are a dark plum colour, showing none of the pink areas associated with inflation and breathing, resemble like liver (Fig.2) and sink in water. Pigs that attempt to breath during the process of farrowing will also show evidence of mucous obstructing the wind pipe.

Figure 1. Still born piglets

Figure 2. Lungs of a prepartum Stillborn piglets

Treatment:

If uterine inertia is occurring remove foetuses manually as soon as possible until normal farrowing continues. If calcium deficiency in the sow suspected, give calcium borogluconate into the ear vein and treat any other illness in the sows. Compromised piglets may be resuscitated by clearing the membranes from the mouth, nostrils, massaging the chest or swinging the piglet by the hind legs to stimulate breathing.

Management to reduce stillbirths

Where stillbirth levels are high it is necessary to eliminate disease as a possible cause and then identify the predisposing factors and their relevance. Most stillbirths in the absence of diseases or environmental faults are related to age, individual sows and large litters.

1. Vaccination of pig against infectious diseases.
2. Do not let the age of the herd spread beyond the fourth partum.

3. Identify problem sows. Observe farrowing behaviour.
4. Look at breed differences.
5. Check farrowing house environments and ambient temperature.
6. Check farrowing pen designs.
7. Monitor farrowing and assistance if needed.
8. Interfere early in prolonged farrowing.
9. Give good management at farrowing.
10. Provide a heat source behind sow at farrowing.
11. Examine the herd records register.
12. Check haemoglobin levels in sows.
13. Check for blood parasites and parasite levels.
14. Check for diseases in the sows.
15. Check for sow nutrition condition.

CONCLUSION

Stillbirths are a worldwide problem in pig farming which mainly affect newborn. Stillborns in the absence of diseases or environmental faults are related to age, individual sows and large litters. Significance if stillbirths are more than 7 to 10 %.

REFERENCES

Bazer, F. W and First, N. L.(1983). Pregnancy and parturition. Journal of Animal Science.54 (supple.2):425-60.

Johnson,R.K.,M.K.Nielsen and D.S.Casey.(1999). Responses in ovulation rate, embryonal survival and litter traits in swine to 14 generations of selection to increased litter size. J.anim.sci.77:541-557.

Knol E.F., Ducro. B.J,van Arendonk, J.A.M.and van der Lende.T. (2002). Direct,maternal and nurse sow genetic effects on farrowing, pre weaning and total piglet survival. Livestock Production science 73:153-164

Sprecher,D.J,.Derman,A.D.,Dzuik,P.J.,Cropper,M and Decker M.(1974).Causes and control of swine stillbirths. Journal of American Veterinary Medicine Association. 165:698-701.

Vanderhaeghe.C, Dewulf.J, de Kruif. A., Maes, D. (2013).Non-infectious factors associated with stillbirth in pigs: A review. Animal Reproduction Science.Vol.139,1-4: 76-88.

Johne's disease (Paratuberculosis): Upcoming Zoonoses

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Paratuberculosis, also known as Johne's disease, is a chronic, contagious bacterial disease of the intestinal tract that primarily affects sheep and cattle, goats as well as other ruminant species. The disease has also been reported in horses, pigs, deer, alpaca, llama, rabbits, stoat, fox, and weasel. The disease is caused by a bacterium called *Mycobacterium avium* subsp. *paratuberculosis* (MAP). Disease has long and protracted incubation period which may extend even up to 2 years or more.

Economic importance

Johne's disease has worldwide distribution and it has been increasing range of animal species. In India, JD has been endemic and highly prevalent. It has devastating effects on livestock sector in terms of production and economics, where losses occur due to sub-clinical stage of disease, in the form of premature culling, reduced carcass value, reduced weight gain, increased susceptibility to other infections, reduced fertility, reduced feed efficiency, reduced milk yield, reduced salvage value at slaughter, increased treatment costs and shorter life expectancy.

Transmission

In ruminants, MAP is mainly transmitted by the fecal-oral route. Infected animals can shed large numbers of organisms in the feces. Young animals are most susceptible to infection and usually become infected when they nurse from an udder soiled with feces or housed in contaminated pens. They may also be infected when they drink milk or colostrums from infected dam. Little is known about the transmission of MAP in non-ruminant species, but fecal-oral spread is likely to be important. Predation might be a route of transmission to carnivores or omnivores.

Clinical signs

Clinical signs usually first appear in adulthood, but the disease can occur in animals at any age over 1-2 years and in dairy cattle is most frequently reported in the 3-5 year old age group. Clinically infected animals show watery diarrhea, emaciation and eventually death due to lack of effective treatment. The initial symptoms can be subtle and may be

limited to weight loss, decreased milk production or roughening of the hair coat. The diarrhea is usually thick, without blood, mucus or epithelial debris, and may be intermittent at first. As the disease progresses, the diarrhea becomes more constant and severe over weeks or months and intermandibular edema may occur. The temperature and appetite are usually normal and animals are alert. The clinical signs are similar in other ruminants. In sheep and goats, the wool is often damaged and easily shed, and diarrhea is less common than in cattle.

Lesions

In cattle, early lesions occur in the walls of the small intestine and the draining mesenteric lymph nodes and infection is confined to these sites at this stage. As the disease progresses, gross lesions occur in the ileum, jejunum, terminal small intestine, caecum and colon. The walls of intestine become 2-20 times thickened. The mucosa of intestine is folded showing transverse corrugations (Chacon et al., 2004). Similar lesions occur in sheep and goats. The mucosa is often only slightly thickened in these species, but caseated or calcified nodules are sometimes found in the intestine and associated lymph nodes. The lesions in other ruminants resemble those found in cattle, sheep and goats.

Zoonotic Risk

MAP is an emerging pathogen of global concern. However, limited data suggest that MAP may be involved in Crohn's disease (CD), chronic granulomatous enteritis of humans that resembles Johne's disease (JD) and share certain clinical and histopathological similarities with JD in animals (Pickup et al., 2005).

CD is characterized by periods of malaise, abdominal pain, chronic weight loss and diarrhea, with remissions and relapses. The disease often begins between the ages of 16 and 25 years, and persists lifelong. There is no cure. The cause of Crohn's disease is unknown; however, it may be the result of several interacting factors including a genetic predisposition, an abnormal immune response, and environmental factors including responses to intestinal microorganisms. MAP has been found in some CD patients; however, isolation is rare and studies to date have not been able to determine whether this organism has a causative role or is simply an "innocent bystander" that can grow in the inflamed intestinal wall. However, MAP is consistently detected by PCR in people with Crohn's disease. This fact, coupled with its broad host range, including nonhuman primates, indicates that paratuberculosis should be considered a zoonotic risk until the situation is clarified (Mishina et al., 1996).

Diagnosis

Diagnosis of MAP is challenging due to complex pathogenesis, long incubation period, and intracellular location of pathogen. Early identification of infected animal is essential to prevent further spread of the disease (http://www.nap.edu/books/0309086116/html). Early "silent" infections can be detected only by culturing the organisms from postmortem tissues or, rarely, by histopathology. Subclinical carriers can be identified with serology, delayed-type

hypersensitivity (DTH) reactions, polymerase chain reaction (PCR) assays or fecal culture (Amarapurkar et al., 2004).

Microscopy

Ziehl-Neelsen stains can be used to detect MAP in the feces, smears from intestinal mucosa or the cut surfaces of lymph nodes; clumps of small, strongly acid-fast bacilli are diagnostic.

Culture

Bacteria can be cultured from the feces, thickened areas of the intestinal wall, and ileal, mesenteric and ileocecal lymph nodes. Suitable media include Herrold's egg yolk medium, (HEYM) modified Dubos's medium and Middlebrook 7H9, 7H10 and 7H11 media.

Serological diagnosis

Serology can be used for the presumptive identification of infected animals, as well as to estimate the prevalence of infection in a herd or confirm paratuberculosis in animals with clinical signs. A variety of serological tests are available, including complement fixation, enzyme-linked immunosorbent assays (ELISAs) and agar gel immunodiffusion (AGID).

Tests for cell mediated immunity

Intradermal testing with johnin or avian purified protein derivative has been used widely to detect delayed-type hypersensitivity (DTH) reactions to MAP; however, this test is insensitive and nonspecific reactions are common. DTH reactions may diminish or disappear as the disease progresses. The test is carried out by the intradermal inoculation of 0.1 ml of antigen into a clipped or shaven site, usually on the side of the middle third of the neck. The skin thickness is measured with calipers before and 72 hours after inoculation. Increases in skin thickness of over 2 mm should be regarded as indicating the presence of DTH.

In vitro tests that detect cell-mediated immunity to MAP include a gamma interferon assay (IFN-γ) and a lymphocyte transformation test (LTT). The IFN-γ assay is a sensitive laboratory test, but less useful and costly. The cell-mediated immune (CMI) response elicited in the early stage of infection is detected by the release of IFN-γ in the blood from sensitized lymphocytes during 18-36-hour incubation period with specific antigen.

PCR and DNA probes

PCR and DNA probes are used to detect MAP and distinguish it from other species and subspecies of mycobacteria.

Prevention and control

Prevention & control of Johne's disease is important as treatment is not available. Control involves good sanitation and management practices including screening tests

for new animals to identify and eliminate infected animals and ongoing surveillance of adult animals. In herds affected with paratuberculosis, calves, kids, or lambs should be birthed in areas free of manure, removed from the dam immediately after birth, bottle-fed pasteurized colostrum and raised separate from adults until at least one year old. This reduces the chance of transmission of disease to this most susceptible population. Also, reducing fecal contamination in animal housing areas by elevating food and water sources is recommended. There are some vaccines for this disease; however they are used only in very well defined situations and under strict regulatory control. Vaccination of young calves has shown a reduction in disease incidence but it does not prevent shedding or subsequent new cases in the herd. However, vaccination may interfere with eradication programmes that are based on detection and subsequent elimination of infected animals. Vaccination against Paratuberculosis can also interfere with tests for bovine tuberculosis. Strategies to control this disease include improved management practices, testing and culling and vaccination.

CONCLUSION

The diagnosis of paratuberculosis can provisionally be made on clinical grounds but confirmation requires certain laboratory investigations. Isolation of the organism is the gold standard diagnostic test. Several serological techniques are employed in the diagnosis of paratuberculosis. Molecular tests have recently been utilized in the diagnosis of the disease. The knowledge of how MAP causes disease still lags behind than for other pathogenic bacteria. Johne‘s disease control programs are the immediate requirements of the country in order to boost per animal productivity. The potential role of MAP in the etiology of Crohn's disease deserves substantial future investigation.

REFERENCE

Amarapurkar DN, Patel ND, Amarapurkar AD, Agal S, Baigal R and Gupta P. 2004. Tissue polymerase chain reaction in diagnosis of intestinal tuberculosis and Crohn’s disease*. The Journal of the Associations of Physicians* of India **52**: 863-867.

Chacon O, Bermudez LE, Barletta RG. 2004. Johne’s disease, inflammatory bowel disease, and *Mycobacterium paratuberculosis*. *Annual Review of Microbiology* **58**: 329-363.

Mishina D, Katsel P, Brown ST, Gilberts EC, and Greenstein RJ. 1996. On the etiology of Crohn’s disease. *Proceedings of National academy of Sciences of the United states of America* **93**: 9816-9820.

Pickup RW, Rhodes G, Arnott S, Sidi-Boumedine K, Bull TJ, Weightman A, Hurley M and Hermon-Taylor J. 2005. *Mycobacterium avium* subsp. *paratuberculosis* in the catchment area and water of the River Taff in South Wales, United Kingdom, and its potential relationship to clustering of Crohn’s disease cases in the city of Cardiff. *Applied and Environmental Microbiology* **71**: 2130-2139.

Diagnosis and Control of Johne’sDisease. National Academies Press http://www.nap.edu/books/0309086116/html

World Organization for Animal Health (OIE) http://www.oie.int

Obstructive Urolithiasis in Male Buffalo Calves: Treatment and Management

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The incidence of retention of urine is more in male bovines as compared to female bovines followed by canine, equine, caprine and ovine. Retention of urine can be due to obstructive urolithiasis, urethral stenosis, urethral fistula and testicular tumour in bovines and equine.

However, the most common etiological factor for retention of urine in male bovine calf is obstructive urolithiasis and this condition is generally encountered more in winter season. Urolithiasis in ruminants is of considerable economic importance as it results in heavy losses to the farmers.

ETIOLOGY OF OBSTRUCTIVE UROLITHIASIS

The condition is multifactorial and some of the possible causes are as under

- The formation of calculi depends upon the diet fed to the animals. The animals maintained on high concentrate diet usually develop phosphate calculi because concentrate are rich in phosphorus. These phosphate calculi are smooth soft small and multiple in number.
- In the second category, the animals maintained on high roughage diet develops carbonates and silicious calculi because roughage is rich in silica. These calculi are rough hard white and usually single in number.
- Urine pH also plays a major determining factor for calculus formation. Mostly urine of herbivore is alkaline and alkaline urine favours precipitation of calcium and magnesium salts.
- Water intake also plays an important role in calculus formation. Less water intake during winter/water deprivation leads to calculus formation.
- Other factors like vitamin A and vitamin D deficiency will cause desquamation of lining of urinary tract.

Site of lodgement of calculi: The calculus formation begins its development in the pelvis of the kidney but majority of calculus are flushed out through the urine but if it hinders the urinary passage the signs of obstructive urolithiasis develops. The calculi usually get lodged at the site of sigmoid flexure in bovines, in the terminal portiont of

urethra/ glans penis in camels, urethral process in sheep and goat and just caudal to os-penis in dogs.

CLINICAL SIGNS

The clinical signs depends on the degree of obstruction whether partial or complete. In **partial obstruction** of urethra there is dribbling of urine, dysuria, abdominal pain/colicky symptoms, haematuria (due to inflammatory conditions of urinary tract). In cases of **complete obstruction** there is teeth grinding, stamping of legs, constant straining that often leads to rectal prolapse. Due to obstruction in the outflow of urine, the urine gets accumulated in the kidneys and will cause dilation of entire urinary tract ,the enlarged kidney due to storage of urine is known as hydronephrotic kidney and if the urine gets infected the condition is known as pyelonephrotic kidney.

If the obstruction is not removed after a gap of 48 to 75 hours then urinary bladder/urethra will get ruptured and urine gets lodged in abdominal cavity which leads to bilateral distention of abdomen known as water belly abdomen. Clinical signs of rupture of urinary bladder are salivation, dehydration and sunken eyes. Urethral rupture will lead to subcutaneous infiltration of urine and with due course of time it will lead to formation of urine scald. Due to accumulation of urine in abdominal cavity /peritoneal cavity there will be diffusion of electrolyte from serum /blood towards abdomen resulting in hyponatremia, hypokalemia, hypochloremia, hypocalcemia. Due to accumulation of sodium (Na+) and chlorine (Cl-) in abdominal cavity, water from intracellular and extra cellular space will move to abdominal cavity and a state of dehydration occurs. Abnormal concentration of urea, creatinine and other non nitrogeneous waste products results into a stage of azotaemia and this may be due to prerenal/renal/postrenal involvement. Due to obstructive urolithiasis there will be metabolic alkalosis in ruminants which further alters the renal functioning and results in uremia (always postrenal).

DIAGNOSIS

- On the basis of history and clinical signs
- Abdominocentesis
- Radiography
- Ultrasonography
- Serum biochemistry by estimating sodium, potassium, chloride, calcium, phosphorus, total protein, creatinine and blood urea nitrogen

TREATMENT

The first line of treatment involves evacuatiuon of urinary bladder which in large animals is done through rectal approach and in small animals by abdominocentesis. Then the calculus is removed by means of urethrotomy either by post scrotal approach or by performing ischial urethrotomy in the first phase calculi is removed and in the second phase bladder is repaired by performing cystorrhaphy.

Apart from these in small calf tube cystostomy can be done in which a incision is given in the paramedian region between the two rudimentary teats under local anaesthesia. After incising the muscles and peritoneum the bladder is approached. A second incision is given on the skin and a tunnel is created through which the catheter (Foley's rubber catheter or silicon catheter) is passed and placed in the bladder. The muscles and the peritoneum are sutured with absorbable suture material (chromic catgut No. 1) and skin is sutured with non absorbable silk No. 1.

The owner is advised to feed the calf with ammonium chloride at a rate of 0.5-1 gram per kg body weight and to restrict the flow of urine from the catheter using cap of a disposable syringe. Ammonium chloride is a urinary acidifier and thus helps in dissolution of the calculi and restriction in the flow of urine makes the animal to strain and with due course of time as a combined effect of dissolution of calculi and straining of animal the obstruction is relieved.

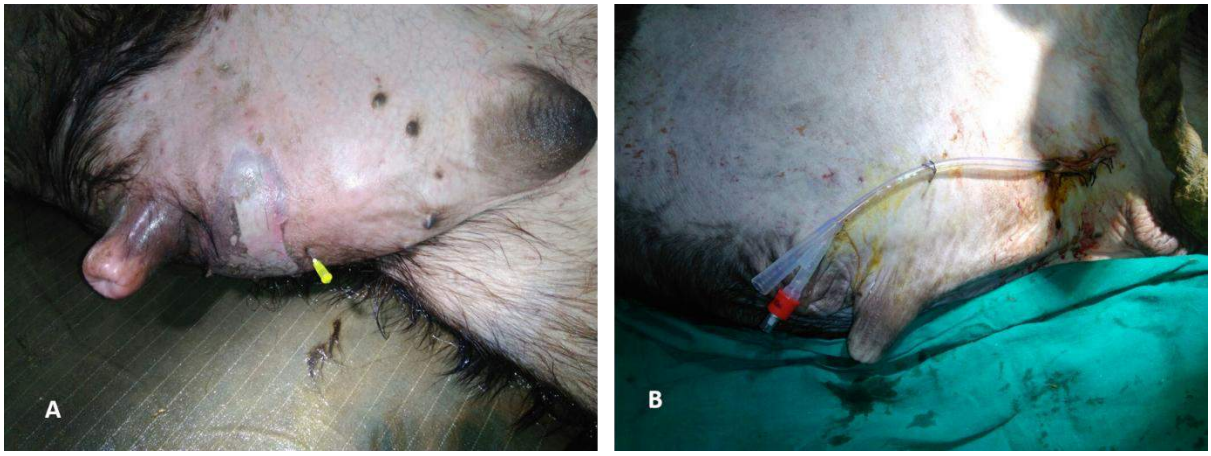

FIG. (A) Male bovine calf with ruptured urethra (B) Tube Cystostomy using Foley's Catheter

POST-OPERATIVE TREATMENT

TREATMENT	REMARKS
Intravenous fluid (NSS) For 3-5 days	To check dehydration
Acid/vinegar water is used	To combat metabolic alkalosis
Inj. Neostigmine @ 2-4 mg by subcutaneous route 2-3 times for 3 days.	For atony of urinary bladder
Systemic antibiotics intramuscular for 3-5 days	To check retrograde infection
Ammonium chloride @ 0.5-1 gm per kg body weight (till normal micturition)	Urinary acidifier
NSAIDs intramuscular for 5 days	To check pain

REFERENCE

Syed, S.H. (2009). Clinical Studies on Obstructive Urolithiasis in Cattle. (Doctoral Dissertation).

Problems and prospects of tuber crops in Kerala

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Tuber crops are one of the most important crops in Kerala. The State has enormous potential for cultivation of tuber crops such as Cassava (*Manihot esculenta*), Sweet Potato (*Ipomoea batatas*), Yams (*Dioscorea spp*.), Elephant Foot Yam (*Amophophallus paeoniifolius*) and Taro (*Colocasia esculenta*) etc. with its diverse agro climatic condition and grown even in low fertile soil with economic yield. Rice is the major crops grown in Kerala, which is highly vulnerable to climate change (Anju *et al*., 2014). The changes in temperature and rain would be detrimental to thermo-sensitive crops like cardamom, tea and black pepper as well. Tuber crops are resilient to climate change due to its capacity to surge over the adverse conditions by becoming dormant and resuming tuber growth during favorable conditions, thereby, bringing down the chances of crop failures. Cassava is a major food of the Keralities and it is considered as the future food security crop having ability to sustain under changing climate conditions especially during drought. Similarly sweet potato can tolerate saline conditions and it yields considerably well under such condition. Elephant foot yam, tania and arrow root are tolerant to shade conditions and hence they can be grown in different cropping systems.

STATUS OF TUBER CROPS IN KERALA

Cassava

Tapioca was one of the main food crops in the past and so the crop was cultivated extensively in the state. In 2006 tapioca was cultivated in 87 thousand hectare and its area has decreased to 18 thousand hectare in 2015. Thus within a span of ten years there was a decline of nearly eighteen thousand hectare of tapioca in Kerala (i.e.21 per cent decrease). This was due to major portion of land under tapioca cultivation was shifted to rubber cultivation. The production of tapioca during the same period increased from 2519 thousand tons to 2662 thousand tons due to the adoption of high yielding varieties as shown in table 1. The compound annual growth rate during this period in area was -2.54 per cent, whereas the production grew at the rate of 0.61 per cent and yield growth was 3.25 per cent.

Table 1: Area, Production and Yield of Tapioca in Kerala

Year	Area in '000' ha	Production in '000' tons	Yield in tons/ha
2006	87.1	2519.0	28.9
2007	84.0	2556.5	30.4
2008	87.2	2712.4	31.0
2009	74.9	2525.4	33.7
2010	72.3	2409.0	33.3
2011	74.5	2547.4	34.4
2012	69.6	2458.5	35.3
2013	67.6	2479.1	36.6
2014	75.5	2943.9	38.9
2015	69.4	2662.6	38.3
CAGR (%)	-2.54	0.61	3.25
% change over previous year	-8.06	-9.55	-1.6

Source: Directorate of economics and statistic (various issues), Kerala

It is essential to popularize tapioca in Kerala as it has high calorific values. Further with value addition, these crops have good prospects in the industrial sector.

Sweet potato

Table 2: Area and Production of sweet potato in Kerala

Year	Area in ha	Production in tons	Yield in t/ha
2006	505	6405	12.6
2007	499	6343	12.7
2008	386	4827	12.5
2009	399	4575	11.4
2010	312	4887	15.6
2011	247	4159	16.8
2012	282	4780	16.9
2013	330	5451	16.5
2014	361	5123	14.1
2015	279	3922	14.0
CAGR (%)	-5.68	-3.17	2.66
% change over previous year	-22.71	-23.44	-0.94

Source: Directorate of economics and statistics (various issues), Kerala

Table 2 indicates that during 2006 the area under sweet potato in Kerala was 505 hectare as compared to 279 hectare sown during 2015, which shows that area of sweet potato crop decreased over the time may be due to shifting of area to other crops. The

production of sweet potato during 2006 to 2012 decreased from 6405 tons to 4780 tons due to corresponding decrease in area of sweet potato crop in Kerala and thereafter area and production of sweet potato has increased. The compound annual growth rate during this period in area was -5.68 per cent, production was -3.17 per cent and yield grew at the rate of 2.66 per cent. Sweet potato is rich in minerals, vitamins and protein and it is essential to create awareness among the rural communities and it needs to be popularized.

Elephant foot yam, Colocasia, Yam and other tubers

Table 3: Area of Elephant foot yam, Colocasia, Yam and other tubers in Kerala (in ha)

Year	Elephant foot yam	Colocasia	Yam	Other tubers	Total Tubers area in ha	% of tubers area to gross cropped area
2006	11578	11185	2402	2570	115368	3.95
2007	11182	10491	2355	2411	110928	4.02
2008	9646	9224	2020	2204	110721	4.11
2009	7897	8804	2015	2259	96230	3.61
2010	7662	8841	1858	2449	93406	3.53
2011	7362	8329	1747	2215	94398	3.55
2012	7547	8035	1666	2259	89375	3.45
2013	7022	7546	1528	2176	86191	3.29
2014	7048	7950	1598	2043	94493	3.60
2015	7143	8085	1617	2268	88797	3.38
% change over previous year	1.34	1.69	1.18	11.01	-	-

Source: Directorate of economics and statistics (various issues), Kerala

Tubers representing about 4 per cent area of food crops during the year 2015. Tapioca, Sweet potato, Elephant foot yam, Colocasia, Yam etc. included the category of tubers. Table 3 shows that total area under tuber crops was 115368 hectare in 2006 as compared to 88797 hectare during 2015, which shows that area of tuber crops decreased over the time due to marginal shifting of elephant foot yam, colocasia, koorka and more on plantation crops rather than cassava and sweet potato. Further this table shows that the percentage change in growth rate over the previous year as estimated for area under elephant foot yam grew at the rate of 1.34 per cent, colocasia was 1.69 per cent, yam was 1.18 per cent and other tubers grew at the rate of 11 per cent.

DISTRICT WISE PRODUCTION AND YIELD OF TUBER CROPS IN KERALA

Table 4 indicates that total area under tapioca was 69405 hectares with a production of 2662 thousand tons and yield of 38.4 t/ha against the national productivity of 22.3 t/ha.

Table 4: District wise Area, Production and Yield of tuber crops in Kerala -2015-16

District	Tapioca			EFY	Colocasia	Yam	Sweet potato			Other tubers
	A	P	Y	A	A	A	A	P	Y	A
Trivandrum	14585	536.3	36.8	398	714	59	17	0.19	11.0	170
Kollam	15147	530.8	35.0	1019	1393	467	2	0.02	11.0	140
Pathanamthitta	5220	209.9	40.2	1157	1202	421	1	0.01	12.0	76
Alappuzha	2715	87.8	32.3	675	830	154	4	0.04	10.8	48
Kottayam	5631	220.5	39.2	511	492	93	1	0.01	11.0	7
Idukki	6919	319.3	46.2	702	647	176	4	0.09	22.0	22
Ernakulam	5152	239.2	46.4	223	238	28	4	0.05	12.0	47
Thrissur	1290	54.6	42.3	81	205	9	4	0.03	7.0	349
Palakkad	1958	62.3	31.8	426	538	32	55	0.83	15.0	1125
Malappuram	5117	198.2	38.7	492	659	69	81	0.97	12.0	138
Kozhikode	1583	39.4	24.9	200	471	36	13	0.20	15.3	89
Wayanad	1888	77.9	41.2	1117	198	45	7	0.11	15.9	7
Kannur	1696	66.5	39.2	98	398	22	30	0.33	11.0	43
Kasaragode	504	20.0	39.7	44	100	6	56	1.05	18.7	7
Total	**69405**	**2662.6**	**38.4**	**7143**	**8085**	**1617**	**279**	**3.92**	**14.1**	**2268**
India	**204000**	**4554.0**	**22.3**	**26000**	**-**	**-**	**130000**	**1472**	**11.3**	**-**

Source: Department of Economics and Statistics (various issues), Kerala

Note: A=Area in hectare, P=Production in '000 tons', Y=Yield in t/ha

Kollam has the highest area of 15147 hectares under tapioca with an average production of 530 thousand tons. The total area under sweet potato was 279 hectares with a total production of 3.92 thousand tons and a yield of 14.1 t/hectare against the national productivity of 11.3 t/ha. Malappuram has the highest area of sweet potato of 86 hectares, followed by Palakkad (55 hectare). The area under elephant foot yam, colocasia and yam is 7413, 8085 and 1617 hectare respectively. The production and yield of elephant foot yam, colocasia and yam is not available as the cultivation of these tuber crops is only to a limited extent.

PROSPECTS OF TUBER CROPS IN KERALA

Strength

1. Adaptability to soil, climate and environmental conditions
1. Grown even in low fertile soil with economic yield
2. Requires less maintenance
3. Food security crop
4. Immense potential for value added products
5. Productivity is more
6. Climate resilient crop

Major weakness or problems of tuber crops

1. Lack of industrial utilization
2. Cannot be stored for longer periods
3. Fragmentation of land holdings
4. Non availability of quality planting materials

Opportunities

1. Great scope for product diversification and value addition in tuber crops
2. Opportunity for industry level bio-ethanol production from cassava
3. Scope to develop prophylactic and therapeutic functional food from tuber crops.
4. Can fit well in different cropping systems
5. Tremendous scope as nutritious food

Threats or challenges

1. Poor market linkage
2. Non availability of planting materials
3. Declining in area and production of Cassava and Sweet potato
4. Wide price fluctuation

CONCLUSIONS

Tapioca, elephant foot yam, colocasia, yam and sweet potato are common tuber crops grown in Kerala. The results clearly indicated that the area under major tuber crops in Kerala is decreasing over the time due to the farmers shifting to plantation crops rather than cassava and sweet potato. These tuber crops are very important for the food security and income of people in this region as well as in many parts of the country. It is

considered as the future food security crop having the ability to tolerate changing climate conditions especially drought and can be grown even in low fertile soil with economic yield. It is essential to popularize these tuber crops which have high calorific values. Further with value addition, these tuber crops have good prospects in the industrial sector.

REFERENCES

Anju L., Ambily P.G., Gopikrishna V.G. and Amalraj M. 2014. A Study on the Scope and Importance of Tuber Crops with Special Reference to Cassava as Resilient Crop towards Climate Change, *Earth Science & Climatic Change,*5(6):1-6.

Government of Kerala, (2014-15), Kerala *Agricultural Statistics*, Department of Economics and Statistics, Thiruvananthapuram, Kerala.

Government of Kerala, (various issues), *Kerala Agricultural Statistics*, Department of Economics and Statistics, Thiruvanathapuram, Kerala.

Plucknett, Donald L. 1984. Tropical Root Crops in the Eighties. In: Proceedings of the 6th Symposium of the International Society for Tropical Root Crops, Hosted by CIP in Lima, Peru, 21-26 February, 1983.

Balagopalan, C., Nayar, T.V.R., Sundaresan, S., Premkumar, T. And Lakshmi, K.R. (1999). Tropical tuber crops in food security and nutrition. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.

Reddy, P.P. (2015). Plant protection in tropical root and tuber crops: An overview, Springer (India) Pvt.Ltd.

Contract farming: An established mutual agreement to earn assured income from agricultural based industries

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Contract farming in a type of agricultural production system, where a mutual agreement is established between the growers and manufacturers. An agreed contract in which the grower has to produce and supply the required quantity of the agricultural products to the manufacturers. In return, the growers fetch income from the manufactures as per the already established contracts. Contract farming agreements involve the timely supply of quality products in pre mentioned quantity by the growers to promote the smooth running of business by the manufactures.

Before establishing the Contacts farming models, production costs and benefits are assayed. When both the parties are ready to accept the terms and conditions, set in the contract, then the contract is signed. In an agricultural production system, these contract farming models basically involve the four major components which include:

- Production of the quality product according to standard parameters provided by the manufacturers or sponsors.
- Production of the required quantity of the product by the manufacturers.
- Timely supply of the product to the manufacturers.
- A previously agreed price and returns to the farmers for their produces as per the contract.

The imperative feature of the contract farming is that the manufacturers seek the information regarding, where the production practices are going to be carried out, how will it be grown and how timely supply of products will be maintained. While the growers also seek the information regarding the timely supplies of inputs, guidelines for carrying the production in a scientific manner and acquisition of new innovation and techniques involved in the production of agricultural inputs

For an example, a cosmetic industry needs Aloe Vera in certain quantity on regular basis, so they can be established periodical contracts with the growers identified by them. They can issue certain guidelines regarding the package of practices and check quality

parameters to growers. Growers grow the contracted products under the inspection of manufactures and earn as per the deal.

HOW DOES THE ACTUAL CONTRACT FARMING WORK?

Contract farming exists between growers and manufacturers. The manufacturers are generally the industrialist of small to major scale or a cooperative organization, or a locally established processing unit or a factory, or a mill. In the developing economies, contract farming models form a well-organized method for the amalgamation of farming communities with the industrial sector where efficient management of the production system is carried out, which enhances the standard of living of the farming communities, as well as the manufactures, scales up his capital and benefits. In this agreement, the growers provide land and labors resources, while the manufactures regulate the smooth credit inflows, provide inputs, establishes production methodology, inspect quality, find the market for selling of the final products. In this scenario, the level of income to the farmer and the overall generation of the employment is increased.

KEY PARTICIPANT IN THE CONTRACT FARMING:

There is there major role player in the contract farming:

- The grower or producer along with its own natural agro environments for the production of the agricultural produces
- The consumers, which prefer and demand particular specialized products according to their level of satisfaction from the manufactures
- The manufactures or sponsor with its technologies and management skills

These three major drivers of the contract farming in which grower and manufacturers are associated directly while consumer associated with them indirectly. Because the assured income and returns to the growers encourage them to deal a contract, while the manufacturing company boosts up its market at the domestic or international level as per the assured supply from the growers, so directly benefitting each other. Ultimately the demands of the consumer are fulfilled and their satisfaction and feedback indirectly encourage both the contracting parties.

WHY IS THE NEED TO ESTABLISH A CONTRACT FARMING AGREEMENT?

1. Its offer a linkage to the farming sector with the agro-industries, farming communities acquires extension advisories, get farm mechanization with new implements, acquire quality seeds and recommended seed rates , knows recommended doses and application schedules of the fertilizers, seeks regular credits inflow to meet the necessary operations and overall assures a profitable market for their produces
2. Without any hesitation, the technologies transfer to the farmer occurs, because manufactures wants the improved and quality produces in low investments.

3. Apart from technologies, the growers get a skill in production and learn efficient management of their available farm and labor resources.
4. The price uncertainty risk which is highly associated with the overproduction of a particular commodity is ruled out if one is in contract or in the already established deal.
5. Overall increase the income and benefits for both the growers and manufactures Increased private capital flow in agriculture
6. Nowadays the health concerns are the primary issues, so these contracts most of the time deal with the proper quality parameters according to the consumer satisfaction.
7. Contract farming imparts the entrepreneurship skills to the growers, one can gain knowledge of the market, even after the expiry of the contract, they can continue their production and sell their products in the market easily.

CONSTRAINTS AND FLAWS ASSOCIATED WITH THE CONTRACT FARMING:

1. In developing economies most of the growers have marginal to small sizes of land holdings,but in cases, manufacturer preference goes to the larger land holding grower to avoid multiple contracts.
2. Growers are foster to grow the certain new or particular crops continuously, but in the case when competition comes in the market then the contracts may drop and both parties come in the loss.
3. Where there is no competition in the market or only monopoly exists, certain malpractices assume their shape as manufacturers sometimes compromise with the quality to reduce the procurement cost and enhance benefits.
4. Improper advisory and constraint in production faced by the growers are not properly met and rectified by the manufactures.
5. Contract farming in most often nurture the habits of monoculturing, this lead to the creation of several problems like deteriorating oil health, new pest development etc. which causes loss to the grower in long run.
6. Crop devastations losses caused by natural calamities are generally not dealt in the contract and there is a lack of certain crop insurance schemes against them, nut if it is there then lack of awareness is another issue.
7. Contract farming discourages the development of employment, avoid much labor practices, low level of personal development of grower by the manufacturer, the lacuna of transparency and inefficient communication etc.

CONCLUSIONS

Now-a-days, growers are favoring the contract farming with agricultural based industries in developing economies, because of certain price surety is given to them. Same time these industrialists are also assured for the regular supply of the agricultural products which

help them in the smooth running of their business domestic or globally. Even though these type of farming agreements are appeared lucrative, but still associated with many flaws. Apart from the several constraint and limitation in contract farming, there is an expanding trend is seen in this area. The scope and interests of contract farming can be escalated if certain new rules and regulation with the involvement of third monitoring parties are included in the deal. A proper mechanism to safeguard the interest of the grower and manufactures should be adopted to bolster the implementation of the contract farming model.

Assessment Water foot print in Agriculture

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The water footprint of a product is an empirical indicator of how much water is consumed and polluted, when and where, measured over the whole supply chain of the product. First of all, the water footprint measures both direct and indirect water use, where the latter refers to the water use in the supply chain of a product. The water footprint is a multidimensional indicator, showing volumes but also making explicit the type of water use (consumptive use of rainwater, surface water or groundwater, or pollution of water) and the location and timing of water use. The water footprint shows human appropriation of the world's limited freshwater resources and thus provides a basis for discussing water allocation and issues that relate to sustainable, equitable and efficient water use. The water footprint is an indicator of freshwater use that looks not only at direct water use of a consumer or producer, but also at the indirect water use. The water footprint can be regarded as a comprehensive indicator of freshwater resources appropriation, next to the traditional and restricted measure of water withdrawal. The water footprint of a product is the volume of freshwater used to produce the product, measured over the full supply chain. Besides, the water footprint goes beyond looking at blue water use only (use of ground and surface water). It also includes a green water footprint component (use of rainwater) and a grey water footprint component (polluted water).

WATER FOOTPRINT ASSESSMENT

Water footprint assessment' refers to the full range of activities to: (i) quantify and locate the water footprint of a process, product, producer or consumer or to quantify in space and time the water footprint in a specified geographic area; (ii) assess the environmental, social and economic sustainability of this water footprint; and (iii) formulate a response strategy.

BLUE WATER FOOTPRINT

The blue water footprint refers to consumption of blue water resources (surface and groundwater) along the supply chain of a product. 'Consumption' refers to loss of water from the available ground-surface water body in a catchment area. Losses occur when water evaporates, returns to another catchment area or the sea or is incorporated into a product.

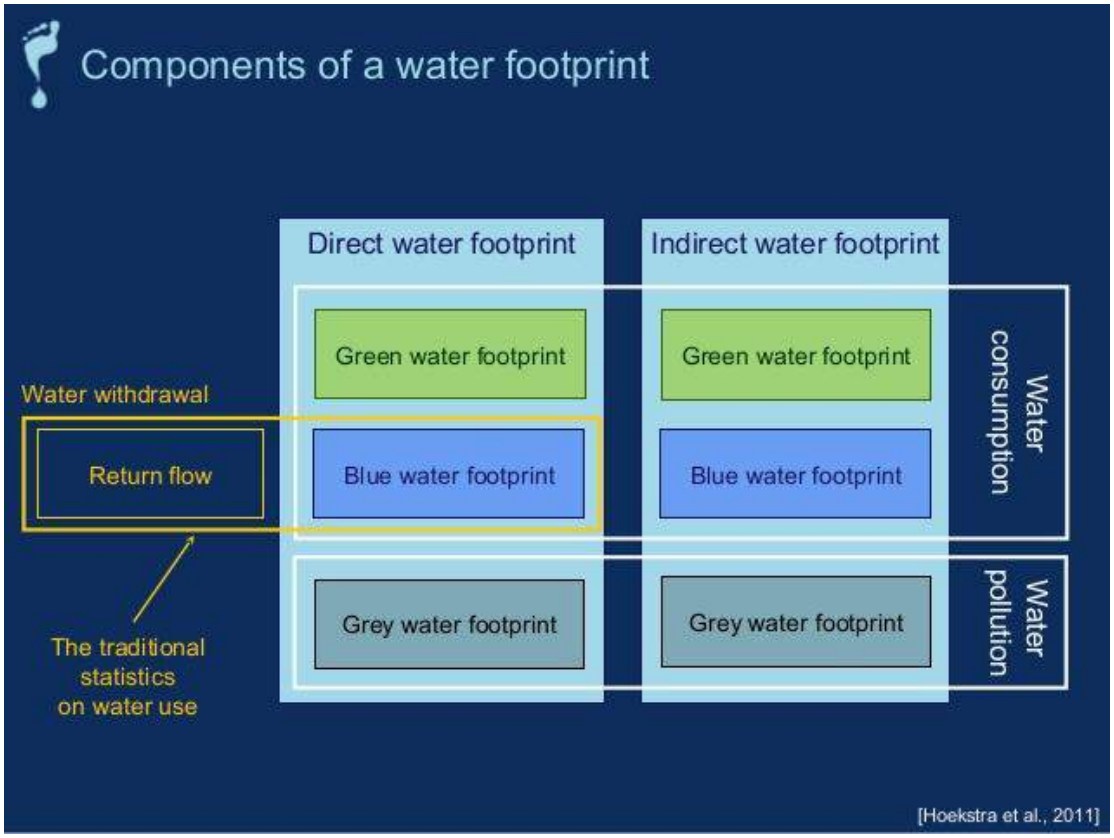
GREEN WATER FOOTPRINT

The green water footprint refers to consumption of green water resources (rainwater insofar as it does not become run-off). Green water refers to the precipitation on land that does not run off or recharge the groundwater but is stored in the soil or temporarily stays on top of the soil or vegetation. Eventually, this part of precipitation evaporates or transpires through plants. Green water can be made productive for crop growth (but not all green water can be taken up by crops, because there will always be evaporation from the soil and because not all periods of the year or areas are suitable for crop growth). The green water footprint is the volume of rainwater consumed during the production process. This is particularly relevant for agricultural and forestry products (products based on crops or wood), where it refers to the total rainwater evapotranspiration (from fields and plantations) plus the water incorporated into the harvested crop or wood. The green water footprint in a process step is equal to Green Water Evaporation + Green Water Incorporation [volume/time] (2) The distinction between the blue and green water footprint is important because the hydrological, environmental and social impacts, as well as the economic opportunity costs of surface and groundwater use for production. Decrease green water footprint (m^3/ton) by increasing green water productivity (ton/m^3) in both rain-fed and irrigated agriculture. Increase total production from rain-fed agriculture.

GREY WATER FOOTPRINT

The grey water footprint refers to pollution and is defined as the volume of freshwater that is required to assimilate the load of pollutants given natural background concentrations and existing ambient water quality standards. The grey water footprint refers to the volume of water that is required to assimilate waste, quantified as the volume of water needed to dilute pollutants to such an extent that the quality of the ambient water remains above agreed water quality standards. The idea of expressing water pollution in terms of a water volume needed to dilute the waste is not new. The term 'grey water footprint' was for the first time introduced by Hoekstra and Chap again (2008) and defined as the pollutant load divided by the maximum acceptable concentration in the receiving water body. A bit later, it was recognized that the grey water footprint is better calculated as the pollutant load divided by the difference between the maximum acceptable and the natural

background concentration (Hoekstra et al, 2009). Grey water footprint can go to zero through organic farming.



Source: Hoekstra *et al,*(2011)

Plate no 1 **Components of water footprint**

REFERENCES

Hoekstra, A.Y. and Chapagain, A.K. (2008) Globalization of water: Sharing the planet's freshwater resources, Blackwell Publishing, Oxford, UK, ISBN 978 1 4051 63354.

Hoekstra A. Y., Chapagain A. K., Aldaya M. M and Mekonnesh, 2011. The Water Footprint Assessment Manual Seting the global standard Eearthscan Publication, Oxford, UK, ISBN: 978-1-84971-279-8.

Teat Laceration and Fistula in Goats: Economic Loss to Farmers

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ABSTRACT

The whole milk production in dairy animal depends largely on the health condition of udder and teat structures. In India, buffaloes, cow and goats form the backbone of Indian dairy industry. Goat rearing is mostly practised by small sized land holders and migrating populations in India. The lesser quantity of milk produced combined with the medicinal qualities attributed to goat milk, make it a highly priced commodity in India. Thus any damage or trauma to teat and udder structures can lead to loss and reduction in milk production and therefore require immediate medical and surgical intervention to avoid further economic loss. In goats, teat laceration and teat fistula are the most common conditions affecting the teats. Any delay in treatment can lead to mastitis, teat necrosis and loss of subsequent quarter. The present article aims to educate the farmers regarding teat health and the requirement of immediate medical and surgical treatments in teat affections to avoid economic loss.

INTRODUCTION

India ranks first among the milk producers in the world with major contribution from buffaloes, cows and goats. Teat laceration reduces the normal functionality of the teat and predisposes it to infection, mastitis, fistula formation and necrosis. Teat laceration and subsequent formation of teat fistulas are common in goats attributed to their pendulous udder and long teats. Teat fistula refers to a communication between the teat cistern and the teat skin caused mainly by teat laceration, characterised by continuous discharge of milk through the fistulous opening. Teat laceration caused mainly by the barbed wire fencing causes serious injuries to the teat structures including the teat cistern and the streak canal leading to formation of fistula and such conditions require immediate surgical attention. Such conditions affects the economics of the farmers mainly due to loss of milk and the cost involved in the treatment. Delay in the treatment of teat laceration can lead to teat fistula, mastitis, necrosis of the teat and subsequent loss of the quarter.

ETIOLOGY

The main factors contributing to teat laceration and teat fistulas are:

1. **Barbed fencing wire**: Most cases of teat lacerations in goats are caused by the barbed wires used for fencing purpose. In India most of the land demarcation is done by using such fencing wires. Teats get injured when the goat jumps over the wire or when they try to cross these wires.
2. **Suckling by Kid**: Suckling of teat by kid causes partial thickness laceration which do not lead to serious complications and can be treated by simple wound management practices.

3. **Traumatic injuries**: Traumatic injuries to the teat caused sharp penetrating foreign bodies like needles, wooden piece, nails, agricultural implements, horns and milking machine can result in teat laceration and subsequent formation of fistula.

PATHOGENESIS

Figure 1: Teat laceration leading to teat fistula in a goat

Teat lacerations can be partial thickness or full thickness in nature. Partial thickness laceration or superficial lacerations are characterised by loss of skin and damage to underlying structures like muscles and blood vessels without the involvement of teat cistern and rarely require surgical intervention. Such lacerations do not cause any serious complications and are amenable by medical treatment. Extensive partial thickness lacerations can be sutured based on the degree of damage. Rarely, teat infections leading to mastitis can occur if untreated or delayed treatment is given.

Full thickness teat lacerations or deep lacerations communicating with the teat cistern are common occurrence in goats. These lacerations leads to formation of fistulas causing continuous discharge of milk through the fistulous opening. These type of lacerations requires immediate surgical intervention that demands suturing and closure of the fistulous opening. Milk serves as a good source of bacterial growth leading to teat infections which subsequently ends up in mastitis, necrosis and sloughing of the affected quarter.

Therefore early identification of teat injuries and providing required medical and surgical treatment is the key to avoid such complications.

TREATMENT

Management of teat lacerations depends on the degree of damage to the underlying structures. Superficial and deep lacerations can be managed independently with appropriate measures.

Superficial lacerations or partial thickness lacerations can be corrected by good wound management practices. It involves daily dressing of the wound site with antiseptic or antibiotic preparations and creating ideal conditions for the wound to heal by its own. Debridement should be done if necrosed or dead tissue is present. Extensive lacerations of the skin and muscles has to be sutured using absorbable or non-absorbable suture material to hasten the healing process and to reduce the chances of infection. Parenteral antibiotics and analgesics should be initiated based on severity of tissue damage and the wound conditions.

Figure 2: After surgical correction of teat fistula

Deep lacerations involving the teat cistern should be attended immediately to prevent further complications like mastitis, necrosis and gangrene. Teat is composed of four layers: mucosa, submucosa, muscle and the skin. The main goal of teat fistula repair is to obtain an impervious seal that prevent the leakage of milk and maintain a constant flow through the teat cistern. This involves the suturing of mucosa, submucosa and muscle layer using absorbable suture material followed by suturing the skin using silk or polyamide suture material. To maintain normal milk flow and to prevent obliteration of teat canal

following teat repair it is advisable to use a polyvinyl chloride prosthetic tube in the teat cistern until complete healing occurs, usually for 2-3 weeks. Antibiotic sensitivity test of the milk sample should be performed. Initially a broad spectrum antibiotic should be started followed by the antibiotic based on culture sensitivity results. Daily wound dressing using antiseptic preparation and

PREVENTION

Good managemental practice to a certain extent can possibly reduce the chances of occurrence of teat laceration in goats. Confinement of the goats and preventing the goats from roaming to places with known possibility of teat damage, like area with barbed wire fencing can reduce the chances of occurrence. Agricultural implements, nails and any sharp foreign bodies should be removed from the vicinity of the animal. Delay in the treatment for teat laceration can lead to fistula formation and related complications. Therefore regular monitoring of the flock and early and prompt diagnosis of the teat condition and providing appropriate treatment is the key goal to maintain good healthy condition of teat and udder.

CONCLUSION

Udder and teat are the most important structures with respect to a milch animal. Any damage to these structures can put the farmers into economic loss as well as it also affects the dairy production. Complications resulting from delayed treatment demands premature culling of the affected animal. Thus early diagnosis and prompt treatment of teat injuries and lacerations are important to maintain good udder health conditions and to avoid such complications affecting milk production leading to economic loss.