Indian Farmer

ISSN 2394-1227

A Monthly Magazine

Volume: 4 | Issue 07 | July - 2017 | Pages - 70

Management Practices of Strawberry

INDIAN FARMER

A Monthly Magazine

Volume: 4, Issue-07 July -2017

Effect of Organic Management Practices on the Quality of Strawberry-A Review

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Abstract

Organic foods represent a significant market segment within the global food industry, since these products are often believed to be safer and more nutritious than their conventional counterparts. Strawberries are considered as a good source of essential minerals and vitamins, which together with the organoleptic properties make the fruit particularly desirable. Organically grown strawberries are in much demand among consumers on account of superior fruit quality. The popularity of organically produced strawberries rests partly on the assumption that these are healthier and taste better despite a lack of conclusive evidence. Therefore, an attempt has been made in this article to assess the impact of organic management practices on the quality of strawberry fruits.

Key words: Organic food, Organic management practice, Strawberry, fruit quality, healthier

INTRODUCTION

Organic agriculture has evolved out of the determined attempt of conscious and inspired people to create the best equation between the earth and men. A major challenge today is certainly its entry into the policy making arena, its entry into anonymous global market and the transformation of organic products into commodities. In today's terminology it is a method of farming system which primarily aims at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution free environment.

Consumer's awareness, pesticide and fertilizer contaminations and environmental concerns have resulted in significant demand for organically grown farm produce. Consumption of berries has become popular among health-conscious consumers due to the high levels of valuable antioxidants, such as anthocyanin and other phenolic compounds.

Strawberries are considered as a good source of essential minerals and

vitamins (Tulipani *et al.*, 2008) which together with the organoleptic properties make this fruit particularly desirable to the consumer (Panico *et al.*, 2011). The overall taste of the berries is a major factor that drives consumer preferences with respect to fruit consumption and it is markedly affected by the content of reducing sugars and organic acids, which are regarded as good indicators of fruit quality (Montero *et al.*, 1996). Strawberry quality is also affected by the crop management (Wang *et al.*, 2002) and special attention should be paid to the undesirable accumulation of nitrates, which are considered a potential threat for human health (Lundberg *et al.*, 2004) and their acceptable daily intake (ADI) is 222 mg for a 60 kg adult (Scientific Panel on Contaminants,2008). In this respect, the choice of the appropriate organic fertilizer form may prevent nitrate accumulation in the plant edible organs (Caruso *et al.*, 2011).

In order to optimize the balance between fruit yield and quality, it is needed to identify and evaluate effective non-chemical farming strategies with moderate environmental impact (Medina *et al.*, 2009; Samtani *et al.*, 2012). In this regard many scientists have studied the effect of organic management practices on strawberry.

REVIEW OF LITERATURE

Organic foods represent a significant market segment within the global food industry, since these products are often believed to be safer and more nutritious than their conventional counterparts. Organic crops produced better quality fruits but a lower yield than conventional crops (Conti *et al.* 2014).

Figure 1: Sweet Charlie

Figure 2: Chandler

The scientific community, however, has not conclusively shown that organic products are more nutritious than conventionally grown food (Winter and Davis, 2006). The nutrition of food is increasingly important to consumers. The popularity of organic food rests partly on the assumption that these products are healthier despite a lack of conclusive evidence (Hargreaves *et al.* 2008). Therefore, an attempt has been made in this literature review to assess the impact of organic management practices on the quality of strawberry fruits.

Effect of organic management practices on yield and berry weight of Strawberry

Hammad *et al.* (2014) studied the influence of Compost, Effective

Microorganisms (EM) and Potassium on Strawberry production in sandy soils of Egypt. The interaction between compost and potassium treatments didn't give any significant increase in fruit yield of strawberry. Also, this study indicated that the application of EM alone was ineffective in increasing yield.

Conti *et al.* (2014) assessed the effects of two farming systems (organic and conventional) of strawberry in southern Italy. The conventional system produced the highest yield, as a consequence of the higher fruit number per plant, while the organic management resulted in increased berry mean weight.

Effect of organic management practices on total soluble solids, sugar, acidity and vitamin content of Strawberry

Cayuela *et al.* (1997) found that organic berries have higher sugar content than conventionally grown fruit. Kumar *et al.* (2015) studied the impact of organic manures (farm yard manure, vermicompost and press mud) and biofertilizers (Azotobacter, Phosphate solubilizing bacteria and Azospirillum) on growth and quality parameters of strawberry cv. Chandler. The treatments combination of vermicompost and PSB significantly affected the Total Soluble Solids, titrable acidity, vitamin C, total sugars and juice content of berries. The effects of organic and conventional nutrient amendments on strawberry cultivation: Fruit yield and quality was studied by Hargreaves *et al.* (2008), he found no difference in the sugar content of fruit grown organically or conventionally.

Abu-Zahra *et al.*, 2006 and Abu-Zahraand Tahboub, 2009 reported higher dry residue and soluble solids content as a result of the organic management compared to the conventional one. Similar effects on soluble solids and sugar were also previously reported by Wang and Millner (2009). Conti *et al.* (2014) stated that organic fruits showed higher values of dry and optical residue and higher content of glucose, sucrose, vitamin C and ß-carotene. Cardoso *et al.,* 2011 reported that vitamin C content was found to be higher in organic strawberries.

Effect of organic management practices on antioxidant levels of Strawberry

Olsson *et al.* (2006) demonstrated that strawberries grown organically had higher levels of all antioxidants including total phenolics, ellagic acid, and flavonols, than the conventionally grown strawberries, whereas Hakkinen and Torronen (2000) reported that organic cultivation had no consistent effect on the antioxidant levels in strawberries when compared to conventional techniques. Campo *et al.* in 2012 stated that the cultivation system (organic or conventional) did not affect the total phenolic content. However, the organic strawberries have a higher nutritional value, in terms of antioxidant compounds, which is also reflected in better sensory color characteristics.

Fernandes *et al.* (2012) studied the influence of Integrated Pest Management and Organic Farming on the phenolic composition and antioxidant properties of strawberries. They evaluated the influence of organic farming (OF) and integrated pest management (IPM) practice on the total phenolic content in 22 strawberry samples from four varieties at Portugal. The total phenolic content was higher for OF strawberry extracts. Organically grown strawberries

were significantly higher in antioxidant activity than were the IPM strawberries. Organically and conventionally grown strawberries had similar total antioxidant capacity Hargreaves *et al.* (2008).

Effect of organic management practices on anthocyanin levels of Strawberry

The colour and anthocyanin pigment were determined in organic versus conventional strawberries (*Fragaria* × *ananassa* Duch, cv. Selva) by Campo *et al.* in 2012. The cultivation system was significant for all of surface color parameters. The color of the organic fruits was darker, less vivid and frequently redder. Furthermore, the organic strawberries had a significantly higher level of anthocyanins and ascorbic acid.

Fernandes *et al.* (2012) showed that the main differences in bioactive phytochemicals between organically and IPM grown strawberries concerned with their anthocyanin levels.

Effect of organic management practices on mineral and trace element content of Strawberry

Comparison of mineral and trace element contents between organically and conventionally grown fruit was studied by Cardoso *et al.* (2015). The concentrations of Mo and Al were higher in organic strawberry when compared to conventional strawberry. Finally the conclusion was organic farming did not result in a clear superiority of the mineral quality of fruit nor did it provide fruit free of toxic elements. Hammad *et al.* (2014) stated that application of EM (Effective Microorganisms) increased the efficiency of both organic and mineral nutrient sources. It was also found that the nitrogen, phosphorus and potassium uptake were significantly increased in strawberry plots that received compost and Effective Microorganism.

Reganold *et al.* (2010) studied the fruit and soil quality of organic and conventional strawberry agro-ecosystem and found that the fruit N, P and K concentrations were significantly higher in conventionally grown strawberry plants than in organically grown plants. Organic fruits showed lower value of nitrate content Conti *et al.* (2014). Inorganic fertilizer treatment significantly increased the concentrations of S and Mn in fruit compared to organic treatments Hargreaves *et al.* (2008).

Effect of organic management practices on shelf life of Strawberry

Organic strawberries had significantly longer survival times (less gray mold incidence) than conventional strawberries. When strawberries were exposed to a two-day shelf-life interval, the percent loss in fresh weight was significantly less for the organic berries than for the conventional berries indicating that the organic strawberries have a longer shelf life than the conventional strawberries because of slower rotting and dehydration Reganold *et al.* (2010).

Effect of organic management practices on resistance of Strawberry

Erhardt *et al.* (2013) studied the performance of ten day-neutral cultivars and a subset of five commercially important day-neutral cultivars at four Washington organic farms with respect to their yield, fruit quality traits, vigor, and flavor. The cvs. 'Aromas' and 'Seascape' were most durable under organic management practices in both the first

and second production years. However, 'Seascape' was susceptible to verticillium wilt.

According to Reganold *et al.* (2010), organic strawberries are more resistant and avoided infection by means other than fungicides application (e.g., systemic-acquired resistance) as there were no fungicides applied to the organic strawberry fields for post-harvest control of gray mold (*Botrytis cinerea*), in contrast to multiple fungicide applications to the conventional fields.

Health benefits of Organic Strawberry:

Olsson *et al*. (2006) reported decreased proliferation of breast and colon cancer cells by extracts of organically grown strawberries compared to conventional berries, with ascorbic acid concentrations correlated negatively with cancer cell proliferation. Organic foods could reduce human cancer risks compared with conventional foods (Winter and Davis, 2006).

CONCLUSIONS

Organic food is mostly preferred by elite consumers now-a-days. The sale of organic food is one of the fastest growing market segments within the global food industry and people often believe organic farm products to be more nutritious and tastier. In some cases, organic foods may have higher levels of plant secondary metabolites, this may be beneficial with respect to suspected antioxidants such as polyphenolic compounds, but also may be of potential health concern when considering naturally occurring toxins (Winter and Davis, 2006). While many studies demonstrate qualitative differences between organic and conventional foods, it is too early to conclude that either food system is superior to the other with respect to safety or nutritional composition. Pesticide residues, naturally occurring toxins, nitrates, and polyphenolic compounds exert their health risks or benefits on a dose-related basis, and data do not yet exist to ascertain whether the differences in the levels of such chemicals between organic foods and conventional foods are of biological significance. Thus further intensive research is required to prove the valid superiority of organically produced strawberries over conventional farming system.

Indian Dairy Sector: Promoting Growth through Dairy Extension

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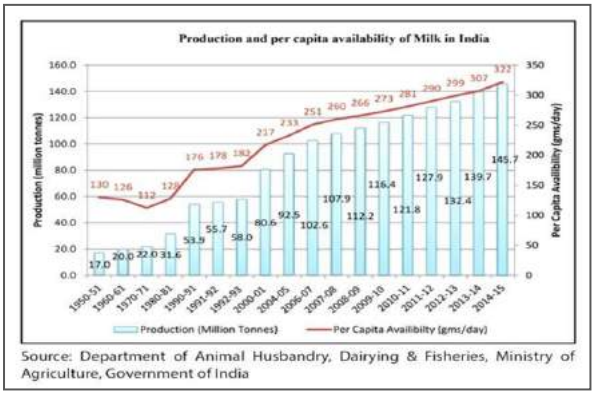
INDIAN DAIRY SECTOR: OVERVIEW

India Ranks First in Milk Production (146.3 MT) in the world (18.5 Per cent of World Milk Production in year 2014-15). Milk Production in India Recorded a growth of 6.26 % compared to 3.1% of the world (2013-14 to 2014-15) . Per capita consumption of milk has increased from 130grams per day in year 1950-51 to 322 grams per day.



Source: Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India

CHARACTERISTICS OF INDIAN DAIRY FARMING

Indian dairy is a classic example of production by masses rather than mass production. The nation's milk supply comes from millions of small producers, (around 70 million rural households) viz. landless labourers, women, marginal, small, medium and large farmers.

More than 70 per cent of the rural households possess a mere 21.8 per cent of land holdings. They, however, own as much as 64.8 per cent of total milch animals. Thus the distribution of milch animals is more even and much less skewed than the distribution of land-holdings.Dairying as an important source of income, employment & plays multi-faceted role in socio-economic development. It supplements income from crop production & reduces seasonality in livelihood patterns of rural poor .Almost 80 % of livestock products still come from small farmers with 3-5 animals .(Rangnekar, D.V, 2001).

The Livestock sector contributes over 25% to the GDP of Agriculture. More than 70 per cent of the rural households possess a mere 21.8 per cent of land holdings. They, however, own as much as 64.8 per cent of total milch animals. Thus the distribution of milch animals is more even and much less skewed than the distribution of land-holdings.

Impediments in growth

- Poor sanitary standards of milk/milk products
- Perishablity of milk
- Low genetic potential of animals
- Lack of infrastructure & market access

Opportunities

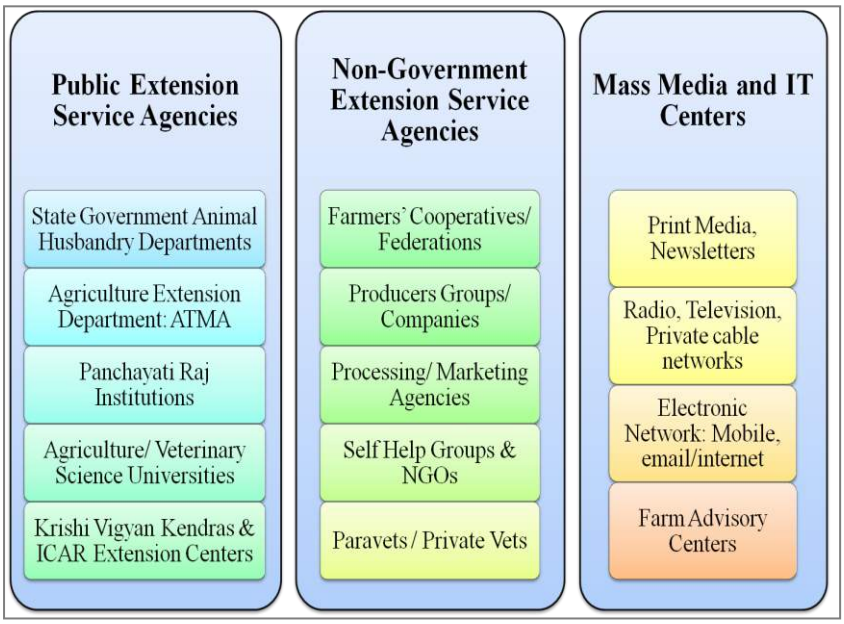
- Large domestic market
- Value addition: scope for innovations
- Tapping potential of Unorganized dairy sector that accounts for nearly 85 %

WHY DAIRY EXTENSION?

- Extension is the key to success of livestock development, through active involvement of small livestock keepers.
- It is almost impossible to ensure effective transfer of technologies needed for enhancing the productivity of dairy animals, without and effective extension programme.
- Assisting farmers through an educational process to improve livestock farming methods & techniques, strengthen the infrastructure & services, to increase production efficiency & income, and enable them to enhance their quality of life. *(Hegde G. Narayan,2012)*

EFFECTIVE DAIRY EXTENSION

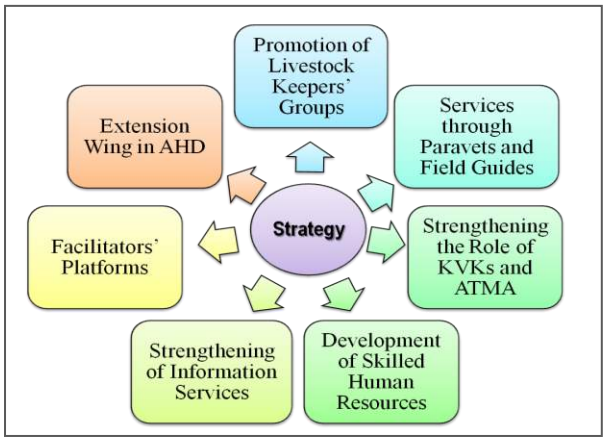
Agencies Involved in Dairy Extension



Need for Revised Focus on Dairy Extension

- Awareness about the problems & opportunities
- Motivation of small farmers to adopt good management practices to optimize production, reduce cost of production & enhance profits
- Promotion of eco-friendly animal husbandry to reduce the ill-effects on bio-diversity & global warming
- Facilitate economical production of critical inputs & delivery of services for improving the productivity
- Bring all the stakeholders on a common platform to improve the value chain
- Develop strong people's organizations for self sustainability

STRATEGY FOR STRENGTHENING DAIRY EXTENSION



CONCLUSIONS

Dairying is the breadwinner for a majority of the rural population in India. But its potentials are not optimally harnessed due to ineffective technology transfer. Extension plays a vital role in livestock productivity enhancement. It is necessary to launch an effective animal husbandry extension programme, for transfer of appropriate technologies. Extension programme should be able to mentor livestock holders to organize themselves, while promoting value chains, involving private and voluntary sectors, to provide critical services & enhance their profitability.

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Soil Acidity- A Potential Threat for Soil Productivity

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Managing to feed the ever increasing population with reducing agricultural area is a big challenge to the agricultural society and this is the high time to overcome the constraints which are affecting the agricultural production and productivity. Acid soils are base unsaturated soils having hydrogen ions concentration above a reasonable limit or pH below 7.0 which is one of the factor affects agricultural production. If the number of hydrogen ions in a solution is more, the greater will be its acidity at the same time the pH count will be the lesser pH. Soil acidity is an important factor for crop production which deals with the nutrient availability to the crop. These soils are extensively found in the region of high rainfall and temperature.

Extend of acid soils in India:

Acid soils are formed due to drastic weathering under hot humid climate and heavy precipitation. Acid soils constitute about 30 % of the total cultivable area in India. Maji *et al.* (2012) reported that out of the country's total geographic area, strongly acid and moderately acid soils covered 6.24 (1.9 %) and 24.41 (7.4 %) Mha respectively. In the north-eastern region of India, approximately 95% soils are acidic, and nearly 65% soils are suffering from strong acidity with pH less than 5.5 (Sharma and Singh, 2002). North-east region has the largest stretches of acid soils followed by West Bengal, Bihar and Orissa. In the coastal region of Kerala and in Western Ghats, high rainfall and temperature have contributed to the development of acid soils. The acid soils of India are mostly found in the Himalayan region, eastern and north eastern region, peninsular India and coastal plains of different agro climatic situations (Bhattacharya *et al.,* 2015). Punjab, Haryana, Rajasthan and Gujarat are the only states in India where acid soils do not occur.

MAJOR CAUSES OF SOIL ACIDITY:

1. ***Rainfall and leaching***: Excessive rainfall is an effective agent for removing basic cations. Rainfall is most effective in causing soils to become acidic if a lot of water moves through the soil rapidly. The continuous removal of basic cations reduces the soil pH and also increases the soil acidity. Sandy soils are tend to become acidic than other textured soils

because rapid water movement in sandy soils.

2. ***Acidic parent material***: The acidic parent materials will form acidic soils over a period of time by weathering process due to differences in chemical composition of parent materials. Thus, soils that developed from granite material are likely to be more acidic than soils developed from calcareous shale or limestone. Eg. Rhyolite and the granites are typical acid igneous rocks.

3. ***Organic matter decay***: Decaying organic matter produces H^+ which is responsible for acidity. The carbon dioxide (CO_2) produced by decaying organic matter reacts with water in the soil and forms a weak acid called carbonic acid.

4. ***Application of acid forming fertilizers:*** Continuous use of acid forming fertilizers (eg. ammonium sulphate, ammonium chloride, etc) for years may also lead to considerable reduction in soil pH.

Classification of Acid Soils: (USDA, 1993)

According to the intensity of acidity, the acid soils are classified into following types:

(1) Slight acidic (pH range 6.6 to 6.1)
(2) Moderately acidic (pH 6.0 to 5.6)
(3) Strong acidic (pH 5.5 to 5.1)
(4) Very strong acidic (pH 5.0 to 4.6)
(5) Extremely strong acidic (pH 4.5 to 3.5)
(6) Ultra acidic (pH < 3.5)

EFFECTS OF SOIL ACIDITY ON CROP PRODUCTION:

- Clays and organic matter in the soil carry a negative charge. These negative charges are balanced by the positive charges of certain plant nutrients, in particular calcium (Ca^{2+}), magnesium (Mg^{2+}) and potassium (K^+). As soils acidify, concentrations of some elements, in particular Hydrogen (H^+), Aluminium (Al^{3+}) and Manganese (Mn^{2+}), increase and they take the place of nutrients such as calcium and magnesium on the clays and organic matter.
- In addition to $Ca^{2+}$and Mg^{2+}, the micronutrients like Sulphur, Boron, Molybdenum, Zinc are reduced in the acid soils and frequently limit the plant growth on acid soils.
- In the case of molybdenum, most soils contain adequate reserves of this nutrient for plant growth, but its availability for plant uptake is minimized under acid conditions.
- When soil pH drops, Aluminium, manganese, iron becomes soluble and the amount of these elements in the soil solution increases and may reach in toxic levels. So the soil phosphorus will fix as Iron phosphate and Aluminium phosphate and reduces the availability of P for crop requirement. The availability of nutrients at different level of soil pH is represented in Fig. 1.

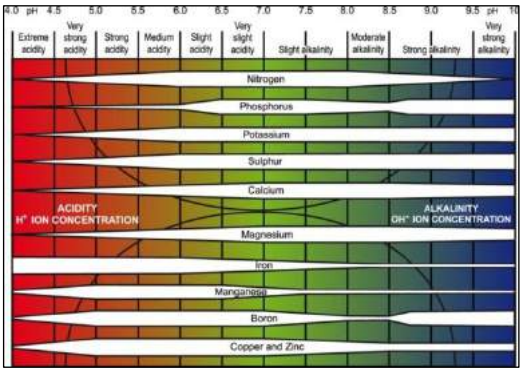

Fig. 1. Availability of soil nutrients at different soil pH

- Under acidic condition, typically, roots become thick and stubby and there is little development of the all-important fine roots. They are the main causes of crop failure in acid soils. Since, the higher concentration of aluminium and manganese hinders the root growth and restricts the water absorption and nutrient uptake by the root hairs. This usually results in stunted, discolored growth and poor yields and ultimately results in crop failure.
- Importantly, in seasons of reduced rainfall, aluminium toxicity greatly magnifies the effects of drought.
- Where sub soils are also acidic, the situation with regard to moisture supply is aggravated further in that moisture reserves in the subsoil are largely unavailable to plants because of restricted root penetration into the lower soil layers. Under these conditions it is common to see plants displaying symptoms of drought stress even on relatively moist soils.
- As the growth of microorganisms is affected by the soil acidity, the amount of nutrient recycling by microorganism is reduced. It affects the microbial population balance, under acidic condition fungi predominates over bacteria.
- Agricultural crops do not all respond in the same way to acid soil conditions, but vary widely in their tolerances to soil acidity. Certain vegetables and temperate legumes are highly sensitive to acid soil conditions, while crops such as cowpeas and sugarcane are highly tolerant. Nevertheless, severe soil acidity has been shown to limit the growth of all species, including the highly tolerant ones. Thus, the management of soil acidity is an essential component of sustainable production practices, regardless of the crop grown.

MANAGEMENT OF SOIL ACIDITY:

Management of acid soils should aim at realization of production potential either by addition of amendments or by manipulation of agricultural practices to derive optimum crop yield under acidic conditions. The impact of soil acidity on crops can be reduced by various management practices as follows,

- Usage of nitrogenous fertilizers which cause less acidification
- Efficient irrigation management to minimize leaching. In lowlands systems, flooding may be an effective technique in raising the pH of the soil, though it is reversible.
- Growing deep-rooting perennial species to take up nitrogen from greater depths.
- Addition of organic matter is a viable option to manage problems associated with soil acidity. In addition, organic matter forms strong bonds, known as “chelates,” with aluminum. Chelation reduces the solubility of aluminum and soil acidity and also increases the base saturation and cation exchange capacity.

- Like organic matter, wood ash increases base saturation and forms chelates with aluminum.
- Growing acid tolerant crops or crop varieties more tolerant of acid soils. Sugar cane and bananas are examples of acid tolerant crops. Some plants are adversely affected and they suffer injuries when grown in acid soils. Familiar crops which can endure fairly acidic soil conditions are oat, rice and linseed and those which are not adapted to acid soils are wheat, barley, cabbage, sorghum (Jowar), tobacco, lettuce, spinach, onion, eggplant or brinjal (Kunhikrishnan *et al.,* 2016).
- Regularly applying lime to counter the acidification inherent in the agricultural system. Liming can significantly improve the physical, chemical and biological properties of soil. There can be significant improvement in yield due to increased availability of several plant nutrients. Soil testing for pH is essential for finding out approximately correct dose of liming material. Lime requirement to bring the soil pH from one level to another, the table.1can be referred which provides pH value of the soil and recommended dose of pure calcium carbonate to be used in an acre of land.
- In addition to liming, acid soil management includes integration of nutrient management practices with in situ soil moisture conservation technology, agro-forestry using a system approach of crop production to meet the food and nutritional security of the farmer. Residue incorporation, minimum tillage, conservation agricultural practices can also increase the crop productivity in acid soil regions.

Table 1: Lime requirement to bring the soil to Indicated pH (Shoemaker et al., 1961)

pH of soil buffer suspension	Lime required to bring the soil to indicated pH (*in tonnes per acre of pure calcium carbonate i.e.$CaCO_3$*)		
	pH 6.0	pH 6.4	pH 6.8
6.7	1.0	1.2	1.4
6.6	1.4	1.7	1.9
6.5	1.8	2.2	2.5
6.4	2.3	2.7	3.1
6.3	2.7	3.2	3.7
6.2	3.7	3.7	4.2
6.1	3.5	4.2	4.8
6.0	3.9	4.7	5.4
5.9	4.4	5.2	6.0
5.8	4.8	5.7	6.5
5.7	5.2	6.2	7.1
5.6	5.6	6.7	7.7
5.5	6.0	7.2	8.3
5.4	6.5	7.7	8.9
5.3	6.9	8.2	9.4
5.2	7.4	8.6	10.0
5.1	7.8	9.1	10.6
5.0	8.2	9.6	11.2
4.9	8.6	10.1	11.8

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Protothecosis: An Emerging Algal Disease of Domestic Animals

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Protothecosis is a rare algal disease of humans and animals caused by achlorophillus saprophytic algae of the genus Prototheca which are considered to be relatives of green algae. The species which are pathogenic to animals include *Prototheca wickerhamii* and *prototheca zopfii*. The disease occurs in either systemic form which is most often caused by P. zopfii or rare cutaneous infection which is associated with *P. wickerhamii*.

EPIDEMIOLOGY:

The organism is ubiquitous in nature and is commonly found in sewage, slime flux of trees and in animal wastes. Despite of the abundance of this organism, sometimes it causes disseminated disease in dogs across Asia, Africa, Europe and North America. In animals this disease was first described as a cause of mastitis in cattle and since then the disease has been reported in dogs, cats and goats. Infections are usually associated with immunosuppressed state or from injury to the skin.

Pathogenesis:

Protothecosis is an opportunistic infection that occurs when the organism comes into contact with injured skin or mucosa. Immunosuppressed animals are at greater risk of infection. Disease is manifested either in systemic form or cutaneous disseminated form. In the systemic form of the disease, the organism when ingested enters the body via intestinal mucosa and spreads throughout body haematogenously or through lymphatics. It was also reported that prototheca spp. may directly alter neutrophil function thus promoting its establishment, persistence or dissemination. *P. zopfii* can also affect antioxidant enzyme and hydrogen peroxide production by milk neutrophils without altering opsonisation or killing of organisms. Aspiration of spores of prototheca can cause local irritation to nasal epithelium and as spores multiply it will cause granulomatous lesion and abcessation.

CLINICAL SIGNS:

Dogs:

Clinically affected dogs are presented with either cutaneous or disseminated systemic infection. *P. wickerhamii* is associated with cutaneous infection. Skin lesions consist of nodules and draining ulcers with crusty exudates on the trunk, pinnae, scrotum, foot pads and mucosal

surfaces. Hyperkeratosis and secondary bacterial infection may present.

The systemic form of protothecosis is caused by *P. zopfii.* Organs commonly affected include large intestine, central nervous system, eyes, kidneys, liver, heart, myocardium, lymph nodes, thyroid, pancreas, peritoneum and diaphragm. Clinical signs in the systemic infection depend on the organ system involved. Most commonly reported clinical signs include severe intermittent haemorrhagic enteritis occurring as a result of involvement distal gastro intestinal tract especially due to colitis. In case of meningioencephalomyelitis, clinical signs observed are seizers, central vestibular disease, blindness, deafness, altered mendation, ataxia or lower motor neuron deficits.

Cats:

Protothecosis is very rare in cats either due to natural resistance to infection or avoidance of contaminated environmental niches. Clinical signs and lesions are non-ulcerated cutaneous or subcutaneous masses on the forehead, distal limbs, tail base, nose or pinnae without any regional lymphadenopathy.

Bovines:

Chronic progressive pyogranulomatous lesion of mammary gland was reported in affected cows. Affected cows serve as potential source of infection with permanently reduced milk yields.

Goats:

The disease is manifested as mucopurulent nasal discharge, inspiratory dyspnoea, sneezing with proliferative nodules in the nasal mucosa of both nostrils.

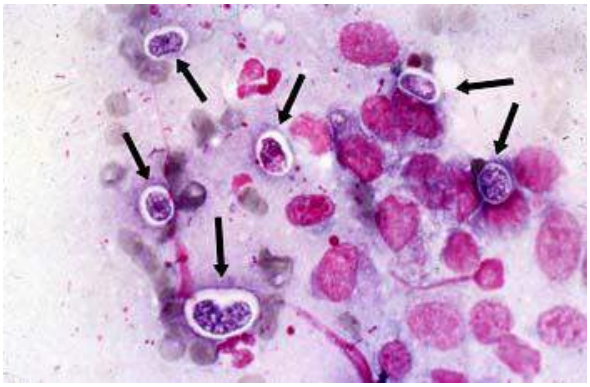
Lesions:

Masses of prototheca cells may be found in the dermis, subcutis, adjacent skeletal muscles and lymph nodes. Microscopic lesions composed of macrophages and multinucleated giant cells arranged in solid sheets in dermis and subcutis. Tissue reaction is variable and plasma cells, lymphocytes and neutrophils may also present. In tissue sections, *prototheca sp.* appears as round or oval cells with a distinct wall and granular cytoplasm. The cell wall stains poorly in H&E stained sections and can be missed if very few in number. But the wall is strongly positive to PAS staining. Characteristic endospores are usually observed within the cytoplasm of infiltrating cells.

DIAGNOSIS:

1. Based on clinical symptoms and lesions
2. Histopathology of colonic biopsies, skin and lymph nodes.
3. Definitive diagnosis requires isolation and culture of the organism from urine, CSF, rectal scrapings, aspirates or biopsies of eyes and PCR.

(Paw of a dog with draining ulcers associated with cutaneous protothecosis. Sourse; vetbook.org)



(Rectal scraping from a dog with protothecosis. Organisms (arrows) are delineated by a thin cell wall, vary size, and have a granular internal structure. Source vetbook.org.)

TREATMENT

Treatment is usually unsuccessful in most of the cases due to difficulty in eliminating the organism from the system because of the disseminated and intracellular location. Protothecal isolates were sensitive to amphotericin B, gentamicin, nystatin, and polymyxin B but systemic administration of these drugs does not produce any clinical response. Combination therapy with amphotericin B and itraconazole have been successefully tried in some cases. Tetracycline, ketoconazole and clotrimazole have been used as an attempt to treat the disease. Antimicrobial effects of tree oils like tea tree and bergamot oil have been evaluated with nospecific *prototheca sp.* Surgical debulking may assist clinical resolution of symptoms

LUPIN: The Next Human Health Food

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INTRODUCTION

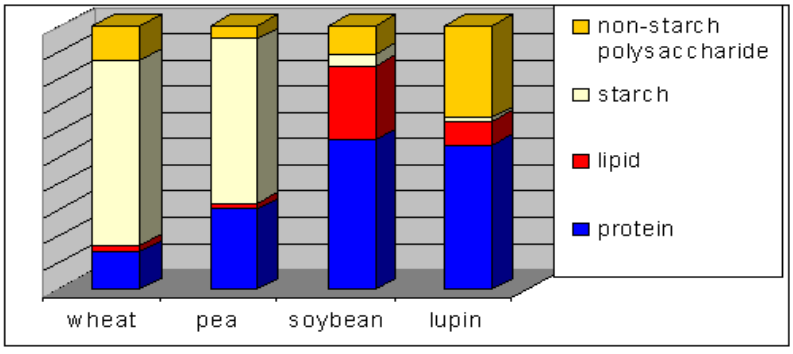
"Australian Sweet Lupin" refers the legume crop of *Lupinus angustifolius* (narrow leafed lupin) cultivated in Australia. Australian Sweet Lupin is related to other legumes, including peanuts and soy. There are 12 lupin species within Lupinus genus, which are native to Europe and the Mediterranean regions. The lupin grain is high in protein (40-45%) and dietary fibre (30%), low in fat (6%) and has minimal starch giving it a very low Glycaemic Index (GI). There has been increasing interest from the food industry, as evidence from research clearly indicates that lupin has great potential as a food ingredient. Lupin ingredients have been included in a range of highly palatable breads, baked goods, meat products and beverages. However the most exciting story to emerge is lupin's amazing attributes in terms of health benefits, particularly in relation to a number of conditions now known as 'metabolic syndrome' which includes a cluster of factors such as, obesity, high blood pressure, insulin resistance and elevated blood cholesterol. Lupin has been used in food products in France, Germany, Britain, Holland Belgium, Denmark, Sweden, Portugal and Italy as well as the South American countries of Chile and Peru often as a substitute of soybean.

Table 1: Chemical composition of Australian Sweet Lupin kernels

Component	% of kernel weight
Moisture	12
Protein	41
Fat	7
Ash	3
Lignin	1
Polysaccharides	29
Oligosaccharides	6
Minor components	1
Total	**100**

Figure 1: Comparative nutritional content of Lupin with other seeds

Table 2: Comparison between nutritional composition of soybean and Australian sweet lupin



Nutritional content	Lupin	Soybean
Protein	40%	40%
Fat	6%	20%
Dietary fibre	30%	12%
Antinutritional factors		
Trypsin inhibitor(mg/g)	0.14	17.9
Saponins (mg/kg)	573	19000
Phytates (%)	0.58	1.59

Potential health benefits of Australian Sweet Lupin:-

1. **Low GI (Glyceamic Index):-** The Australian Sweet Lupin is high in protein (30-35%) like soybean but is significantly higher in dietary fibre (30%) and lower in oil (6%) and contains minimal starch. It therefore has a very low GI, which has significant implications for modern societies with an increasing incidence of obesity and associated risk of diabetes and cardiovascular disease. Lupins (Australian Sweet Lupin & *L. albus*) have the lowest GI of any commonly consumed grains.

i. Lower post-digestion glucose rise
ii. Reduced daily mean insulin levels
iii. Lower total and LDL cholesterol levels
iv. Reduce liver cholesterol synthesis
v. Decrease serum Apolipoprotein B levels
vi. Decrease 24h urinary C-peptide output
vii. Higher satiety rating, control appetite

2. **Effect of lupin on Appetite / obesity: -** High protein and fibre content of lupin has the potential to increase the protein and fibre in the diet. Lupin enriched food increase satiety and reduces appetite. Such diets may influence satiety via effects on appetite-regulating hormones suchas ghrelin, a peptide that is released from the stomach and acts on the central nervous system to stimulate food intake. The protein and fiber contents in the diet may be an important determinant of ghrelin secretion, thereby influencing post meal satiety and subsequent energy intake.

3. **Type 2 diabetes:-** Partial replacement of refined carbohydrate in foods with lupin protein can reduce glucose / reduce the GI / this assist in the management of type 2 diabetes. Higher fibre diets have been associated with reduced risk of type 2 diabetes. Both dietary fibre and protein reduces postprandial glycaemia. As lupin enriched food contain higher amount of dietary fibre and protein whih result in reduction of postprandial glycaemia. This is due to several factors including an increase in viscosity, an increase in gastrointestinal solids, a delay in gastric emptying time, the presence of hypoglycemic photochemical and the increased protein and/or fibre content.

4. **Blood pressure: -** Dietary protein and dietary fibre have independent and additive effect on lowering blood pressure in humans. Lupins are one of the largest natural sources of the amino acid arginine, which has been implicated in having beneficial effects on endothelial function (improved blood vessel performance). It found lupin inclusion in the diet had a protective effect by normalizing vascular function of salt loaded rats. By study, it was also found that lupin

kernel flour enriched bread reduces blood pressure in human due to increase in protein and fibre in the bread.

5. **Effect on cholesterol:-**Lupin fibre acts as a soluble fibre and drops the total cholesterol without affecting the HDL cholesterol. A study by Hall *et al* (2005) involving 38 men ate a control diet and a diet of food products enriched with Australian sweet lupin fibre for a month each found that the lupin-enriched diet lowered total blood cholesterol by 4.5 percent and the bad LDL cholesterol by 5.4 per cent.
6. **Improve bowel health:-**Johnson *et al* (2006) found that Australian Sweet Lupin foods reduce transit time, lower the colon pH (anti cancer) and act as a 'pre-biotic' therefore are potentially very beneficial for bowel health.

Source of isoflavones (nutraceuticals): Australian Sweet Lupin sprouts are an excellent source of isoflavones a group of molecules often referred to as 'phytoestrogens'. Research from various sources indicates that consumption of isoflavones may play a role in lowering risk for disease. Isoflavones are natural antioxidants. The isoflavones diadzein and genistein may improve bone health by conserving calcium and thereby reducing the risk of osteoporosis. Some isoflavones are believed to inhibit the growth of cancerous cells for example studies show isoflavones slowed prostate cancer growth by causing prostate cancer cells to die. Isoflavones act against cancer cells in a way similar to many common cancer-treating drugs.

Use of Australian Sweet Lupin in foods: With Australian Sweet Lupins ability to enhance protein content and aesthetics of baked products there are significant opportunities for the future. Australian Sweet Lupin can improve the nutritional value, health benefits and consumer acceptability of a variety of foods. Food manufacturers would also benefit by the substitution of a low cost food ingredient. Technologists believe potential food applications may include: sprouts, fermented foods as meso and tempe, high protein and high energydrinks, snacks ans ready to eat meals, milk type beverages, yoghurts probiotics and tofu, baked foods such as breads, cakes, muffins, biscuits and donuts**,** vegetarian meal like products, Lupin substituted meat analogues & sausages, Whipped products fillings and glazing, ice cream, cream desserts, mayonnaise and dressings, Noodle and pasta products, High dietary fibre foods, including weight reduction diets

Protein Concentrates and Isolates:- Australian Sweet Lupin protein concentrates and isolates can be used in pâté, potted mince, sausages, mousses for their binding and emulsifying properties as well as their capacity to substitution for meat proteins and egg proteins. Australian Sweet Lupin protein in particular, act in meat preparations as a structure and texture stabilizer on the basis of synergistic impact with meat components and added ingredients like gums, hydrocolloids and phosphate. One or several of the following properties are responsible for successfully using Australian Sweet Lupin protein concentrates in meat preparations:

- Emulsifier for free animal fat

- Binder for added water/ice
- Meat juice absorber
- Matrix binder for larger meat particles ("sticking" effect)
- Softener and creaminess promoter in spreadable sausages
- Dry-out controller and accelerator in dry/fermented sausages
- Gel strengthener and syneresis inhibitor in cooked sausages

Problem with use of lupin

Lupin species cannot consumed directly because they contain quinolizidine alkaloids, mainly sparteine and lupanine, giving a bitter taste in white lupin and causing respiration problems and liver damage.Allergic reactions to lupin have been reported on ingestion or inhalation of lupin seed proteins. It contain flatulance causing factors alpha-galatosides.

Solution to overcome the problems:-

- The presence of alkaloids proves to be non-toxic at low conc.
- Also it has possible to grow sweet genetic varieties with low alkaloid content. Bitterness can be reduced by-Boiling and Steeping.
- Alpha-galactoside can be reduce by giving some treatment like: Fermentation, Germination, Dehusking, Soaking and cooking

CONCLUSION

Lupin which is not as commonly consumed as the other legume is a very healthy crop. The high protein, dietary fibre, oils, the relatively balanced fatty acids and the vitamin B level make it a good source of food material. It is a potential future healthy food. Lupin is an economical and nutritive food for a very rapidly increasing world population. Many drugs and cosmetic products are also available in the market not only in Australia but also in India.

Indian gooseberry- A brief note

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Indian Gooseberry, also known as Amla belongs to the *Euphorbiaceae* family. This fruit ripens in the autumn in wet, forested, hilly areas on the Indian subcontinent. In India it is considered as a sacred tree. The fruit is very nourishing, but it tastes sour. Both dried and fresh fruits can be consumed for their health benefits. Indian gooseberry is a tree that grows in India, the Middle East, and some Southeast Asian countries. Indian gooseberry has been used in ayurvedic medicine for thousands of years.

Today people still use the fruit of the tree to make medicine. Gooseberry is very rich in vitamin C, & containsany minerals and vitamins like ca lcium, phosphorus, iron, carotene and vitamin B complex. Vitamin-C is a good antioxidant agent, which makes gooseberries a powerful tool against a variety of conditions, including various types of cancer. It provides remedies for many diseases, so it is widely used in ayurvedic treatment. Many health problems are caused by oxidative damage, when body cells use oxygen; they produce by-products called free radicals that can cause damage. Antioxidant agents prevent and repair these damages.

HOW DOES IT WORK?

Indian gooseberry seems to work by reducing total cholesterol levels, including the fatty acids called triglycerides, without affecting levels of the "good cholesterol" called high-density lipoprotein (HDL).

HEALTH BENEFITS OF AMLA

Hair care: Amla is used in many hair tonics as it enriches hair growth and pigmentation. Eating fresh gooseberry or applying its paste on hair roots improves hair growth and color. Amla oil is very popular in India because it has been shown to reduce the chances of hair loss and baldness.

Eye Care

Drinking Gooseberry juice with honey is good for improving eyesight, and studies have shown it to improve nearsightedness and cataracts, while reducing intra-ocular tension. Vitamin A and carotenes reduce macular degeneration, night blindness, and strengthen vision before the age-related degeneration from free radicals can occur.

Calcium Absorption

Calcium is an essential component of our bones, teeth, and nails. So, eating vitamin C-rich Indian gooseberries is a great way to keep body looking and feeling great.

Metabolic Activity

Eating foods that are high in protein is one of the most important ways to stay healthy, since proteins are an essential part of our body's metabolic activities. Our enzymes can breakdown plant proteins into amino acids and reassemble them into usable proteins for our body.

Menstrual Cramps

Some of the minerals and vitamins in amla combine to make it very useful in the treatment of menstrual cramps. Since it takes a while for the necessary elements to accrue in the body, it is better to consume Alma on a regular basis so it is always in the system and menstrual cramps can be prevented every month for women.

Diabetes: Gooseberry contains chromium, which has a therapeutic value for diabetic patients. Indian Gooseberry stimulates the isolated group of cells that secrete the hormone insulin, thereby reducing blood sugar in diabetic patients and keeping their body balanced and healthy.

Diuretic Activity: Besides being a fruit that is very high in water, amla is also slightly diuretic in nature. This means that it increases the frequency and volume of urination. Urination helps our body eliminate unwanted toxins and excess levels of water, salts, and uric acid.

Digestion

Alma is very high in fiber, like most fruits. Fiber adds bulk to the stool and helps food move through the bowels and keeps your bowel movements regular. Fiber also stimulates the secretion of gastric and digestive juices, so food is digested efficiently.

Heart Disease:

Gooseberry strengthens the heart muscles, so the heart pumps blood smoothly throughout the body. By reducing excess cholesterol build-up, the chromium can reduce the chances of atherosclerosis, or plaque build-up in the vessels and arteries. This can reduce the chances of strokes and heart attacks.

Infection

Due to its antibacterial and astringent attributes, Indian Gooseberries protect the body against infection and improves the body's immune response.

Diarrhea and Dysentery

Due to its strong cooling and laxative properties, Gooseberry is a useful component in remedies for diarrhea and dysentery. It provides great relief for gastric syndrome and hyperchlorhydria (burning sensation in the abdomen).

Improving Appetite

Consuming Gooseberry powder with butter and honey before a meal improves appetite. It also helps to balance nitrogen levels, thereby increasing weight in a healthy way.

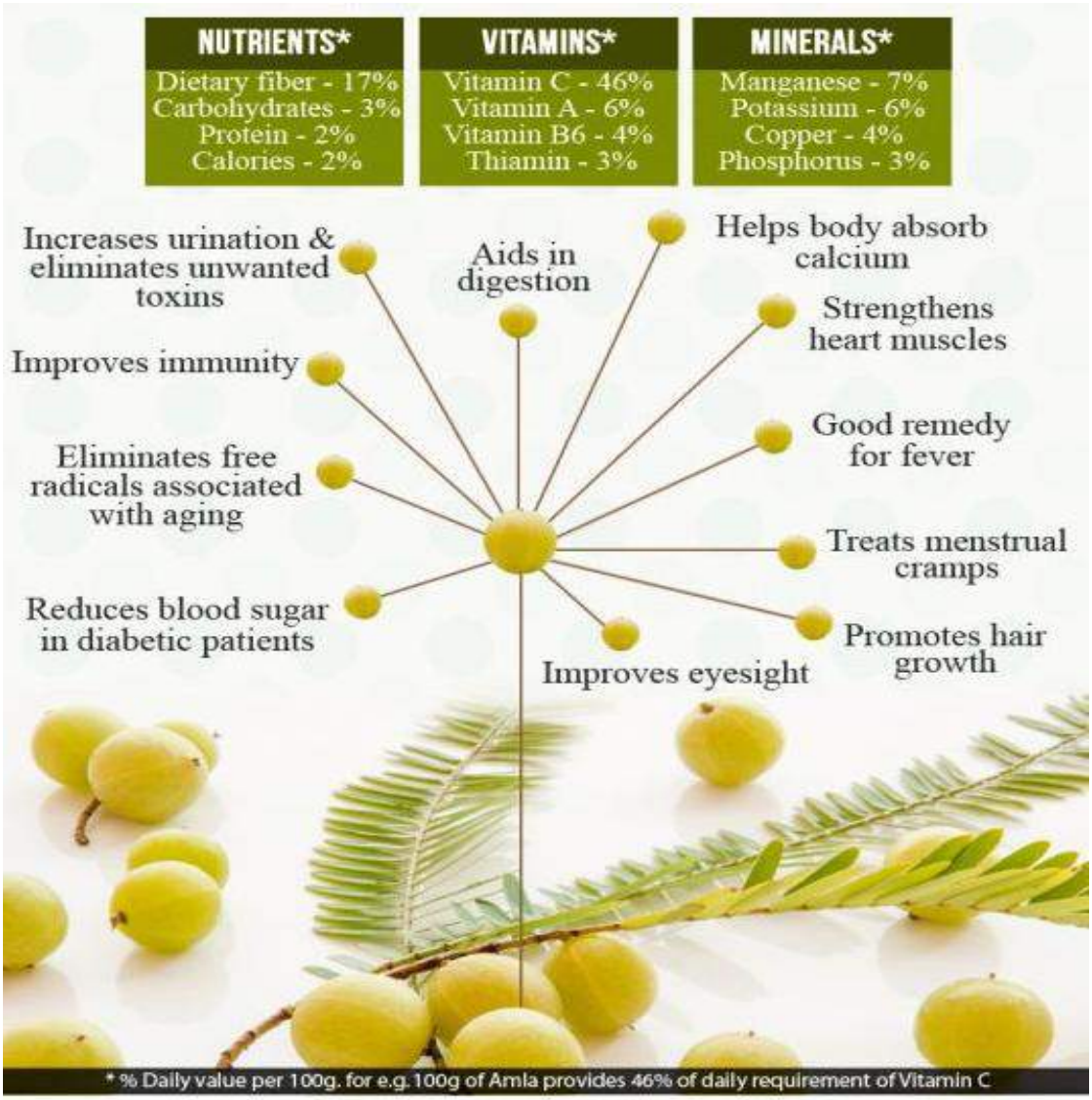
Anti-Aging

Amla prevents health-related hyperlipidaemia by reducing the amount of free radicals in the body through its antioxidant qualities. Gooseberry

lowers cholesterol levels, increases red blood cell production, and strengthens teeth and nails.

CONCLUSION

If we consume Indian Gooseberry (Amla) as a fresh fruit, juice, or dried form, it enhances big improvement in the overall health.



Panchagavya:

a boon to organic farming, animals and human beings

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Global awareness of health and environmental issues is increasing in recent years and there is a growing demand for organically grown food products world wide. Before the Green Revolution, cultivation was mostly by natural and traditional farming methods which involved natural methods of maintaining soil fertility and controlling crop pests. Consequent upon Green Revolution, the use of high yielding and fertilizer responsive varieties and cultivation system has been intensified and this prompted the use of chemical fertilizers and pesticides. Indiscriminate use of chemical fertilizers and pesticides led to several harmful effects on soil, water and environment causing their pollution and decline in the productivity of the soil.

Inspite of the intensive use of inputs for about half a century in Indian agriculture, the yield gap in various crops still remains large even after following the best practices. Also the agricultural lands continue to shrink and there is a greater threat to global environment and soil resources. These threats are erosion of biodiversity and change of climate marching towards desertification and environmental, soil, air, water and food pollution. Hence, there is now a great concern to maintain soil health and protect environment by popularizing eco-friendly and cost effective organic manures.

In fact, organic agriculture is a holistic way of farming with an aim of conserving the natural resources through the agronomic practices and the use of locally available low cost inputs in order to maintain soil fertility and conserve the rich bio-diversity to provide safe clean water, air and to achieve economical sustainability.

Due to the prohibitive cost of chemical fertilizers, majority of Indian farmers who are mostly marginal and small, do not apply the recommended dose of fertilizers. They are using indigenous organic manures as sources of nutrients. These organics are bulky in nature but, contain reasonable amount of nutrients. Our experiences reveal that the supply of nutrients through organics alone has failed to maintain yield level in a short period. The combined application of organics such as FYM, compost, green leaf manure, vermicompost *etc*. and liquid organics *viz.,* Jeevamrut, Beejamrut, Panchagavya, Gomutra, Angara, Vermiwash *etc.,* which contain microbial count and plant growth promoting substances (PGPR) stimulate growth,

yield and quality of crops. Further it helps to build soil organic matter status besides minimizing the cost of cultivation. Panchagavya a promising natural liquid manure is being used by many organic farmers in many crops in different parts of our country. In this context, it is felt that organic nutrition is a remedy to manage the ill effects of chemical farming so as to manage soil health for sustaining the soil productivity and quality of crops.

PANCHAGAVYA PREPARATION

Ingradients:

Fresh cowdung (7 kg) and ghee (1 kg) to be mixed together and keep in a plastic bucket for two days. The mixture has to be mixed daily once. On the third day, three litres of cow urine, ten litres of water to be added and has to be fermented for 12 days. Then, two litres of curd, two litres of milk, 100 g of yeast, two litres of coconut water, 250 g jaggery and 12 ripe bananas to be added and contents to be stirred for 15 days thoroughly thrice a day. Afterwards, mixture to be filtered through a cotton cloth and can be used for foliar spray @ 3 per cent.

PROPERTIES OF PANCHAGAVYA

Panchagavya possess almost all the major nutrients, micro nutrients and growth harmones (IAA & GA), fermentative microorganisms like yeast and lactobacillus

Fatty acids	Alkanes	Alconol and Alcohols
Oleic acids	Decane	Heptanol
Palmitic acid	Octane	Tetracosanol
Myristic	Heptane	Hexadecanol
Deconore	Hexadecane	Octadeconol
Deconomic	Oridecane	Methanol, Propanol, Butanol & Ethanol
Octanoic		
Hexanoic		
Octadeconoic		
Tetradeconoic		
Acetic, propionic, butyric, caproic and valeric acids		

Chemical composition		
pH	:	5.45
EC dSm2	:	10.22

Total N (ppm)	:	229
Total P (ppm)	:	209
Total K (ppm)	:	232
Sodium	:	90
Calcium	:	25
IAA (ppm)	:	8.5
GA (ppm)	:	3.5
Microbial Load		
Fungi	:	38800/ml
Bacteria	:	1880000/ml
Lactobacillus	:	2260000/ml
Total anaerobes	:	10000/ml
Acid formers	:	360/ml
Methanogen	:	250/ml

Beneficial effects of Panchagavya on commercial crops

Panchagavya play the role of promoting growth and providing immunity in plant system. Generally panchagavya is recommended for all the crops as foliar spray at 30 % level (3 litre panchagavya in 100 litres of water).

Mango

Induces dense flowering with more female flowers. Irregular or alternate bearing habit is not experienced and continues to fruit regularly. Enhances keeping quality by 12 days in room temperature. Flavour and aroma are extraordinary

Guava

Higher TSS. Shelf life is extended by 5 days

Acid lime: Continuous flowering is ensured round the year. Fruits are plumpy with strong aroma. Shelf life is extended by 10 days

Banana

In addition to adding with irrigation water and spraying, 3% solution (100 ml) was tied up at the naval end of the bunch after the male bud is removed. The bunch size becomes uniform. One month earlier harvest was witnessed. The size of the top and bottom hands was uniformly big.

Turmeric

Enhances the yield by 22%. Extra long fingers. Ensure low drainage loss. Narrows the ratio of mother and finger rhizomes. Helps survival of dragon fly, spider etc which in turn reduce pest and disease load. Sold for premium price as mother/seed rhizome. Enriches the curcumin content

Jasmine

Exceptional aroma and fragrance. No incidence of bud worm. Continuous flowering throughout the year

Vegetables

Yield enhancement by 18% and in few cases like Cucumber, the yield is doubled. Wholesome vegetables with shiny and appealing skin. Extended shelf life. Very tasty with strong flavour

Time of application of Panchagavya for different crops is given as follows

Crops	Time schedule
Rice	10,15,30 and 50th days after transpalnting
Sunflower	30,45 and 60 days after sowing
Black gram	Rainfed: 1st flowering and 15 deays after flowering Irrigated: 15, 25 and 40 days after sowing
Green gram	15, 25, 30, 40 and 50 days after sowing
Castor	30 and 45 days after sowing
Groundnut	25 and 30th days after sowing
Bhendi	30, 45, 60 and 75 days after sowing

Moringa	Before flowering and during pod formation
Tomato	Nursery and 40 days after transplanting: seed treatment with 1 % for 12 hrs
Onion	0, 45 and 60 days after transplanting
Rose	At the time of pruning and budding
Jasmine	Bud initiation and setting
Vanilla	Dipping setts before planting

Beneficial effects of Panchagavya_for animal health

If animals and human beings take panchagavya, the living micro organisms in the Panchagavya stimulate the immune system and produce lot of antibodies against the ingested microorganisms. It acts like vaccine, and helps to prevent illness and cures disease. Panchagavya improve apetite, digestion and assimilation and elimination of toxins in the body. Constipation is totally cured.

Pigs: Panchagavya feed at the rate of 10 ml – 50 ml/pig depending upon the age and weight, The pigs became healthy and disease free.

Goats and Sheep: The goats and sheep became healthy and gained more weight in a short period after having administered 10 ml to 20 ml Panchagavya per animal per day depending upon the age.

Cows: By feeding at the rate of 100 ml per cow per day, cows become healthier with increased milk yield, fat content and SNF. The rate of conception increased.

Poultry: When fed at the rate of 1 ml per bird per day, the birds became disease-free and healthy. They laid bigger eggs for longer periods.

Fish: If panchagavya was fed to fish ponds, it increased the growth of algae, weeds and small worms in the pond, thus increasing the food availability to fish.

Beneficial effects of Panchagavya_for human health

AIDS/HIV: AIDS/HIV patients regained lost appetite and digestion and put on weight.

Psoriasis: In Psoriasis, it is very effective and the lesions disappear within six months.

Neurological disorders: When given to patients suffering from neurological disorders it helped to reduce the frequency of the attacks in convulsions and reduced shaking of the hands and head in Parkinsonism.

Diabetes mellitus: When 50 ml of filtered Panchagavya per day was taken early in the morning on an empty stomach, it reduced the blood sugar. Complaints like general weakness, indigestion, constipation and burning sensation in the feet disappeared within a month.

Pulmonary Tuberculosis: It can be given in addition to the regular anti-TB drugs. Fever disappeared within a week and cough was controlled within two weeks. Appetite improved and the patients gained body weight.

Arthritis: It completely relieves the joint pain, swelling and stiffness.

CONCLUSION

Panchagavya is an organic tonic which not only improves crop quality and yield but also beneficial in improving animal and human health and controls many diseases and acts as an antibiotic to many animals and human beings.

Traditional Practice against Poultry Disease

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Growth in poultry sector can contribute to enhanced nutrition and poverty reduction in India, because a large share of the rural poor is dependent on poultry for food and income. Traditional medicines have the potential to improve the growth as well as health status of the birds. Ethno veterinary practices involve the traditional beliefs, knowledge, practices and skills pertaining to healthcare and management of livestock and poultry. Ethno-veterinary medicine (EVM) system, an indigenous knowledge on animal health is re-emerging as holistic animal health care.EVM is widely utilized by the family poultry rearers across the country. Antibiotics resistance, residues and withdrawal periods is major problem that affect export marketing. Ethno-veterinary medicine role in organic egg and meat production. Plant and plant parts have been serve as an indispensable source of medicine for indigenous poultry production system. The inherent utility and practical application of indigenous medicinal herbs/plant extract (garlic, cinnamon, tulsi, turmeric, lemon, neem, etc) are used to improving poultry health as well as production with fruitful results.

ADVANTAGE

- Reduces Antibiotics use
- Traditional practice of herbal medicines for poultry health management can diminish the cost of production thereby give more benefit to the farmers.
- Farmers' self dependence.
- Preserve herbs.
- User friendly, Eco friendly.
- Provide some intervention for viral diseases.

ANTI BACTERIAL /ANTI VIRAL/ANTISEPTIC

1. Turmeric – (*Curcuma longa*)
2. Garlic – Anti viral - *Allium sativum*
3. Neem – *(Azadirachta indica)*

Neem is important herbal medicine having different active principle azadrachtin, nimbin, salanin, melicin, etc. Neem oil is selectively activates the cell mediated immune response by activating macrophage and lymphocytes. Apart from this have wide range of pharmacological activities

Neem products

Leaves

Fowl pox -Turmeric and neem paste for external application on pox lesion.

Neem Oil

Used as fly control by spray on litter

Dried fruit

1. Act as Immuno stimulant -0.5 to 1 kg per tonne of poultry feed
2. Thyme oil (*thymus vulgaris)* – Antibacterial.
3. Turmric, Black pepper, thyme used to effective control of clostridium perfringens and enterobacteria.
4. Carica papaya which lyse the bacteria by papain enzyme
5. Sweet flag (Vasambu)
6. *Acalypha indica* (Kuppaimeni)
7. *Tridax procumbens* (Vettukaaya poondu)

7-O-β-D-gluco- pyranoside.

8. Deva-5 is a herb formulation composed of five herbs namely *Momordica cochinchinensis* L., *Gentiana decumbens* L., *Polygonum bistorta* L., *Hypecoum erectum* L. and *Terminalia chebula* Retz showed in vitro antiviral activity against avian influenza A virus subtype H3N8. *Alchemilla mollis* extract synergistically potentiates the anti influenza effect of zanamivir.
9. Sweet wormwood (*Artemisia annual*) extracts inhibited the Newcastle Disease Virus (NDV) proliferation in chicken embryos without causing side effects.
10. Essential oils derived from peppermint and eucalyptus showed protective action in broilers against multiple respiratory pathogens mainly *Mycoplasma gallisepticum* and H9N2 influenza virus infections

Liver stimulant/ hepatoprotective

1 *Phyllanthus niruri* (Keelanelli)

2. *Eclipta prostrata* (Vellai karisaali)

Herbs for respiratory ailment

1. *Justicia adhatoda* (Adathoda)

2.Tulsi – (*Ocimum tenuiflorum*)

3. *Plectranthus amboinicus* (Karpooravalli)

4. *Solanum trilobatum* (Thoothuvali)

Anticoccidial

Vast usage of sulphanilamide, ionophorous antibiotics, amprolium or synthetic chemical compounds for the treatment of coccidiosis in poultry results in emergence of drug-resistant strains and antibiotic residues in poultry meat posing serious problems to the meat consumers. *Sinomenium acutum, sage, Garlic, Aloe vera*

HERBS FOR ECTOPARASITES

Common temporary external parasites of poultry include fowl ticks (also known as blue bugs), bed bugs and chicken mites (also known as red mites or roost mites). The use of chemicals viz., hydrocarbons, organophosphorus, carbamates and pyrethroids are found not to be free from adverse effects of toxicity to human, added up drug resistance by target parasites and high cost of drugs, paving the way for herbal alternatives.

Cinnamon oil has shown anti-parasitic activity against *Trichomonas*, *Histomonas meleagridis* and head lice in chicken. *Allium cepa* (onion) has proven pronounced anti-parasitic activity against many helminthes and protozoa such as, *Trichinella spiralis* and *Leishmania* sp. For preventing lice in ducks, drop the bulb in the bird's drinking water and for chickens green leaves (spring onions) can be used to be picked by the birds.

Chopped seeds of pumpkin (*Cucurbita moschata*) are shown to be good for the control of tapeworms in laying hens.

- Sweet flag (Vasambu), Purasa thalai also used againt ectoparasitic in poultry

IMMUNOMODULATORY HERBALS

Modulation of immune response to alleviate diseases has since long been of great interest to researchers. Indian medicinal plants are a rich source of substances which are claimed to induce immunity, thereby stimulating the non-specific immunomodulation, essentially granulocytes, macrophages, natural killer cells and complement functions

Ashwagandha (*Withania somnifera)* is one of the well-known medicinal plants. Several bioactive compounds have been isolated from this plant, among which the important one is the steroidal lactone called Withanolides, having antibacterial, antiviral, antineoplastic and immunomodulatory activities

Neem (*Azadirachta indica*) is another immunomodulatory herb, that has shown marked influence on the haematological parameters in birds like haemoglobin, PCV and RBC indices.

Wild mint (*Mentha longifolia*) has been found to enhance immunity especially in broiler chicks in addition to the improvement in growth performance, feed conversion ratio and gross return. *Echinacea* sp., *Glycyrrhiza glabra* (Liquorice), *Allium sativum* (garlic) and *Uncaria tomentosa* (Cat's claw) and they can improve the functions of lymphocytes, macrophages and NK cells a s well as increase phagocytosis and stimulate the interferon synthesis

Herbs for Other conditions

- Amla *(Phyllanthus emblica)* - ascorbic acid (vitamin C) - Immunostimulant. We can use as antistress 1 kg per tonne of poultry feed during summer.
- Small onion **:** Growth promoter -1 kg per tonne of chick feed.
- Wet pox - Neem bark @ 1kg/1000 birds to be given after soaking in water, over night and Neem leaves as top dressing.

Herbs for treatment of gout

1. Betel leaves - (*Piper betle*) – Gout
2. Banana stem - Gout

TURMERIC AND GARLIC USED FOR DIFFERENT DISEASE

No	Name and disease	Dosage
	TURMERIC POWDER	
1.	Growth Promoter	1 kg per tonne of chick feed
2.	Wing rot	1-2 kg per tonne of chick &grower feed
3.	Fowl pox	Turmeric and neem paste for external application
4.	Respiratory conditions	1-2 kg per tonne of feed with garlic
	GARLIC	
1.	Supplement	Chick feed – up to 4 kg per tonne Layer feed – up to 8 kg per tonne
2.	Spray in vv ND	5 – 10 ml of extract in one litre of water for spray
3.	Breeder male	Top dressing with garlic pieces for breeder male

CONCLUSION

Herbs can be used as a good alternative therapeutic aid to costly allopathic medicines/chemotherapy and boosting immune functions in intoxicated conditions and can also effectively complement allopathic medicines in diseased state. Detailed scientific validation on these in poultry would be a worthful research in future. Ethnoveterinary practices using plant products are effective against some diseases. These plant products are locally available and free or very cheap. These will all together improve prospects of this traditional wealth towards modern medicines, drugs and health care products derived from their origin to improve the market potential and commercialization aspects at global level.

Ethno-veterinary medicine in poultry

Tridax procumbens (Vettukaaya poondu)

Acalypha indica (Kuppaimeni)

Garlic

Turmeric

Neem

Grafting Techniques in Vegetable Crops

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Abstract

Grafting is a technique where two portions of plant with similar organic texture are joined to continue their development as a single plant. In other sense, grafting comprises union of two living plant parts so that they grow as a single plant. Grafting vegetables onto compatible rootstocks offers a number of advantages *viz;* resistance against soil borne pathogens, in particular *Verticillium* and *Fusarium*[1]. Therefore, grafting of desired scion on suitable resistant rootstock is practiced especially in vegetables to solve the problem of soil borne diseases and nematodes. Typically, buds or stem of desirable clone (the scion) are inserted in a rootstock either produced by seed or by vegetative means so that cambium tissues align and form a graft union. In general, grafting is a technology that is readily accessible to commercial suppliers of nursery and vegetable transplants. It should be easily applicable by the field technicians and has a relatively low cost.

APPLICATION

Inter-specific grafting is common in eggplant *(Solanum melongena* L.). Scarlet eggplant *(Solanum integrifolium* Poir.) and (*Solanum torvum* Swartz) are popular rootstocks for eggplant production. While inter-generic grafting was commercially followed in many fruit bearing vegetables; *i.e.,* cucumber *(Cucumis sativus* L.) grafted on pumpkin *(Cucurbita* spp.), watermelon *(Citrullus lanatus* Matsum.) on bottle gourd *(Lagenaria siceraria* Standi.) and melon *(Cucumis melo* L.) on ash gourd *(Benincasa hispida* Cogn.).

The problem of fusarium wilt *(Fusarium oxysporum* f. sp. *momordicae*) disease of bitter gourd can effectively be tackled by grafting on sponge gourd *(Luffa cylindrica)* rootstock as *F. o.* f. sp. *momordicae* can only infect bitter gourd and summer squash and not other cucurbits. Grafting increases number of marketable fruits and enhance other morphological and horticultural traits which were ultimately preferred by the consumers. Grafting of tomato on resistant rootstocks provides an alternative to methyl bromide fumigation for the control of diseases such as corky root *(Pyrenochaeta lycopersici)* and *Fusarium oxysporum* f. sp. *lycopersici*. Similarly, *Solanum torvum* is most compatible root stock for a number of brinjal cultivars and provides a good resistance against *Meloidogyne incognita.* In our country, a good success against fusarium wilt and nematode infestation in tomato and soil borne bacterial wilt and nematode attack in brinjal has been obtained by using black night shade plant *(Solanum nigrum)* as a rootstock. Suitable

rootstocks for grafting of vegetables are enlisted in Table 1.

Table 1: Suitable rootstocks for grafting of vegetables

Cucumber	*Cucurbita moschata, C. ficifolia* (fig-leaf gourd), *C. maxima, Sicyos angulatus* (bur cucumber)[5]
Muskmelon (for open field)	*Cucurbita* spp., *C. moschata* × C. *maxima, Cucumis melo* [5]
Muskmelons (for greenhouse)	*Cucumis melo, Benincasa hispida, Cucurbita spp., C. moschata* × C. *maxima* [5]
Watermelon	*Lagenaria siceraria, Cucurbita* spp., *Benincasa hispida* [5]
Bitter gourd	*Cucurbita moschata, Lagernaria siceraria, Luffa cylindrica* [5]
Tomato	*Solanum pimpinellifolium, S. esculentum, S. nigrum*
Brinjal	*Solanum torvum, S. integrifolium, S. melongena, S. nigrum*

Objectives of vegetable grafting

The main objective of grafting is to avoid soil-borne diseases *viz*, fusarium wilt, bacterial wilt and nematodes. Currently grafting is used for induction of disease resistance especially caused by soil pathogens, low temperature tolerance, salt tolerance, flood tolerance, drought tolerance, enhancing nutrient and water uptake, high temperature tolerance and increase source-sink relationship. Detailed objectives of grafting as suggested by Lee[3] in specific vegetable crops are shown in Table 2.

Grafting techniques:

Grafting involves the joining of plant parts by means of tissue regeneration, in which the resulting combination of parts achieve physical union and grows as single plant. It involves :*(i)* the choice of root stock and scion species, *(ii)* creation of a graft union by physical manipulation *(iii)* healing of the union and *(iv)* acclimation of the compound plant.

A. Conventional manual grafting

There are number of methods applicable for conventional herbaceous grafting. These techniques vary with the kind of crops to be grafted, preferences, experience of the growers, and the kind of grafting machines. Conventional grafting is carried on by growers or by commercial plug seedling nurseries.

1. Hole insertion grafting (HIG)

When scion and rootstocks have hollow hypocotyls, the hole insertion and one cotyledon grafting methods are preferred[2]. HIG is mainly practiced in watermelon in many parts of the world because of the smaller seedling size of watermelon as compared to the size of the rootstock (squash or bottle gourd). Watermelon seeds are sown 7-8 days after the sowing of bottle gourd seeds (rootstock) or 3-4 days after sowing squash rootstock seeds. Grafting is made 7-8 days after the sowing of watermelon seeds. The true leaf including the growing point should be carefully removed and a hole is made with a bamboo or plastic gimlet at a slant angle in the longitudinal direction. The hypocotyl portion of the watermelon is prepared by slant cutting to have a tapered end for easy insertion. Care should be taken to avoid the insertion into the stem pith because it greatly interferes with formation of a rapid union and facilitates later protrusion of watermelon adventitious roots in the soil after downward

elongation through the pith cavity of the rootstock.

Table 2: Objectives of vegetable grafting (Lee[3])

Species	Objectives
Tomato	Tolerance to bacterial wilt *(Pseudomonas solanacearum), Fusarium oxysporum, Pyrenochaeta lycopersici* (corky roots), root knot nematodes *(Meloidogyne spp., Verticillium dahliae*
Brinjal (Eggplant)	Tolerance to bacterial wilt *(Pseudomonas solanacearum),* verticillium wilt *(Verticillium dahliae, Verticillium albo-atrum*), fusarium wilt *(Fusarium oxysporum),* low temperature, nematode, increase vigour
Cucumber	Tolerance to fusarium wilt, low temperature, *Phytophthora*
Watermelon	Tolerance to fusarium wilt *(Fusarium oxysporum),* wilting due to physiological disorders, low temperature, drought tolerance
Muskmelon	Tolerance to fusarium wilt *(Fusarium oxysporum* f. sp. *melonis),* low temperature, wilting due to physiological disorders, *Phytophthora* diseases

2. Tongue approach grafting (TAG)

This method is commonly used in *Cucurbitaceous* crops *viz.,* melons and cucumbers because it produces high survival rate. It can also be applied successfully for tomato, especially when greenhouse conditions for healing and acclimation are less ideal for successful tube grafting. However, this method is not extensively used mainly because it is labor intensive, requires more space and produces frequent rooting from the scion after transplanting. This method is applied in comparatively aged seedlings *viz.,* 14 to 21 days old seedlings of tomato, 10 to 13 days old seedlings of cucumber, and 7 to 10 days old seedlings of pumpkin to ensure sufficient stem diameter to perform the graft. For TAG, both scion and rootstock seedlings should have the similar width. In this approach, the cucurbits seeds of scion are sown 5-7 days earlier than the rootstock seeds. The growing point of rootstocks is removed carefully. The grafting cut for rootstock is made in a downward direction and the scion is cut in an upward direction at an angle of 30 to 40° to the perpendicular axis and deep enough to allow the fusion of as many vascular bundles as possible. After grafting operation, specially designed clips are placed to fix the graft position.

3. Splice grafting (SG)

The major advantage is the production of strong and healthy grafted seedlings since all the vascular bundles of the scion will get fused with those of rootstock and the graft union is strong enough to bear shock of post-graft handling. Intact or excised (root-removed) rootstock seedlings may be used, depending on the grower's preference. For the cucurbit rootstocks, one cotyledon and the growing point are removed for grafting. After placing the scion on the rootstock, ordinary grafting clips as in TAG are used to fix the grafted position tightly together.

4. Cleft grafting (CG)

This method is mostly used for grafting of tomato. The seeds of the rootstock are sown 6 to 7 days earlier than those of the scion. The stem of the scion (at 4 leaf stage) and rootstock seedlings (at 4-5 leaf

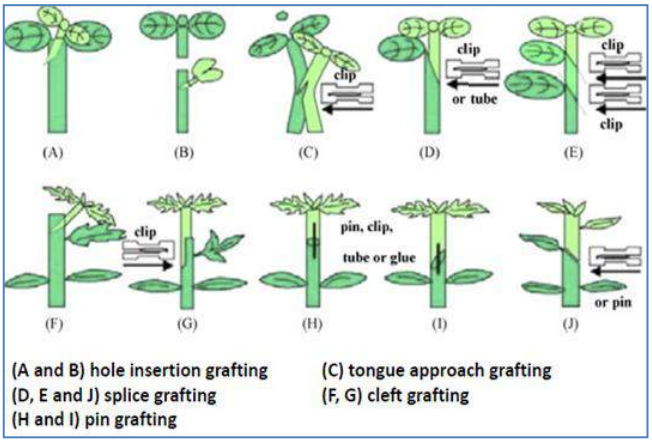
stages) are decapitated and a 1 to 1.5 cm longitudinal cut is made in a downward direction. The scion is pruned to 2 to 3 true leaves and the lower stem is cut to slant angle to make a tapered wedge. After placing the scion into the split made on the rootstock, a clip is placed to hold the both in position until the union is completed.

5. Pin grafting (PG)

Pin grafting is basically the same as splice grafting. However, instead of placing grafting clips to hold the grafted position, specially designed pins are used to hold the grafted position in place. The pins are made of natural ceramic so it can be left on the plant without any injury. Bamboo pins, rectangular in cross-sectional shape, successfully replaces the expensive ceramic pins being low in cost. This method is easy, reducing labor cost, but ceramic pins add expense, and a special environmentally-controlled chamber is needed to acclimatize the grafted plants[4].

6. Tube grafting (TG)

Tube grafting makes it possible to graft small plants two or three times faster than the conventional method. This method is widely used in grafting of tomato. The name 'tube grafting' originated because when the technique was first developed, a tube was used to attach the shoot to the root. The scion is attached to the rootstock and fixed tightly by a grafting tube or clip[5] . Clips are now used to make this graft. Tube grafting is quicker and less complicated than cleft grafting because it only requires a single straight cut on both the root and shoot portions of the graft. Also, because fewer intricate cuts are involved, this technique can be used on very small seedlings.



B. Robots

The first robot was developed by IAM BRAIN to graft cucurbit vegetables for the "Cutting off Cotyledon Grafting" (CCG). The robot takes into account of variation the shape of seedling, location of cutting and gripping, cutting and attachment. Seedlings are cut at the point of attachment of the cotyledon to the hypocotyls at an angle of 10° for the scion and 30° for the rootstock. The prototype grafting robot was constructed in 1987 and the second in 1989. They can make plant grafted in 3 seconds with 95 per cent survival. A prototype semi-automatic grafting system was also developed by Hwang in Korea. Three grafting robots have been developed in Korea, two in 1998 and one in 1999, and one is commercialized in 2001. The PG robot developed by Rural Development Administration for solanaceous crops can graft 1200 seedlings per hour. The simple and economic grafting machine is developed by Yupoong and has been very popular in Korea. This machine can graft nearly 600 seedlings per hour by TAG, mostly in cucurbitaceous crop. However, an experienced operator is needed to run this machine effectively and efficiently.

Grafting machines and robots developed in Japan and Korea are listed in Table 3.

CONCLUSION

The use of grafting is an efficient technique to overcome problems related to soil borne pathogens and other biotic and abiotic stresses in vegetable production. Although, grafted plants also offer increased yield and consequently higher profit for farmers. It may also decrease to a certain level the use of certain pesticides (especially soil fumigants) because the rootstocks will provide tolerance to many soil insect and disease pests and therefore it is an environment-friendly operation of sustainable agriculture. It is very much necessary to select the best combination of rootstock and scion to get best result. Private and public sector need to work together to integrate this modernized technology as an effective tool for sustainable horticultural production.

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Table 3: Grafting machines and robots developed in Japan and Korea

Grafting machine	Company (Country)	Crop	Efficiency	Others
CCG	IAM BRAIN (Japan)	Cucumber	500/hr	Cutting-off cotyledon grafting (CCG)
G 892	IAM BRAIN (Japan)	Cucumber	1200/hr	First prototype grafting robot (1987)
Super Angel G-710	Nasmix Co. (Japan)	Cucurbits	600-800/hr	Super Idol 31 silica rubber split tube for fixing
Super Angel G-720	Nasmix Co. (Japan)	Solanaceous	600-800/hr	Super Idol 31 silica rubber split tube for fixing
Grafting robot AG 1000	Yanma (Japan)	Solanaceous	1000/hr	
TGR grafting robot	Technical Grafting Res. Institute (Japan)	Solanaceous and Cucurbits	800/hr	Instant glue is used and all 128 seedlings in a tray can be grafted at once
Grafting robot/Korea (plug-in type)	Kyungpuk Univ. (Korea)	Solanaceous and Cucurbits	900/hr	Not yet commercialized
Pin-grafting robot	RDA (Korea)	Solanaceous	1200/hr	Ceramic pin is used
Tongue approach grafting robot	SungkyunKwan Univ. (Korea)	Cucurbits	900-1200/hr	Ordinary pin is used
Semi-automatic Grafting Machine	Yupoong (korea)	Cucurbits	400/hr	One operator is needed per machine

Role of Resident Microorganism on Success of Insect in the Environment

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Insect are most diverse and abundant animal groups in terms of numbers of species globally, in ecological habits, and in biomass. The diversification and evolutionary success of insects have depended in part on their myriad relationships with beneficial microorganisms, which are known to upgrade nutrient-poor diets, aid digestion of recalcitrant food components, protect from predators, parasites and pathogens, contribute to inter- and intraspecific communication, affect efficiency as disease vectors, and govern mating and reproductive systems. The microbiology of healthy insects has become the focus of intense research interest in recent years because of dramatic technological advancement and increase awareness among biologists of the wider importance of animal-associated microbiota. Hence, here we discuss some aspects related to microbial impact on insect phenotype i.e. nutrition, protection against natural enemies, detoxification, source of cues and signals.

NUTRITION

Many insect-associated microorganisms promote insect capacity to utilize diets of low or unbalanced nutritional content by providing specific nutrients that the insect cannot synthesize, including essential amino acids and B vitamins and sterols and, for insects feeding on diets rich in plant fiber, by degrading complex plant polysaccharides. The role of microorganisms in provisioning essential amino acids has been demonstrated most conclusively in hemipteran insects feeding on plant phloem sap. The principal sources of nitrogen in phloem sap are the free amino acids of unbalanced composition, with <20% essential amino acids. *Buchnera aphidicola*, a primary symbiont in aphids synthesizes and releases essential amino acids. Likewise, insect nitrogenous waste is recycled to essential amino acids in the ant-*Blochmannia* symbiosis, in planthopper (*Nilaparvata lugens*)-yeast associations, and in cockroaches and termites. As far as availability of sterols are concerned, it is exclusively related to eukaryotic, particularly yeast, symbionts, because bacteria lack the capacity for sterol synthesis. A fungal source of insect sterols is indicated by the fungal sterol ergosterol and related compounds in the sterol profile of anobiid beetles. Wood feeding insects like termite, roaches and scarab beetle larvae dependent on microorganisms that are located in a

hindgut fermentation chamber, where they mediate the slow enzymatic degradation of the cellulose and hemicellulose components of the diet to sugars, which are then fermented to short-chain fatty acids.

PROTECTION AGAINST NATURAL ENEMIES

Resident microorganisms can protect their insect hosts against pathogens and other natural enemies by multiple mechanisms that are not mutually exclusive, including competition for nutrients or space, production of toxins active against the invader, and activation of insect immune system functions that are more deleterious to the invader than the resident. Coevolutionary interactions between insects and their microbiota are also expected and would lead to selection for reduced toxicity of the microbial agents against the host and coordination of the timing and magnitude of microbial toxin production to optimize protection of particularly vulnerable insect life stages or tissues. The secondary symbiont *Hamiltonella defensa* confers pea aphid resistance to the parasitoid *Aphidius ervi*, but not all *Hamiltonella* spp. are protective. Function has been correlated with a bacteriophage in the *Hamiltonella* spp., and specifically with phage-encoded genes for toxins, such as Shiga-like toxin, cytolethal distending toxin, and YD-repeat toxins. Antimicrobial compounds are of particular importance to insects living in enclosed, humid environments, where opportunistic fungal or bacterial infections can develop rapidly. Adult females of the solitary digger wasp *Philanthus triangulum* smear the ceiling of each subterranean brood cell with an antennal secretion containing antibiotic-producing *Streptomyces* spp. Similarly, adults of the spruce bark beetle *Dendroctonus rufipennis* smear oral secretions containing bacteria onto the gallery walls of the trees they infest, likely conferring protection against antagonistic fungi, such as *Aspergillus* spp.

From an evolutionary perspective, these beneficial effects of resident microorganisms in insects challenged by natural enemies can be attributed to strong selective overlap between the microbiota and their insect host: Persistence of the insect habitat is advantageous to the microbiota. Some microbial partners may, however, respond to pathogen/parasitoid-mediated reduction in insect fitness by increased proliferation and dissemination from the failing insect.

DETOXIFICATION OF TOXINS: PLANT ALLELOCHEMICALS AND INSECTICIDES

Most described instances of detoxification in insects are intrinsic. They are mediated by capabilities encoded by the insect genome, including cytochrome P450 monooxygenases, glutathione S-transferases, and esterases. Resident microorganisms have, however, been implicated in a few systems. Elimination of the yeast-like symbiont *Symbiotaphrina kochi* from *Lasioderma serricorne* beetles depresses larval development on diets containing allelochemicals that cultured *S. kochi* can degrade. The capacity of the mountain pine beetle *Dendroctonus ponderosae* to utilize terpene-rich trees may be facilitated by species of *Pseudomonas*, *Rahnella*, and other resident gut bacteria that have the genetic capacity to degrade terpenes.

Resident microorganisms have repeatedly been proposed as a source of insecticide resistance, but most claims lack proper validation. Exceptionally, the resistance of the alydid stink bug *Riptortus pedestris* to the organophosphate fenitrothion is mediated by fenitrothion-degrading *Burkholderia* bacteria that are acquired from the soil by the insects.

A SOURCE OF CUES AND SIGNALS

Microorganisms associated with insects have been invoked as the source of chemicals that alter the behavior of conspecifics or other organisms, to the benefit or disadvantage of the insect host. To illustrate, *Drosophila* prefer to mate with conspecifics that have a similar gut microbiota, and this preference is probably linked to microbiota-dependent variation in the cuticle hydrocarbon profile, and parasitic wasps of the bark beetle *Dendroctonus ponderosae* are attracted to logs containing the fungal partners (*Grosmannia clavigera* and *Ophiostoma montium*) of the beetle, suggesting that these parasitoids use fungal volatiles as cues to locate beetle larvae and pupae.

CONCLUSION

Microorganisms are ubiquitous in insects and have pervasive impacts on multiple aspects of insect biology. Consequently, microorganisms should be included as candidate factors affecting virtually any aspect of insect biology. Fortunately, the tools to study these associations are increasingly available, including methods to identify and quantify microorganisms and their functions, to manipulate the composition of the microbiota, and to investigate their interactions with the nutrition, immunity, and other physiological systems of the insect. Some aspects of insect-microbe interactions now have a firm experimental foundation, but others remain contentious.

Of particular interest for future research are the mechanisms by which resident microorganisms influence insect susceptibility to pathogens, insect capacity to degrade phytotoxins, and insect capacity to vector plant viruses and medically important disease agents. Careful experimental analyses are required to assess the generality of microorganisms as determinants of insect communication, plant range, resistance to insecticides, and insect speciation events.

Application of Ultrasonography in Equine Reproduction

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Ultrasound has an increasing number of diagnostic applications in veterinary practice, with both large and small animals. Being non-invasive, it has considerable advantages over other methods and its cost is now well within the range of most veterinarians. It allows the clinician to obtain instant information about a wide range of body systems and in some cases the dynamic function of organs can be assessed. In addition, ultrasonography has led to new insights into basic anatomy and physiological processes. The ability to examine a mare's reproductive tract non-invasively with ultrasonography provided the opportunity to diagnose pregnancy earlier than by rectal palpation, effectively manage twins and detect impending early embryonic death (EED). However, ultrasonography should not be limited to these areas. It can be used to diagnose uterine pathology, such as intrauterine fluid, air, debris, cysts and occasionally abscessation and neoplasia. In addition, ultrasonographic examination of the ovaries may aid in determining stage of oestrous cycle, status of preovulatory follicles, development and morphologic assessment of the corpus luteum (CL) and in interpreting ovarian irregularities, such as anovulatory or haemorrhagic follicles, neoplasia and peri-ovarian cysts. The costs of equipment initially resulted in a rather limited application of reproductive ultrasonography. Equine owners enthusiastically support use of ultrasonography to detect pregnancy now-a-days.

After a mare is bred, waiting to determine if the mare returns to heat before having her examined for pregnancy may appear to be a way to save money by avoiding "needless" pregnancy evaluations, but may ultimately result in greater costs. The use of ultrasound enables us to diagnose pregnancy at an early stage, 12 to 14 days after ovulation. The advantages of early pregnancy diagnosis are numerous, whereas the disadvantages are negligible.

The use of ultrasound to evaluate the fetus and intrauterine environment in mares during gestation is relatively new and very wide, starting from confirming pregnancy existents, fetal gender determination to monitoring high risk pregnancies. Previous researches described various fetal and maternal parameters partly describing a connection between the parameters and the success of the pregnancy. Among the parameter described were: fetal aortic diameter, fetal heart rate, fetal activity

and combined thickness of the uterus and the placenta (CTUP).

Ultrasonography makes it easier to know that a mare is not pregnant before the time she is due to come back into heat, plans can be made to prepare for another breeding. Although the length of time a mare is in estrus or "heat" varies somewhat between mares and according to the time of the year, the length of time a mare is out of heat is fairly consistent, approximately 15 days. By checking a mare for pregnancy two weeks after she goes out of heat, if she is not pregnant, plans can be made to either take her back to the stallion for rebreeding or prepare for another artificial insemination. This time frame allows for arrangements to be made before she comes back into heat, thereby providing ample time so that the next cycle is not missed and valuable time is not lost. If pregnancy examination is delayed until 18 or 21 days after breeding, the mare may be too close to ovulation (or even just past ovulation) for rebreeding during that cycle.

Because the length of time between heats is fairly consistent, if a mare is showing strong signs of heat at the time of pregnancy examination 12 to 14 days after the last breeding, it is an indication of some problem causing her to "short cycle." Short cycling, or coming back into heat before expected, may result from a uterine infection. Examination for pregnancy in late diestrus may reveal fluid in the uterus, another abnormal condition that should be further evaluated.

Pregnancy losses during late gestation (>5 months) represent a great problem for the equine breeding industry. Affected mares will not only fail to produce a foal but often have a lower conception rate during the next breeding season. The major cause of late term pregnancy loss in the mare is placentitis. Difficulties in early detection of Placental failure in pregnant mares make the management and treatment of affected mares challenging. Placental evaluation by ultrasound provides important information regarding abnormal events which may cause abortion or delivery of abnormal foal and enables to deal and treat problems in early stages and in some cases to prevent abortion.

Ultrasonography has become indispensable to our practice. Fortunately much of the equipment used for reproductive ultrasonography can be used to examine many other parts of the horse. Ultrasonography is more fundamental than any other diagnostic technique.

ULTRASOUND MACHINE

Ultrasonography utilizes pulses of sound waves that are projected towards its intended structures and within seconds the echoes are returned to the source from which they originate. Various body tissues conduct sound differently. Some tissues absorb sound waves while others reflect them. The density of the tissue dictates the speed at which the echoes return. The transducer is responsible for sending and receiving the sound signals while the machine converts the sound signal into an electrical signal, which is ultimately viewed on screen.

Transducers come in two types:

- Linear which produces a rectangular image, and
- Sector which produces an image similar to that of a “slice of pie”.

Transducers come in several frequencies: a 7.5MHz transducer is used to produce great detail but will only image superficial structures, a 3.5MHz transducer can penetrate deeper structures but lacks detail, and a 5 MHz transducer is usually a good compromise in detail and penetration.

The picture that the ultrasound generates on the monitor is in different shades of white and grey, which is dictated by the echogenicity of tissues. Echogenicity of a tissue is described by how quickly sound waves are reflected back to the transducer from which they originate. Hence, the echogenicity of a tissue is related to the brightness of the image on the ultrasound monitor. Tissues and or fluids present two types of echogenic patterns:

- Anechoic: No echoes of sound; hence, black is visualized on the monitor (i.e., fluid).
- Hyperechogenic: Increased echoes of sound; hence, white is visualized on the monitor (i.e., bone).

Appearance of ultrasound images

- Bone: Increased reflection of the sound so the image appears white on the screen. In the early developing fetus, this is usually cartilage with some bone.
- Connective tissue and fat: Moderate reflection of sound with a dull white image.
- Organ tissue: Medium gray appearance on the screen, which varies between organs.

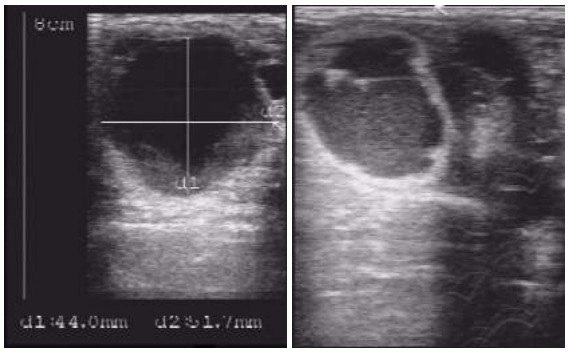
The corpus luteum of the ovary is a good example.

- Fluid: Appears black on the screen since there are few reflective surfaces. Follicles on the ovary are a good example and also blood vessels.
- Complex fluids: Cell clumps within fluid resulting in a black image with white speckles. A cystic follicle would be a good example.

FOLLICULAR DYNAMICS PRECEDING AND DURING OVULATION

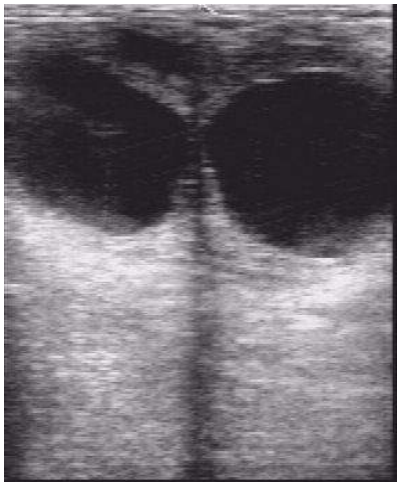
Ultrasonography is useful for monitoring dynamic follicular and luteal changes in equine ovaries, since it permits rapid, visual, non-invasive access to the reproductive tract. A 5 MHz transducer has greater resolution and is more suitable for evaluation of ovaries than a 3 or 3.5 MHz transducer. Follicles as small as 2 to 3 mm can be seen and the corpus luteum can usually be identified throughout its functional life (Pierson & Ginther. 1985). Potential applications of ultrasonographic examination of the ovaries include:

i. estimating stage of the oestrous cycle,
ii. assessing preovulatory follicles,
iii. determining ovulation,
iv. examining the corpus luteum, and
v. diagnosing ovarian abnormalities and pathology.



Mature Graffian Follice *Corpora Haemorrhagicu*

Ovulation based on ultrasonography can be defined as a change in the echogenic pattern characterised by disappearance of the large, black, fluid-filled, non-echogenic structure and the presence of an echogenic area.



Double Ovulation

Double ovulations occur during 8 to 30% of oestrous cycles, the frequency depending upon the breed and type of the mare (Thoroughbreds, highest rate; ponies, lowest rate). Accurate detection of such ovulations is important as twinning is undesirable, firstly because it accounts for 10--30% of abortions and, secondly, even if both foetuses survive and are carried to term, many are dysmature, resulting in a high neonatal mortality rate.

THE CORPUS LUTEUM (CL)

Methods to evaluate the CL are extremely important. Because of the position of the CL within the ovary, palpation per rectum is of little value for identification and evaluation. However, ultrasonography has been shown to be an effective and accurate means of identifying this structure. Some of the reasons for ultrasonographic evaluation of corpora lutea are:

i. detection of ovulation
ii. evaluate CL formation
iii. determine size and characteristics of the CL
iv. determine if failure of a mare to display oestrus is due to prolonged maintenance of a CL or absence of a CL and follicular activity
v. distinguish between anovulatory haemorrhagic follicles, luteinised un-ruptured follicles or CL
vi. determine if a mare has ovulated more than one follicle.

Corpus Luteum

The ultrasonographic image is affected by amount of blood within the corpus luteum. Blood is non-echogenic, whereas luteal cells are echogenic. Generally, luteinisation begins on the periphery of the structure and migrates medially. Normally, as the CL ages, blood is resorbed and a uniformly echogenic, luteal structure develops. Fibrin-like material can separate the blood clot into areas of dark, non-echogenic sections containing red blood cells, plasma and/(or) perhaps follicular fluid. Lighter areas may be indicative of fibrin strands or developing luteal tissue. Although the ultrasonographic properties of the mature CL are similar to ovarian stroma, a CL can be distinguished by its defined borders. the majority of CL's had a distinct mushroom or gourd shape.

Ultrasonography can also be used to diagnose pseudo-pregnant mares. A persistent CL and absence of an embryonic vesicle are evidence of a pseudo-pregnant mare. Once these mares are identified, then prostaglandins can be safely given to induce oestrus.

OVARIAN ABNORMALITIES

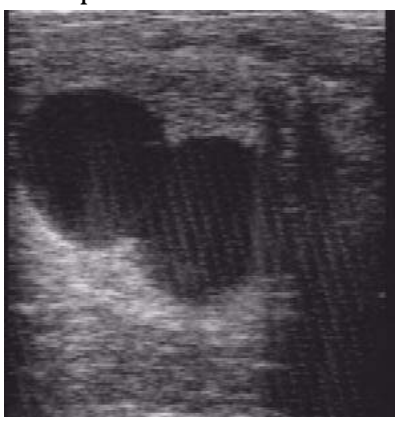
The ability to non-invasively examine the mare's ovaries permits diagnosis of various forms of ovarian abnormalities and pathology. Some ovarian abnormalities that have been recognised with ultrasonography are: 1) multiple preovulatory follicles, 2) anovulatory haemorrhagic follicles, 3) luteinised, un-ruptured follicles, 4) persistent CL's, and 5) various ovarian tumours and peri-ovarian cysts.

Hydrosalpinx is not common in mares, but since it is a fluid-filled structure, it may be detected with ultrasonography. Definitive diagnosis will probably require laparoscopy or exploratory surgery

UTERUS

Day 14

• The 14 day conceptus is 13 to 18 mm in size and lies centrally in the uterine body. The embryonic vesicle grows at a rate of approximately 3.5 mm/day at this early stage of pregnancy and remains highly mobile, making thorough examination of all parts of the uterus important. Although pregnancy diagnosis is highly accurate even at this early stage, it is important to be aware of the possible confusion caused by uterine cysts and the presence of twin conceptuses.



Twin Pregnancy 20 Days

By day 16 of pregnancy the vesicle is normally fixed at the base of either the left or the right horn. The shape is still regular, but more ovoid than strictly spherical.

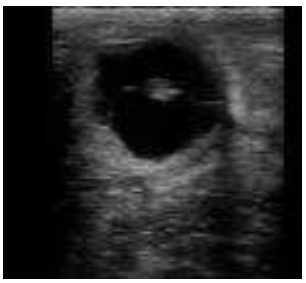
Day 16

• At day 20 of pregnancy the conceptus is irregular in outline. This irregular shape is normal and is not an indication of imminent pregnancy loss. The appearance can be so irregular that it could be confused with a collection of intraluminal uterine fluid, particularly as no embryo is

likely to be visible at this stage. If the pregnancy is normal, the primary corpus luteum should also be visible. If the edema pattern of the uterus becomes widespread it may be an indicator of early embryonic death. It is important to re-schedule subsequent pregnancy examinations at more frequent intervals than normal and the first re-examination should be in 3 or 4 days to monitor the pregnancy.

Day 24

• By day 24 of pregnancy, the embryo is approximately 6 mm in length. The heartbeat can normally be detected as a flickering movement in the middle of the echoic embryo around this stage of pregnancy. It is important to recognize the embryo and identify a heart-beat because the irregular shape of the vesicle is easily confused with an endometrial cyst.



Day 28

• In the day 28 pregnancy the apposition of yolk sac and allantois results in an ultrasonically visible thin line normally orientated horizontally. The embryo is visible as an echoic mass on this line.
• By day 30 of pregnancy the embryo is highly echogenic and is visible on the line separating the allantoic and yolk sacs and the heartbeat can be clearly seen.
• By day 35 the embryo is usually in the dorsal part of the vesicle and is approximately 16 mm in length. The volume of the allantois greatly exceeds that of the yolk sac.

SEXING THE FOETUS

Accurate knowledge of the gender of an unborn foetus gives the owner an opportunity to decide to sell or keep a pregnant mare. If performed early enough it may allow the mare to be aborted and rebred in the same breeding season. The technique of sexing, using ultrasonography, relies on visualisation of the genital tubercule and its location relative to the tail or the umbilicus. The genital tubercule becomes the penis in the male and the clitoris in the female. The genital tubercule is distinguished close to the umbilicus in the male and the tail in the female. (Bergin, Gier, Frey, & Marion. 1967). Sexing the foetus with ultrasonography has been shown to be accurate under both research and farm conditions (Curran & Ginther. 1989; Curran & Ginther. 1991).Under research conditions it was first established that the most accurate time for diagnosis was between day 59-68 (Curran & Ginther. 1989).

Twins

Twins are important for a variety of reasons. Firstly, historically twins have been the single most important cause of abortion in Thoroughbreds (Acland. 1987; Acland. 1993) and secondly, regardless of the breed twinning is a huge cause of reproductive wastage as most pregnancies terminate in early foetal resorption or loss, late term abortions, or the birth of small growth retarded foals. Mares aborting twins in late gestation frequently have foaling difficulties, damage their reproductive tracts and are difficult to rebreed, presumably due to delayed involution of an oversized uterus. Because the expected outcome for mares with twins is so poor for either the mare or the resultant foal(s) it is our responsibility to successfully manage early pregnancies such that no mare delivers or aborts twin foals.

Early Embryonic Death

Early embryonic death results in low reproductive performance of mares. Various causes and factors responsible for EED in mares, apart from presence of twins, have been suggested; which included nutrition (Belonje & Van Niekerk. 1975; Van Niekerk & Morgenthal. 1982), plant oestrogens and photo-period (Blythe & Kitchell. 1982), seminal treatments (Moberg. 1975), lactation stress, and foal-heat breeding (Merkt & Gunzel. 1979), genital infections (Day. 1940; Kenney. 1978; Merkt & Gunzel. 1979), chromosomal abnormalities, hormonal deficiencies (Van Niekerk & Morgenthal. 1982), anabolic steroids (Villahoz, Squires, Voss, & Shideler. 1985), stress (Van Niekerk & Morgenthal. 1982), failure of maternal recognition and deficiency of pregnant mare serum gonadotropin (PMSG) production.(Allen. 1984), immunological factors (Shivers & Liu. 1982; Liu & Shivers. 1982) and even a higher incidence from some individual stallions (Platt. 1973).

Early embryonic death is diagnosed when an embryonic vesicle seen previously is not observed on two consecutive ultrasonographic scans and/(or) when only remnants of a vesicle are observed. Ultrasonographic criteria for impending EED are an irregular and indented vesicle, fluid in the uterine lumen and vesicular fluid that contains echogenic spots. Early embryonic death is suspected, particularly after day 30, when no foetal heartbeat is observed, there is poor definition of foetal structure, foetal fluids are very echogenic, or the largest diameter of the foetal vesicle is two standard deviations smaller than the mean established for that specific day of age. Vesicles increasing in size more slowly than normal may also be characteristic of early embryonic death (Ginther, Bergfelt, Leith, & Scraba. 1985).

UTERINE PATHOLOGY

With ultrasonography the uterus can be examined non-invasively for pathologic changes and to monitor therapeutic regimen(s). The three most common forms of uterine pathology detected by ultrasonography are accumulations of intrauterine fluid, air and cysts. Less commonly, foetal remnants, debris, abscessation and neoplastic conditions are observed.

Intrauterine Fluid

Ultrasonography is extremely valuable for estimating quantity and quality of fluid in the uterine lumen. Rectal palpation is only accurate when quality of intrauterine

fluid is large (> 100 ml) and (or) when uterine tonicity changes. Volumes of fluid within the uterine lumen are estimated with ultrasonography and quality is graded from I to IV according to degree of echogenicity (McKinnon, Squires, Harrison, Blach, & Shideler. 1988). Degree of echogenicity is related to amount of debris or white blood cell infiltration into the fluid.

Endometritis

There are numerous techniques to diagnose endometritis. However, no technique is completely reliable. The common, currently accepted techniques are: 1) rectal palpation, 2) vaginal-speculum examination, 3) bacterial culture of uterine contents, 4) cytological examination of uterine contents, 5) endometrial biopsy and 6) ultrasonography. A study was conducted (McKinnon, Squires, Carnevale, et al. 1987) to examine the efficacy of individual diagnostic techniques to predict endometritis. This study demonstrated that ultrasonography was as accurate as all the other diagnostic tests of endometritis. In addition, it was determined that in progesterone dominated mares, multiple invasive procedures (ie. culture, biopsy, vaginal-specular examination and cytologic specimen collection) resulted in persistent endometritis, thus highlighting the usefulness in having a non-invasive diagnostic test such as ultrasonography.

Uterine Cysts

Prior to ultrasonography, uterine cysts were most commonly diagnosed from post-mortem examination and occasionally by rectal palpation (Kenney & Ganjam. 1975). More recently they have been diagnosed by hysteroscopy and ultrasonography (McKinnon, Squires, Carnevale, et al. 1987; McKinnon, Squires, & Voss. 1987). When visualised with ultrasonography, cysts are commonly rounded, with irregular borders, and occasionally are multiple or compartmentalised. Movement of the early equine conceptus (days 10 to 16), presence of specular reflection, spherical appearance and growth rate of the embryo should aid in its differentiation from uterine cysts.

Miscellaneous Uterine Pathology

There are other less commonly recognised forms of uterine pathology, the most common of which is air in the uterus. Air is recognised as multiple, hyper-echogenic reflections (occasionally a ventral reverberation artefact is present) and it appears to be more prevalent slightly cranial to the cervix, although it can be present in the cranial body or uterine horns. Air, when present < 24 hr after artificial insemination, is considered normal. However, it is not expected to be found in normal mares < 48 hr after breeding. The observation of air in the uterus of mares that have not been bred recently is an indication of pneumo-uterus and reflects failure of the competency of the vaginal labia, vestibulo-vaginal sphincter and (or) cervix (McKinnon, Squires, Carnevale, et al. 1987). On occasion, strongly echogenic areas in the uterine lumen are observed with a concomitant echo shadow, such as is seen with dense tissue like foetal bone. This might be expected after mummification.

STALLION ULTRASONOGRAPHY

Although ultrasound evaluation of the reproductive tract of stallions was

introduced to veterinary practice long ago, this examination is not always conducted during routine breeding soundness evaluation. On breeding soundness evaluation of stallions including ultrasonography of external and internal genitalia, various pathological conditions can be detected using this technique, with the most frequent being varicocele, thickened vaginal tunics and cystic structures. Varicocele and thickened vaginal tunics are associated with decreased quality of semen, while cysts of the epididymal head, urethra and uterus masculinus are frequently associated with ejaculatory problems. Routine ultrasound evaluation of breeding stallions may be very helpful in detecting pathological conditions that may impact their reproductive status.

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Parturition in Domestic Animals and Stages of Parturition

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Parturition is the most critical phase in the life of an animal. Little negligence at the time of parturition can put the life of dam and fetus at risk. Hence, it is important to understand events occurring at the time of parturition. In cows approaching parturition, due to relaxation of sacro-sciatic ligaments, the base of tail seems to be raised with pitting on the sides of the base of tail. Extreme relaxation of ligaments, hollow flanks with tense and pendulous abdomen indicates that the parturition is due within 24-48 hours. When the labor pains start, animal becomes restless. Although parturition is a continuous process, yet, it can be divided into three phases termed as three stages of parturition.

FIRST STAGE OF PARTURITION

It is the stage of cervical dilatation. It is said to begin when the uterine contractions start and the stage ends when cervix is fully dilated and fetal parts enter the birth canal. Complete dilatation means when vagina and cervix form a continuous passage. Under the influence of changed hormonal pattern, the cervix relaxes. Estrogens, relaxin and prostaglandin play a major in structural changes in cervical tissue. It becomes edematous, water is retained and charges on the collagen fibers change making them more loose, thus, relaxing the cervix. External os opens before the internal os. Dilatation of internal os starts 2-4 h after the external os has reached a diameter of 3-6 inches. Cervix fully dilates in 6-12 h. During the first stage of labor, regular myometrial contractions begin which earlier are of low amplitude and frequency. In unipara animals these contractions start at the apex of the horn and the part of genitalia caudal to the fetus dilates for easy passage of fetus. In case of multipara animals, the contractions occur in the cranial region to the most caudal fetus.

In mare and bitches, the fetus lying in the dorso-pubic position rotates to dorso-sacral position. In bovine and ovine, there is no rotation as the fetus is already lying in dorso-sacral position.

Cows become restless during first stage of parturition. In mares apart from restlessness, there is slight sweating behind the elbows and around the flanks. Tail is elevated and there is switching of tail. Bitches and cats experience nervousness, panting and sometimes vomiting.

Duration of first stage of labour:

Cows	2-6 h
Mare	1-4 h
Bitch	2-12 h

Second stage of parturition

It involves delivery of the fetus. When along with uterine contractions the abdominal contractions start, the second stage is said to begin. During this stage, first the allantoic sac (1st water bag) is presented at vulva that ruptures due to forceful contractions and urine like amber colored fluid is released. Then the amniotic sac (2nd water bag) (Fig. No. 1) is forced through the vulva with fetal limbs inside it. Force of contractions makes the fetal extremities move forward that rupture the second water bag. The amniotic fluid is white, thick and viscous in consistency, which lubricates the whole of genitalia for smooth passage of the fetus. During the second stage of labor, there are 4-8 uterine contractions in every 10 minutes and each contraction lasts for 80-100 seconds. The frequency and force of contractions is the maximum when the fetal head is forced through the vulva (Fig. No. 2). Once the head passes through the vulva, the dam usually rests for few minutes and again starts straining. Strong uterine and abdominal contractions (Ferguson's reflex) force the fetus out. Majority of deliveries happens when the animal is sitting or the animal will lower down its haunches when fetus is to be delivered. In mare, straining is characterized by strong expulsive efforts followed by rest for 2-3 minutes. Moreover, one of the forelimbs precedes the other by about six inches so that elbow and shoulder of one side enter the birth canal before the other. It is done to avoid dystocia. In bitches once the water bag appears at vulva, the bitch licks it vigorously and ruptures it. Thereafter, bitch forces out the pup, cleans its head, and bites the umbilical cord. If the bitch does not clean the head of fetus, pup may die of asphyxia. In mare, cow and ewe, the fetus is usually delivered in anterior presentation. In bitches and sows, 40-45% of the fetuses may be delivered in posterior presentation.

Fig. No.1 Second Stage of Labour in a cow showing the appearance of Amniotic sac outside Vulva

Fig.No. 2 Fetal head and forelimbs forced through the vulva due to strong uterine contractions

Duration of second stage of labour:

Cows	0.5 – 4 hrs
Mare	5-40 min
Bitches	3-6 hrs

THIRD STAGE OF PARTURITION

It involves the expulsion of fetal membranes and involution of the uterus. Once the fetus is delivered, due to decreased blood supply the fetal villi shrink. The contractions of uterus help the maternal crypts to dilate leading to separation of placenta. Uterine contractions occur from apex of uterus towards the cervix, so placenta gets detached first at the apex of the uterine horn and then detaches gradually towards the cervix. Due to peristaltic contractions of the uterus, placenta gets inverted at the time of its shedding. Suckling by the calf helps in separation of placenta by causing uterine contractions due to release of oxytocin from posterior pituitary.

Duration of third stage of labour:

Cattle	4-5 hrs
Mare	30 min to 3 hrs

In bitches placenta is expelled along with the fetus or it comes with the next fetus.

Status of Agricultural Marketing Reforms in the State of Karnataka

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ABSTRACT

India is second largest country in food grains production next to the china. In earlier days agricultural marketing means buying and selling of agricultural commodities mainly on barter basis. Now a days agricultural marketing is not simply buying and selling but it is process of series of activities from point of production to the point of consumption. In Karnataka state policy related to agricultural marketing dates back in 1930s. The aim of these policies were protect the interest of farmers, identifying farmers problems related to low rate of prices for their commodities, higher transportation cost, post-harvest losses etc. There is a limited access of agricultural produce markets so there is a need to increase the markets. There are several government organization involved in the marketing of agricultural commodities, aims to provide remunerative price for farmers (producers) and reasonable price for consumers for their commodities. The policy related marketing seeks to increase competition, better price realization to the farmer, to encourage investments in warehousing infrastructure, assaying and grading facilities, cold chains, food processing, etc. and make this sector an attractive one for generating employment in rural areas for equitable growth of the state.

Key words: Market, Agricultural, Karnataka

INTRODUCTION

India is second largest country in food grains production next to the china. But, still not achieve satisfactory marketing channels for produced food grains. In earlier days agricultural marketing means buying and selling of agricultural commodities mainly on barter basis. Now a days agricultural marketing is not simply buying and selling but it is process of series of activities from point of production to the point of consumption. There are several government organization involved in the marketing of agricultural commodities, aims to provide remunerative price for farmers (producers) and reasonable price for consumers for their commodities. In

Karnataka state policy related to agricultural marketing dates back in 1930s. The aim of these policies were protects the interest of farmers, identifying farmers problems related to low rate of prices for their commodities, higher transportation cost, post harvest losses etc. All the states recognised these problems and started legislation for establishing systematic marketing structure for agricultural commodities. Karnataka conceived the idea of regulated markets before many other states conceived it. The state legislative enacted the Karnataka Agricultural Produce Marketing (Regulation and Development) Act, 1966 which came into effect on May 1, 1968. This act provided the improved regulation for the agricultural marketing commodities, marketing system developed efficiently, improved the marketing infrastructure, promotion of agricultural commodities processing, exporting of agricultural commodities and improved the systematic administrative for agricultural produce. The state made recommendations frequently to change the marketing scenario and also to provide efficient marketing facilities for the farmers.

CONSTRAINTS FACED BY AGRICULTURAL MARKETS

1. **Limited Access of Agricultural Produce Markets:** National commission on agriculture (2004) recommended that ideally regulated market should available within radius of 80 sq km (5 km). But it varies from 118 sq km. in Punjab to 11,214 sq km. in Meghalaya. The 114.45 sq km is the average area served by the market, while 462.08 sq km is the average area served by the regulated markets.
2. **Barriers of Licensing:** The commission agents and traders are major barrier for licensing of new entrepreneurs to preventing the competition in the markets. The marketing functionaries like traders, commission agents and others organize themselves into association and which generally do not allow any new entry easily. The licensing is quite restrictive and barrier for new entrepreneur in the market.
3. **Inadequate Infrastructure in Markets:** In most of the markets infrastructure facilities are inadequate mainly for storage, grading, sorting, post harvest management and cold storage. Some studies revealed that covered and open platforms exist only in two-third of the markets, drying yards exist only in one-fourth of the markets, cold storage facilities exists in less than one tenth of the markets, grading facilities available in less than one-third of the markets and very few markets have electronic weigh-bridges.
4. **High Market Charges:** The market fees collection is authorised by the APMCs. The markets can collect 0.5% to 2.0% of the sale value of the produce as market fees. In addition, 1% to 2.5% commission charges in food grains and 4% to 8 % in fruits and vegetables. Also, other charges such as, weighment charges, hamal charges, purchase charges etc. makes huge burden on the farmers. In Karnataka state market fees for fruits and vegetables it is 1% of the value of the produce, 0.1% for the dry grapes

and 1.5% for the all other notified commodities.

5. **High Wastages in Supply Chain:** The study was conducted by the Association Chambers of Commerce and Industry of India (ASSOCHAM) on "Horticulture sector in India: State Level Experience". The post harvest losses of fruits and vegetables by spoilage are about 30 per cent. The post harvest losses worth of Rs. Two lakh crores, because of absence of food processing units, modern cold storage, etc. in the country. The post harvest losses of the fruits and vegetables in west Bengal, Gujarat, Bihar, Uttar Pradesh and Maharashtra worth of Rs. 13,600 crore, Rs. 11,400 crore, Rs. 10,700 crore, Rs. 10,300 crore and Rs. 10100 crore, respectively.

Another study was conducted by ICAR (2010) about post harvest losses, it was shows that the post harvest losses for cereals varies from 3.9 to 6 percent, for pulses 4.3 to 6.1 per cent, for fruits 18 per cent and 6.8 to 12.4 per cent for vegetables. About Rs. 44,000 crore was total post harvest losses of agricultural commodities have been estimated at 2009 wholesale prices.

6. **Agricultural Produce is Seasonal and Need Long Gestation Period for Infrastructure:** Agricultural produce is seasonal and it needs huge amount of money for infrastructure creation. There is need to attract investment for the infrastructure development by providing subsidy and easily loan availability.
7. **Lack of National Integrated Market:** the integrated national market helps to moves commodity at one point and competition for pricing may increase. Therefore, there is need to one platform for marketing of all commodities at national level.
8. **Less Farmers' Price Realization:** the intervention of middlemen, lack of infrastructure and poor holding capacity may reduce the share of farmer in consumers rupee. There is need to increase the share of farmer in consumer's price.
9. **Large Number of Marketing Channels with Long Supply Chain:** the agricultural marketing channels are long with large number of intermediaries from producer to consumer. These intermediaries add more costs without adding more value.
10. **High Marketing Cost Affects Small and Marginal Farmers:** the marketing costs are high and bearing these costs by farmers is difficult. This affects small and marginal farmers in price realisation. There is a need to reduce the marketing cost by government intervention.

RECOMMENDATIONS OF AGRICULTURAL MARKETING REFORMS COMMITTEE

The above mentioned problems are same for every state. Thus, Karnataka agricultural marketing committee recommended the following points as:

1. **Comprehensive Electronic Auction System:** The seller has full information about produce like content, quality, extraneous matter etc. but, the buyer has no information or limited information. The information in the market is asymmetry and it leads to inefficient

of markets. To solve this problem transparency in market operation and information dissemination. The comprehensive electronic auction system brought transparency in market by availing the real time information of the produce to participants of market and it provides equal chances for every lot for being bid in the auction, also informed to buyer about quantity of commodity available on that day. This transparency system leads to improved price discovery. However, the information about quality of produce brought for sale is asymmetry. Anyhow this can be improved by displaying the tested quality parameters of produce brought for sale in auction screen.

2. **E-tendering/Electronic Tendering:** Karnataka state is the pioneer state to start this project in the country. The first phase of this system was started in the year 2008 and 2010, aim to cover 45 APMC yards and another 33 markets were taken up for the computerisation in the II phase. This system ensures the market practices are fair and farmers will get competitive price for their produce. In this system slip of tender entered in the computers at the trader end or in kiosks established in the market. The quote lodged in the server in markets generated competitive price for the commodities in lot for sale. Some markets were implemented this system, while other markets yet implement and in some markets implementation is abandoned. However, the e-tendering system has disadvantages such as:

a) The implementation of this project in the hands of local authorities.
b) Potential of information technology (IT) is not used at full extent.
c) Software is limited in its use and not go for other activities like credit the amount of sale proceeds to farmers account directly etc.
d) Integration of market in this system is difficult.
e) Need fresh investment for new markets to be brought.

3. **Sampling and Assaying:** The arrivals of all commodities to be tested in market. This testing requires sampling infrastructure, space for sample to avoid dispute arise due to sale of commodity by non sight. Therefore, this requires investment and sufficient skills to test process. Thus, state invited the private companies for the sampling and assaying through the transparent process to establish these facilities in the state on a BOOT model. Parameters for testing all selected commodities and the process of testing should be decided with the knowledge of all participants and well publicised. Establishing agency need to bring professional expertise, the Directorate of Agricultural Marketing should prescribe necessary Control procedures so that participants develop confidence in the system. In initial stage farmers need pay for sampling and assaying is looks reluctant, so there is need to aware and convince the farmers about advantages of assaying to their produce. Finally market committee may this service without fee as market development activity.

4. **Market Information Dissemination:** The market information is still asymmetry. Currently sellers are more handicapped regarding the availability of information of prices. The Ministry of Consumer Affairs, GOI installing price ticker board in the market. However, this board contains past information only not current and information pertains to market away from the place where farmer place. This information gives farmers to take decision regard where to sell his commodities. However, the information regarding market price is not make much difference in farmer's decision about sale of commodity if the information is not current. The disseminating information through massages to mobile phone daily is the better way and farmers can also make use of this information for sell of commodity.
5. **Post Auction Process:** This helps to reduce the two important process weighing and bagging of the produce and issue of the sale invoice by the commission agent to the seller and payment to the seller. In this method weight of the particular produce mention against lot number without any manual intervention. This will eliminate the any inadvertent error that may happen in manual process. The sales transactions are captured electronically and consequent sale invoices generated for printing by the buyers. In payment of sale proceeds also directly send to famers, it does not require any market intermediary. The cess amount payable by the individual participants will be debited to the designed account of the buyer and credited to the APMC account/government.
6. **Integrating Markets:** Integration of two same commodity market helps to satisfy the excess demand of in the one market by accessing supplies of the market without physically available in that market. All the markets are connected by central data centre. So, there is no need for physical inspection of commodity before auction and these commodities key quality parameters are tested and displayed in the screen. Standardisation of quality and quantity parameters, dissemination of these parameters to the buyers, clearing and settlement mechanisms and dispute resolution are key pre-requisites for integration of market and allowing the participation of participants in a remote location. The markets are transacting more than one commodity means those markets are integrated with other markets and also those markets operating comprehensive electronic auction system are logically integrated with some other markets.
7. **Commodity Funding:** It helps farmers not to go for distress sale. Farmers stored the goods in scientifically managed warehouse and they can easily take loan from banks and other institutes by keeping the warehouse receipt or lien the stored commodity for lending institution. The lending institute lien on the stored commodity for the security. The commodity accounting system should preclude offering lien marked goods for sale unless the borrower offers authority to pay off the loan amount to

the bank and rest amount credited to the seller account.

8. **Private Markets:** Encouraging the private markets in existing situation may foster the healthy competition. The collection of market fees is the mandate to market from the market participants. In private market the market fee payable to the proximate APMC. If the APMC not render any service to the market participants then the market fees is exempted. This makes the private market viable and attracts investors.
9. **Farmer Produce Organisation:** The Primary Agricultural Co-operative Society (PACS) and Taluk Agricultural Produce Co-operative Marketing Societies (TAPCMS) and other institutes have capability to take up the role of aggregators. So, there is need to encourage the organisation so that farmers can easily market their commodity. The aggregators must provide services like pooling the agricultural produce, cleaning, grading, packing, dissemination of market information, transportation etc. so, farmers can sell their commodity and get good prices for their produce. Therefore this kind of institutes should be encouraged and trained to enhance to perform above activities.
10. **Creation of Infrastructure:** The proper infrastructure creation is the responsibility of market committee. The storage facilities, weighment facilities, market information dissemination, building for market participants etc. for proper and efficient marketing of agricultural produce. There is need to improve the infrastructure of market in the state.
11. **Awareness Creation and Capacity Building for Stakeholders:** Need to aware the farmers about quality parameters of produce. Market should adopt new legislation like food safety and standards act, 2006 and warehousing (development and regulation) act, 2007, technology advancement, new practices for trading etc. to cop up with the increasing competition. Therefore there is need to train and equip the participants in the market.

CONCLUSIONS

Agriculture sector needs well functioning markets to drive growth, employment and economic prosperity in the country. In order to provide dynamism and efficiency in the marketing system, large investments are required for the development of post-harvest and cold chain infrastructure nearer to the farmers' field. Well developed marketing infrastructure and efficient marketing system in the country will promote competitive trade as well as facilitate farmer's access to value addition services such as grading and storage, etc. on one hand and reduce supply chain inefficiency and post- harvest losses on the other. Moreover, the policy also seeks to increase competition, better price realization to the farmer, to encourage investments in warehousing infrastructure, assaying and grading facilities, cold chains, food processing, etc. and make this sector an attractive one for generating employment in rural areas for equitable growth of the state. Towards this end, the States need to amend their

Marketing Laws in true spirit on the line of Model APMC Act and Rules.

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Implementation of Radiation Technology for Improvement of Sesame

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When people think of atomic energy they often have nuclear reactors in mind. Few, however, realize that another aspect of atomic energy has changed their daily lives during the last 20 or 30 years. Many organizations like International Atomic Energy Agency since 1957 has been playing a major role to promote the wider use of radioisotopes and radiation sources in research, industry, agriculture and medicine.

RADIATION TECHNOLOGY IN AGRICULTURE

Globally, undernourishment is a disturbingly persistent problem. India has also a part of this problem. In spite of industrialization, India remains an agrarian economy. The national agricultural policy focuses on sustained production and nutritional security for the one billion plus population. By 2025 we may need about 340 million tons of food grains to feed the increasing population (Anonymous, 2014). To increase agricultural productivity equitably in an environmentally sustainable manner in the face of diminishing land and water resources is a highly challenging task. There is a need to develop better crop varieties with better water use efficiency, which are high yielding and resistant to biotic and abiotic stresses. To overcome the food scarcity, global agriculture system has mainly focused on major food grains. Many neglected and under-utilized crops are extremely important for food production in low income food deficit countries. Sesame is a neglected crop from the plant breeding point of view, being in the second stage of plant domestication. The fact that sesame is a crop of mainly developing countries with limited available research funds for long term breeding programmes, resulted in very few breeding efforts in research stations. The two most commonly used breeding approaches in sesame are selection (mostly from local landraces) and pedigree; introduction, backcross and induced mutations are less common (Ashri, 2001).Until recently most of the released sesame varieties in countries such as China, India and the Republic of Korea were the product of selection and pedigree breeding. A major constraint in this approach was the lack of sufficient genetic variation within the existing germplasm collections, especially for traits such as earliness, ideal plant

architecture, resistance to various diseases and insect-pests and seed retention (Ashri, 2001) .This is where mutation techniques could offer a possible solution. The nuclear agriculture programme provides variation in plant structure and function from which breeders can select plants having useful traits. Gustafsson (1947) advocated that mutation approach through radiation was superior to other methods of crop improvement for generation of genetic variability. The most important aspects of mutation breeding have been the quick rectification of defects in varieties and advanced breeding lines, induction of polygenic mutations and development of ideotypes for various agro-climatic conditions.

The ionizing radiations have been widely and routinely used to generate genetic variability in various crop species including sesame (Tomlekov , 2010). In India, majority of the mutant crop varieties have been released using gamma rays because they have shorter wave length and therefore possess more energy per photon than X-rays and penetrate deep into the tissue. In sesame, for gamma rays, doses ranging from 150–800 Gy proved successful in inducing useful mutations. Doses in the lower range were recommended for inducing desirable mutations with minimal simultaneous induction of additional, often undesirable mutations (Van Zanten, 2001).

Main constraints of breeding and Production of Sesame in India

- Poor yield due to lack of improved cultivars
- Low harvest index
- Susceptibility to diseases, pests and environmental stresses
- Indeterminate growth habit
- Asynchronous capsule ripening that accentuates seed shattering

Why radiation technology is important in sesame?

Sesame has a wide range of genetic variability in its extensive germplasm collections. However, certain highly desirable traits have not been found so far including good seed rotation and resistance to certain diseases. These needs prompted sum investigations to initiate radiation induction projects. Three FAO experts consultation (Ahon, 1981b, 1985a and Ashri, 1987) recommended that induced mutation through irradiation should be used to enhance the genetic variability of sesame selecting characters that can be easily identified in large segregation populations e.g., seed retention , modified plant architecture, modified growing period and resistance to disease and pests. Pioneering investigations on induced mutations in sesame where conducted by Kobayashi (1985, 1965) who found both morphological developmental mutants. The non-shattering traits can be obtained on through and induced or spontaneous mutation. In Thailand Wongyaj *et al*. (1997) reported a delayed shattering mutant and Maneekao *et al*. (1997) found semi shattering mutants. The mutants with determinate growth habit as compare to in determinate appear to be superior for some agronomically important characters such as synchronous flowering, lodging resistance, uniform and early maturing. In these respect many researchers have become interested in the determinate habit and the development of determinate

cultivars. A monogenic, recessive, determinate growth habit mutant with very unique plant architecture and with clustered capsules was induced by Ashri gamma rays (500 Gy) in the Israeli cultivar `no 45' (Ashri, 1988, 1995). Using gamma rays (300 – 600 Gy), 4 male sterile mutation were inducing in India (Murty, 1997) but some were also female sterile. 6 male sterile mutants were induced in China (Li, 1997) and 3 are under study in Turkey (Cagrigan, 1997). Male sterile mutation was induced by Rangaswami and Rathinam (1982) and Ramanathan *et al*. (1992) with lower gamma ray doses. Li & chun (1998) developed 6 male sterile lines in sesame through gamma radiations. Sorour *et al*. (1999) obtained mutants with more capsules, long capsules; multi capsules per axil and early maturation type from there experiment. However, the mutants and the breeding lines which have as mentioned desirable aspects did not yield as well as their wild type (Uzun *et al*., 2006). They found that shorter fruiting zone, length and plant heights in determinates resulted in a lower number of capsules per plant than their counterparts. Variations for fatty acids content were induced by gamma rays (Lee *et al*., 1984) and by sodium azide (Kang, 1997) in South Korea. These efforts culminated with the release of 'Seudum' in 1997 which had somewhat higher oleic content and more tolerance to *Phytophthora* (C.W. Kangs, Pers. Commun).

Objectives in Sesame for its Improvement through radiation technology

Key potential mutant traits of importance for sesame improvement are:

Good seed retention, shorter plants, higher harvest index, shorter growing period, determinate habit, uniform maturity, and reduced biomass. Some important characters which are highly desired are described below.

Disease resistance:

Disease problems tend to be country/region specific. Therefore, varieties that are resistant to the locally prevalent diseases (and at times pathogenic races) should be developed. Diseases that are known to be important in most countries/regions are Fusarium oxysporum f.sp. sesami, Phytophthora parasiticavar. sesami, Macrophomina phaseolina ssp. sesamica, Cercospora sesami, Alternaria sesami, Pseudomonas syringae pv. sesami, Xanthomonas campestris pv. sesami, phyllody (Mycoplasma Like Organism = MLO), powdery mildew (Oidium sp. and others) and Sesame Mosaic Virus. In the Republicof Korea mutant varieties have been developed with resistance to Phytophthora; mutants resistant to itwere induced also in Sri Lanka. However, the yield potential should be improved in these resistant or tolerant lines. The programme in Bangladesh has successfully induced tolerance for Sesame Mosaic Virus.

Pest resistance:

Until now no efforts have been made to induce mutations for pest resistance, but identifying lines with tolerance or resistance to devastating pests in sesame such as *Antigastra catalaunalis* (webworm, leaf webber, capsule borer), sphingid moth (*Acherontia styx*), aphids and gall-midge would be very helpful.

Shatter resistance:

Seed shattering before and during the harvest causes considerable losses in sesame. Mutations for seed retention (often monogenic) were critical in the domestication of most seed crops. A spontaneous indehiscent mutant (id) was discovered in 1942 in Venezuela by Langham (1946). However, due to its low yields and other undesirable side effects it has not been possible to use it in commercial varieties. Non-shattering mutants have been reported also in other crops.

Seed retention in sesame would be aided by determinate habit, i.e. that the plants would stop flowering, shed their leaves, and reach physiological maturity before their first capsules dry. Subsequently, the plants should dry as quickly as possible and release the seeds from the capsules in a way commensurate with the harvest and threshing methods. Flowering and shattering are affected by branching, capsule length, capsule width, number of capsules per leaf axil and other characters. The preferred trait contributing to seed retention should be chosen according to the projected harvest method. Thus, if the crop is to be machine harvested good placenta attachment is necessary, but if the plants are shocked, this is not necessary. In fact, for manual harvest farmers would prefer no placenta attachment, in order to ease the threshing work.

The gs allele for seamless capsules and the id allele can be used only for the oil or food ingredients market and then only if the seeds can be processed in a timely manner to minimize the effects of seed damage from threshing. Much breeding work has been devoted to the development of productive gs/gs and id/id cultivars, adapted to combine-technology and with undamaged, good quality, whole seeds. These efforts have been unsuccessful so far, but still they should not be abandoned. It should be realized that the probability of success is low unless a breakthrough is found, e.g. a modifying gene or a change in the combine technology. Eight gamma ray (300–750 Gy)-induced mutants with indehiscent (closed) capsules were recovered in four different Turkish cultivars. Allelism tests are planned to determine if these mutants are in the same locus, the known id locus, or if there are different loci. In Thailand, irradiation with gamma rays (500 Gy) of two local varieties resulted in three shatter resistant mutant lines, all out yielding their respective parent varieties. Radiation technology is proposed for determinate growth habit, maturity, and shatter-resistance in order to have a uniform frame of reference. Criteria need to be defined with time and additional experience.

Seed quality and contents

Oil yield

- To improve the oil yield two parameters have to be improved, that is seed yield of the crop and oil content in the seed.
- Oil content of the seed should be higher than 50%.
- There seems to be a correlation between oil content and seed colour; dark seeded varieties have lower oil content than the light seeded varieties, perhaps because the dark ones have thicker seed coats. However, breeders should aim at raising the oil contents of the dark

seeded accessions, possibly by selecting for a thinner seed coat. It is suggested to attempt to increase oil production per unit area also through testing of promising lines under higher plant density.

- When screening for oil content, the seed samples (capsules) should be taken about 2.5 cm below the middle of the capsule bearing zone of the main stem of the plant. The seeds should be fully mature.

Oil quality

Mutations were used to induce changes in the fatty acid composition in sesame seeds in the Republic of Korea and could be attempted elsewhere, e.g. in lines with high oil content (>50%).

Antioxidants

Induction of mutations could be attempted for increased contents of lignans in the seeds and for their composition, e.g. relative amounts of sesamin and sesamolin and similar products. These substances have a wide variety of applications in the production of pharmaceutics, pesticides and other industrial end products.

Confectionery quality

The lines to be developed for confectionery uses should be screened for seed colour, size and shape, for flavour, and for seed coat thickness and texture, using specific descriptors developed together with the processors.

Harvest index

This is an important character that may be improved by modifying plant architecture. According to the various farming systems this would mean to develop cultivars that:

- are optimal in height (0.5–1.5 m),
- are uniculm for dense stands under high input conditions,

Or

- is medium branching with apprised branches for low input conditions,
- have high capsule density,
- form the first capsules at the height of 15–40 cm above ground

Yield potential

To improve yield the important components to be considered are:

- Number of capsules per unit area. This should be given priority rather than number of capsules per plant.
- 1000 seed weight.
- Number of seeds per capsule. A representative sample of capsules from the top, middle and bottom part of the plant should be used to obtain a mean value for this parameter. However, the use of this parameter is debatable since eight-loculed plants have more seeds per capsule but they are not necessarily the highest yielding cultivars. Thus, the breeder should decide whether this is an appropriate parameter for his lines and conditions.

Adaptability

Cultivars to be developed should be adapted to the production systems of their prospective area(s) of cultivation.

- Short duration, early maturing cultivars that can be planted as a second crop (e.g. after rice in India, Pakistan, Bangladesh or after wheat or hay in Turkey, Israel) or as a single crop to exploit the short duration of the rainy season.
- Cultivars should be developed that are resistant or tolerant to the prevalent biotic and abiotic stresses.

METHODS OF IRRADIATION

The most common sources of radiation are radioisotopes and they are produced by nuclear reactors either by utilizing available excess neutrons for activation of stable elements or by separating useful fission products from the spent fuel. In India, the production of radioisotopes started in the late 50s with the commissioning of the Apsara reactor in 1956. The production capability was augmented in 1963 when the CIRUS reactor attained its full rated capacity of 40 MWt. There was a major increase in the production capacity when the 100 MWt reactor, Dhruva, attained criticality in 1985. Dhruva is one of the large research reactors in the world and it caters to the production of a wide spectrum of radioisotopes for use in medicine, industry, agriculture and research. All these reactors are located in Bhabha Atomic Research Centre (BARC) at Trombay. A major part of Cobalt-60, an isotope that is used for several applications including radiation processing, is produced in the power reactors of the Nuclear Power Corporation of India Ltd. (NPCIL).

A major challenge in the production of radioisotopes is to prepare them with the appropriate specific activity and radionuclidic purity conforming to the specifications for different applications for which they are used. For example, the low specific activity (~60 Ci/g) Cobalt-60 would suffice for radiation processing applications, whereas very high specific activity (>250 Ci/g), is needed for teletherapy applications.

Appropriate irradiation conditions at high flux irradiation position in suitable reactors are essential to get high specific activity radionuclides. Well-equipped processing facilities with hot cells are needed for handling the large quantities of activity involved. The hot cell facilities at the Radiological laboratories and at the High Intensity Radiation Utilization Project (HIRUP) at Trombay; and at the cobalt handling facility at Rajasthan (RAPCOF) are used for processing the irradiated Cobalt- 60 and for fabrication of the radiation sources as per the designs approved by regulatory agencies. Board of Radiation and Isotope Technology (BRIT) operates processing facilities for radioisotopes.

X-rays are produced when high velocity electrons strike the target material of high atomic number and lose their kinetic energy to the target material4. DAE (Department of Atomic Energy) is also working in the area of synchrotron sources, which offer the advantage of wavelength tunability and very high brightness and have wide ranging industrial and research applications.

In sesame

The parent materials chosen for sesame breeding programmes using induced mutations should preferably be the best well adapted available varieties requiring improvement in one or two characters, which lend themselves to screening large number of plants. The treated varieties or lines should be homozygous and uniform, and if necessary selfed first for one or two generations to attain the above.

- For gamma rays, doses ranging from 150–800 Gy proved successful in inducing useful mutations. Doses in the lower range were recommended for inducing desirable mutations with minimal simultaneous induction of

additional, often undesirable mutations.

- With fast neutrons' irradiation of dry sesame seeds, preliminary results in Thailand showed that doses of 30 and 80 Gy were effective for the induction of useful mutations.

ACHIEVEMENTS ON IRRADIATION IN SESAME

Induced mutation can play an important role in restructuring plant type leading to yield improvement together with shortening of growth period for the important grain legumes. Though the desirable mutations do not arise in large number in well adapted and genetically stable varieties, the occurrence of even a few desirable mutations in high yielding ideotypes has the great advantage of becoming homozygous and expressing its superiority within a couple of generations after induction. Mutations of crop plant, appearing inferior to cultivated types sometimes prove to be very important source of germplasm when transferred to favorable ideotypes. Again a mutation that is inferior to the original line in a particular area of cultivation may become distinctly superior in other climate or environmental conditions (Ganguly and Bhaduri, 1980).

ACHIEVEMENTS IN INDIA

A large number of mutant varieties of various crop plants have been developed in India. By 2004 this list has grown to 313 (Chopra, 2005). The mutants varieties released include cereals, grain legumes, oil seeds, fibre crops, vegetables and ornamentals. The success story of mutation breeding in ornamentals and horticultural crops in India is particularly impressive. The mutant varieties released in sesame are as below:

Sesamum indicum L. – Sesame – 3 mutant varieties (Chopra, 2005)

CONCLUSION

As sesame is an ancient and advantageous crop but it is still at an early stage of breeding. It is being amply demonstrated by its present state of very poor yield performance as because

- To narrow genetic base its is not possible to restructure the sesame crop thoroughly.
- Its cultivation in marginal and sub marginal lands under minimum or no input management practices.

But if we followed the irradiation technology steps in sesame we can get high yielding varieties with desirable morphological and agronomical characters

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Table 1: Officially Released Sesame Varieties Derived from Induced Mutations and Reported to the Plant Breeding and Genetics Section, Joint FAO/IAEA Division, Vienna[1]

Country	Variety	Year	Mutagen	Main Character
Egypt	Cairo white 8	1992	Gamma rays	Non-branching
	Sinai white 48	1992	Gamma rays	Seed color
India	Kalika	1980	EMS	Short stature
	UMA	1990	Chemical mutagen [2]	Uniform maturity
	USHA	1990	Chemical mutagen [2]	Higher yield
Iraq	Babil	1992	Gamma rays	Earliness
	Rafiden	1992	Gamma rays	Earliness
	Eshtar	1992	Gamma rays	Capsule size
R of Korea	Ahnsan	1985	X-rays	Disease resistance
	Suweon	1991	Cross [3]	Lodging & disease resistance
	Pungsan	1996	Cross [4]	Determinate habit, seed retention
Srilanka	ANK-2	1995	Gamma rays	Disease resistance

[1] Source: L. Van Zanten, from database of the Plant Breeding and Genetics Section, Joint FAO/IAEA Division, Vienna; [2] Mutagen unspecified (possibly an arsenic compound), [3] From progeny of cross with mu ztant. [4] From progeny of the cross with the dt 45 mutant induced by A. Ashri

Community Radio for Agricultural and Rural Development

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India being an agrarian economy, with majority of its population residing in rural areas, any development intervention in these areas have direct impact on the overall development of nation. One among such interventions is community radio which gives a voice to the community they serve with programmes in local languages, respecting local culture, traditions and interests. And it facilitates dialogue within the community; while on a national level it encourages diversity, creativity and citizens' participation in democratic processes. In the more remote rural areas, Community Radio stations are often the only media available, where they are listened to by large parts of the population. Community Radio stations fill the gap left by national and commercial media, and reach local audiences the national media ignore.

They fulfil the role of public broadcaster, informing the public at a local level, and representing their views. In this way, they give a voice to the voiceless, enabling people to speak and make their opinions, grievances and ideas known to those who have the power to make decisions.

WHAT IS COMMUNITY RADIO?

Community radio is a type of radio service that caters to the interests of a certain area, broadcasting content that is popular to a local audience but which may often be overlooked by commercial or mass-media broadcasters. Community Radio implies a range of terms like "alternative", "radical" or "citizen radio". Traditionally in sociology, a community is defined as a group of interacting people living in a common location. Community radio is often built around concepts of access and participation, and so the term "community" can be thought of as often referring to geographical communities based around the possible reach of the signal, i.e., the people who can receive the message, and their potential to participate in the creation of such messages

Community radio is confined to a small geographical area. It depends on low power transmission covering not more than 20-30 km. radius. It serves a community which uses common resources for livelihood, has common development issues and concerns, which are relatively localized, nevertheless connected to national and regional development goals.

Community radio is distinguished by three essential principles. Non-profit

making, community ownership and management and community participation. Community radio is also characterised by its limited local reach, low power transmission and programming content that reflects the educational developmental and socio-cultural needs of the specific community it serves.

Community radio in agricultural and rural development

Agricultural extension is the vehicle or system for delivering useful information to farmers and assisting those farmers to develop requisite knowledge, skills and attitudes to make use of this information or technology effectively. In recent times advances in Information and Communication Technologies (ICTs) are revolutionizing agriculture extension by offering various technological options such as television, internet, mobile, telephony etc. Since independence, India has implemented many extension programs for agriculture and rural development. Despite being well-intentioned and comprehensively designed, these efforts could not fulfil all the needy rural mass.

Among the three main categories of mass communication tools for agricultural extension such as radio, television and print media, the importance of radio for agricultural extension cannot be denied.

All India Radio is the state monopoly broadcasting organization in India. It's centralized broadcasting and bureaucratic approach prevents people's large-scale participation in broadcasting. Community Radio is a new concept in broadcasting in India. Each of the stations serves a small area, providing utility services reaching right into the heart of the community which uses the microphone to reflect and enrich its life and artistic expression. The first experiment in local/community radio was conducted in Tamil Nadu. The experiment was launched on October 30, 1984. The main objective of this station is to support the development of socio-economic and cultural objectives of the local people. Besides providing information, education and entertainment this local radio station disseminates information relating to government policies and programmes extensively and motivates the people to participate in the national endeavour for integrated development of the country. Other experiments have been carried out in rural areas of Bangalore, Karnataka and Hyderabad, Andhra Pradesh. Experience with rural radio has shown the potential for agricultural extension to benefit from both the reach and the relevance that local broadcasting can achieve through participatory communication approaches. Extension workers use radio for communicating information on new methods & techniques, giving timely information about the control of crop pests & diseases, weather, market news, etc. For this purpose, talks, group discussions, folksongs, dialogues & dramas are usually organised.

CHALLENGES TO COMMUNITY RADIO

Community radio faces the challenges in effective and quality programme production in terms of content, production quality and community involvement:

- A high turnover of staff that causes a lack of journalistic and technical skills and thus a consistent demand for training. Training on offer in most

countries does not address the specific needs of Community Radio.

- Community Radio derives its strength and popularity from community participation. In practise participation is harder than it seems, because it is labour intensive, requires the right attitude, skills and mobile equipment.
- Without proper management skills, as well as some knowledge of financial management and income generation, it is very hard for Community Radio to survive without donor funding, which will always, eventually, dry up.
- In many countries, there is still a lack of a clear regulatory framework in which Community Radio operates.

Among the various challenges faced by the community radio, the participation from the people is the major one and no community radio can survive without participation of people. In this regard, it is essential that political leaders, religious leaders and other opinion leaders be included or consulted during planning of the programmes.

SUMMARY AND CONCLUSIONS

Agriculture has always been a highly knowledge-intensive sector requiring continuous information flow. Farmers' quest for authentic, credible and usable information is increasing. The diverse socio-cultural backgrounds, linguistic barriers, geographical remoteness and differential incentives make the task of information dissemination challenging. Community radio can foster to the needs of remote rural base on varied aspects which are usually unseen in the conventional media. Efforts can be directed in ways for promoting more effective means of using community radio in rural development.