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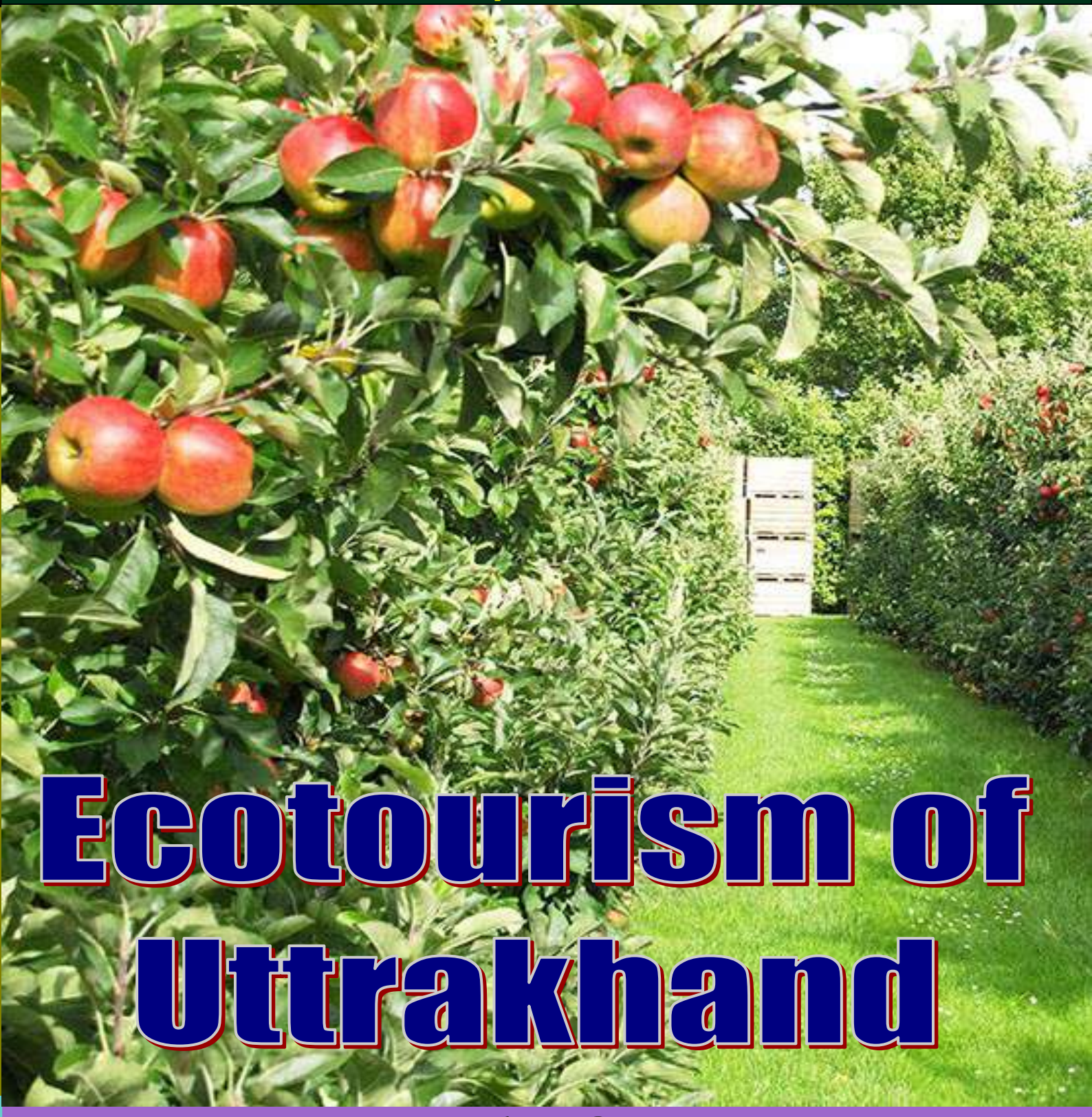

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Waste management and solution in India

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Abstract

Industrialization becomes very significant for developing countries like India having large number of population. Rapid increase in urbanization and per capita income lead to high rate of municipal solid waste generation. India is having second largest population in the world after China with more than 1.27 billion population contributing 17.6% of world's total population. On the contrary, India is sharing only 5% of world's area accounting 3,185,263 km^2. Out of total population, 68% lives in rural areas, while 32% lives in urban areas (World Bank, 2014). Seeing the scenario of increase in waste generation, improper utilization and disposal of waste in the country the Ministry of Environment and Forest (MoEF) has developed "the Municipal Solid Waste (Management and Handling) Rules, 2000", which states that "Municipal Solid Waste (MSW) is commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. (Anonymous 2019). Therefore, the management of waste generated in Indian cites has been found inadequate and challenging. This comprehensive review looks into various useful management methods and solutions that deal with the problems associated with Municipal Solid Waste generation for protecting the environment from the long effects of waste and its issues and suggests the remedial measures to cope with it.

INTRODUCTION

Waste is a continually growing problem at global and regional as well as at local levels. Solid wastes arise from human and animal activities that are normally discarded as useless or unwanted. In other words, solid wastes may be defined as the organic and inorganic waste materials produced by various activities of the society and which have lost their value to the first user. As the result of rapid increase in production and consumption, urban society rejects and generates solid material regularly which leads to considerable increase in the volume of waste generated from several sources such as, domestic wastes, commercial wastes, institutional wastes and industrial wastes of most diverse categories. In India, the National Environment Policy, 2006 while suggesting measures for controlling various forms of environmental pollution lays emphasis on the need for collection and treatment systems for recycling wastes and devising measures for environmentally safe disposal of residues. With rapid urbanization, the country is facing massive waste management challenge. Over 377 million urban people live in

7,935 towns and cities and generate 62 million tonnes of municipal solid waste per annum. Only 43 million tonnes (MT) of the waste is collected, 11.9 MT is treated and 31 MT is dumped in landfill sites (Anonymous 2018). In India, waste management is governed by various sub-ordinate legislations and the Ministry of Environment, Forest and Climate Change, Government of India ("MoEF") in conjunct with State Pollution Control Boards of different states ("SPCB") administer the gamut of waste management regulations.

Swachh Bharat Abhiyaan, Prime Minister Narendra Modi's ambitious project to make India a clean country, aims to teach citizens to reduce and even clean their own waste. But first a matter of real urgency needs to be sorted out: India needs to increase landfill area, even as it looks into overhauling its municipal solid waste management system India generates 62 million tonnes of waste every year, of which less than 60% is collected and around 15% processed. With landfills ranking third in terms of greenhouse gas emissions in India, and increasing pressure from the public, the Government of India revised the Solid Waste Management after 16 years. (Swaminathan, 2018). Ten million tonnes of garbage is generated in just the metropolitan cities: Delhi, Mumbai, Chennai, Hyderabad, Bangalore and Kolkata.

Waste management is the generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes. There are various types of solid waste including, municipal, agricultural, and special like hazardous and household *etc*. The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment, or aesthetics. The initiative was first done by Waste Management Inc. in 1971. It is mainly based in North America. The major services include the Waste, recyclables, yard debris, and hazardous materials collection, hauling, treatment and disposal, Dumpster rental, Portable toilet rental, and security services. According to the Press Information Bureau, India generates 62 million tonnes of waste (mixed waste containing both recyclable and non-recyclable waste) every year, with an average annual growth rate of 4% (PIB 2016). The generated waste can be divided into three major categories: Organic (all kinds of biodegradable waste), dry (or recyclable waste) and biomedical (or sanitary and hazardous waste).

In India, a proper waste management system is urgent necessary. Because
(a) To control different types of pollution, *i.e.,* air pollution, soil pollution, water pollution *etc.* **(b)** To stop the spread of infectious diseases **(c)** To conserve all our environmental resources, including forest, minerals water *etc.* **(d)** To recycling of hazardous wastes for further production **(e)** To implement proper wastes management policy, successful and safe disposal of solid and liquid wastes are very necessary.
In this connection the Government of any country has to follow the steps below:

i. Collection
ii. Segregation
iii. Dumping
iv. Composting
v. Drainage

vi. Treatment of effluents before discharge

Collection of Wastes:

Waste collection is the component of waste management which results in the passage of a waste material from the source of production to either the point of final disposal.
Waste collection also includes the kerb-side collection of recyclable materials that technically are not waste, as part of a municipal landfill diversion program,

(a) Household Waste Collection
(b) Commercial Waste Collection

Segregation of Wastes:

Waste segregation means division of waste into dry waste and wet waste. Dry waste includes paper, cardboard, glass tin cans *etc.* Wet waste on the other hand, refers to organic waste such as vegetable pads, left-over food *etc*. Separating our waste is essential as the amount of waste being generated today causes immense problem.

Waste can be segregated as:

(a) Biodegradable waste include organic waste, *e.g.,* kitchen waste, vegetables fruits, flowers, leaves from the garden and paper.
(b) Non-biodegradable waste can be further segregated into:

i. Recyclable waste– plastics, paper, glass, metal, *etc.*
ii. Toxic Waste– old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticides containers, batteries, shoe polish.
iii. Soiled– hospital waste such as cloth soiled with blood and other body fluids. Toxic and soiled waste must be disposed with utmost care.

Dumping of Wastes:

Removing or transferring of toxic wastes from the primary collection area to the safe disposal area should be done very effectively. There are several ways of transporting wastes from primary collection area to secondary collection vehicles. The collection, transfer and transport of waste are basic activities of waste management system all over the world. Disposing waste products is major problem since last many decades.

Composting of Wastes:

Organic matter constitutes 35% to 40% of the municipal solid waste generated in India. This waste can be recycled by the method of composting, one of the oldest forms of disposal. It is the natural process of decomposition of organic waste that yields manure or compost, which is very rich in nutrients.

Composting is a biological process in which micro-organisms, mainly fungi and bacteria convert degradable organic waste into humus like substance. It recycles the nutrients and returns them to the soil as nutrients. The process of composting ensures the waste that is produced in the kitchens is not carelessly thrown and left to rot. Apart from being clean, cheap and safe, composting can significantly reduce the amount of disposable garbage.

Drainage of Wastes:

A proper drainage of waste is very important and essential part of waste management in the urban and industrial areas.

Treatment of Effluents:

Sewage (Effluents) treatment or domestic waste water treatment, is the process of removing contaminants from waste water and house hold sewage, both run off (effluents) and domestic. It includes physical, chemical and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer). Using advanced technology it is now possible to reuse sewage effluent for drinking water.

CONCLUSION

Human ways of life have placed pressure on the environment and have caused imbalance in the eco systems by the producing, consuming and wasting of natural resources. With an exponentially increasing population, it is even more important to be considerate about how well individuals take care of the planet. There is an increased focus from regulators towards the need for sustainable environment and the same is evidenced from the new Companies Act which requires certain companies to compulsorily carry out corporate social responsibility activities, including environmental development. However, if the problem of municipal solid waste is to be truly addressed, the root of the issue must be looked at first. If less waste is generated in the first place, the challenge of finding environmentally feasible ways of disposing of waste will be much easier.

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Silicon: The beneficial element

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Silicon (Si) is the second most abundant constituent (28%) of the total soil weight in the earth's crust (Epstein, 1994), which is only lower than oxygen that is 47%. Si is not considered within the group of nutrients that are essential or functional for plant growth, but its absorption brings several benefits, especially for rice, such as the increase of cell wall thickness below the cuticle imparting mechanical resistance to the penetration of fungi, decrease in transpiration (Yoshida *et al.,* 1962), and improvement of the leaf angle, making leaves more erect. Rice has a general high ability to absorb and accumulate Si; Si deposition in rice varies greatly.

Beginning in 1848, numerous laboratory, greenhouse and field experiments have shown benefits of Si fertilization for rice (*Oryza sativa* L.) (15 to 100%), corn (*Zea mays* L.) (15 to 35%), wheat (*Triticum aestivum* L.) (10 to 30%), barley (*Hordeum vulgare* L.), sugar cane (*Saccharum officinarum* L,), cucumber (*Cucumis sativus* L.) (10 to 40%), strawberry (*Fragaria* spp.) (20 to 30%), citrus (*Citrus* spp.)(15 to 50%), tomato (*Lycopersicon esculentum* Mill.) (15 to 50%), grasses (*Stenotaphrums ecundatum* Kuntze, *Cynodon dactulon* L., *Loliummultiforum* L.) (10 to 25%) (Snyder *et al.*, 2006). Silicon fertilization has a double effect on the soil-plant system.

Firstly, improved plant Si nutrition reinforces plant protective properties against diseases, insect attacks, and unfavorable climatic conditions such as drought, salt, heavy metal or hydrocarbon toxicity. Secondly, soil treatment with biogeochemically active Si substances optimizes soil fertility through improved water, physical and chemical soil properties and maintenance of nutrients in plant-available forms.

The theoretical prerequisites for the first investigations of silicon fertilizers were found in the end of 18th century. In 1819, Sir Humphrey Davy wrote "The siliceous epidermis of plants serves as support, protects the bark from the action of insects, and seems to perform a part in the economy of these feeble vegetable tribes (Grasses and Equisetables) similar to that performed in the animal kingdom by the shell of crustaceous insects". In 1840, Justius von Leibig suggested using sodium silicate as a Si fertilizer and conducted the first greenhouse experiments on this subject with sugar beets. Starting in 1856 and being continued at present, a field experiment at the

Rothamsted Station (England) has demonstrated a marked effect of sodium silicate on grass productivity.

In the 19th and 20th centuries, many naturalists measured the elemental composition of plants. Their data has shown that plants usually contain Si in amounts exceeding those of other elements (Kovda 1956). Today numerous researches have demonstrated a possibility to raise crop production on various soils in different climatic zones including extremely dry sub-tropic and humid tropic regions (Datnoff *et al.* 1997).

Silicon content in different parts of a rice plant generally ranged from high to low, in descending rank in the hull, leaf, leaf sheath, culm, and root (Zhu, 1985). Si helps plants to overcome multiple stresses including biotic and abiotic stresses (Ma, 2004). For example, Si plays an important role in increasing the resistance of plants to pathogens such as blast on rice(Datnoff *et al.,* 1997). In addition to crops, the value of silicon is gaining attention in animal nutrition where Si may play a role in the health of bone, joints, skin, hair and connective tissues.

As agriculture has become more intensive and yields have been dramatically increasing, the level of Si being removed from the soil has also been increasing resulting in depleted soil Si concentrations and limited plant growth and yields. Removal rates of Si varies with the plant species, for example sugar cane removes 300 kg ha/year (Meyer and Keeping 2001), rice removes 500 kg/ha/year (Makabe *et al.* 2009), grasslands in the U.S. remove 22 - 67 kg/ha/year (Blecker *et al.* 2006) While tropical forests remove 41- 67 kg/ha/year (Lucas *et al.* 1993; Alexandre *et al.* 1997) and temperate forests remove 2.3 - 44 kg/ha/year (Cornelis *et al*. 2010). Crops remove Si faster than the natural soil system can mineralize and replace the utilized Si.

It has been calculated that 210–224 million tons of Si are removed from cultivated soil every year (Matichenkov and Bocharnikova 2001). This figure is roughly equivalent to the annual discharge of dissolved silica from rivers to oceans (Berner and Berner 1996) and indicates that agriculture may play a significant role in Si utilization and removal from the soil. Changes in farming practices have led to less incorporation of organic matter back into the soil which Often results in lower Si levels. Savant *et al.* (1997a) suggested that not returning straw to the field Soil might lead to a depletion of plant-available Si in soils with a resulting decline in cereal yields.

Table 1. Si Concentration of some of the most important crops ranked by production.

Crop	Production (MT)	Si Concentration in Shoots (% Dry Wt.)*
Sugar Cane	1.736	1.509
Corn	826	0.827
Rice	686	4.167
Wheat	683	2.455
Potatoes	326	0.4
Cassava	232	0.5

Soybeans	231	1.399
Sugar Beet	222	2.34 -7
Barley	155	1.824
Tomatoes	136	1.55

Dr. Patrick McGinnity (2015).

Silicon is considered an agronomically essential element for sustainable rice production (Savant *et al.* 1997a) and recognized as such in Japan (Ma, 2004). Silicon is believed to play the following roles in rice plants: i) Rice as a Si accumulator; Si is absorbed as PAS by rice plants in far larger quantities than the macro nutrients. For example, Si uptake is 108 % greater than nitrogen (N) uptake. A rice crop producing a yield of 5000 kg ha^{-1} removes 230-470 kg Si ha^{-1}. ii) Increases rice plant growth: Savant *et al.* (1997a) reported that an adequate supply of Si increased the number of panicles, the number of grains per panicle, the percentage ripening and the light-receiving posture of rice plants, thereby improved photosynthesis. iii) Increased fertilizer efficiency: Elawad and Green (1979) reported that Si has the potential to raise the optimum rate of N.

Table 2.General Properties of Silicon

Element name	**Silicon**
Derived from	**Latin word *silex,* meaning flint**
Element symbol	**Si^{+4}**
Atomic number	**14**
Atomic weight	**28.085**
Density	**2.33 g/cc**
Hardness	**6.5 (Mohr scale)**
Appearance	**Dark gray, bluish**
Melting point	**1410 °C**
Boiling point	**2355 °C**

SOME FEATURES OF SILICON

- ✓ Silicon (Si) is not yet classed as an essential nutrient but it exists in all plants grown in soil and is recognizedas a functional nutrient.The benefits of silicon include drought and heavy metal tolerance, and improved quality and yield of agricultural crops.Si is taken up at levels equal or greater than essential nutrients such as Nitrogen and Potassium in certain plants such as rice and sugarcane, for which it is considered Agronomically essential for sustainablecrop production (Savant *et al.* 1997).
- ✓ Si is the only element that does not damage plants when accumulated in excess due to its properties of un-dissociation at physiological pH and polymerization (Ma *et al*., 2001).The uptake rate of Si by rice roots is much faster than that of water, resulting in a quick decrease in Si concentration of external solution (Okuda and Takahashi, 1962).

- ✓ Mostly present as Silicon dioxide and as various silicates.Used in glass as silicon dioxide (SiO_2). Used as semiconductor to make microchips for electronics.Silicon is also used in solar cells, tools, cements, grease and oils. In INDIA, though research started earlier to 1960's/ 1970's. Silicon research in Indian Farming is limited (Prakash, 2002).
- ✓ Silicon is accumulated at levels equal to or greater than essential nutrients in plant species belonging to the families Poaceae, Equisetaceae, and Cyperaceae. In rice, Si accumulation is about 108% greater than nitrogen. It is estimated that a rice crop producing a total grain yield of 5 ton ha^{-1} will remove 0.23 to 0.47 ton Si ha^{-1} from the soil (Savant *et al*., 1997b).Increased growth and fruit yields in some species. Tolerance to abiotic stress: frost, drought and salinity, toxicity by Al, Mn, heavy metals (Ma, 2004).

- **Why Do Plants Need Silicon?**

  Si exists in all plants grown in soil and its content in plant tissue ranges from 0.1 to 10% (Epstein, 1999). Si is considered as a nutrient of agronomic essentiality in that its absence causes imbalances of other nutrients resulting in poor growth, if not death of the plant (Epstein, 1994; Savant *et al,* 1997).Silicon responsive plants are Rice, Wheat, Barley, Beans, Boston fern, Citrus, Peace Lily, Croton, Cucumber, Grapes, Sorghum, Maize, Oats, Orchid, Pumpkin, Sunflower, Rose, Rye, Strawberry, Sugarcane, Brinjal, Turf grass, Umbrella Tree, Watermelon and Zinnia.

- **Higher plants differ in their capacity to accumulate Silicon**

Crop type	Si %
Wetland grasses (Rice)	4.60 – 6.90 %
Dryland grasses (sugarcane, cereal & turf species)	0.46 – 1.38 %
Dicots (esp. legumes)	< 0.23 %

Marschner (1995)

- **Plant Families – known Si accumulators**

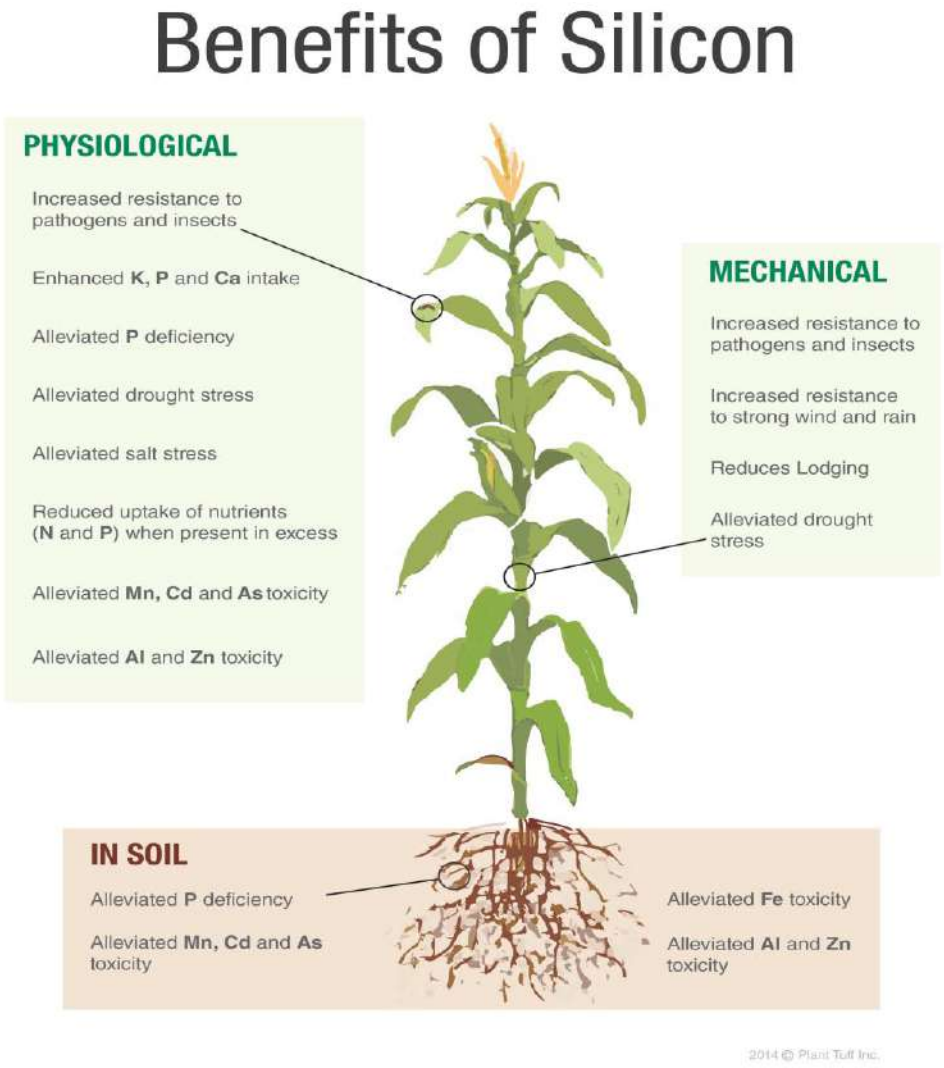
Arecaceae	Equisetaceae	Muscaceae
Aceraceae	Juncaceae	Papaveraceae
Asteraceae	Limaceae	Poaceae
Balsaminaceae	Liliaceae	Polemoniaceae
Cornaceae	Lycopodiaceae	Saururaceae
Cucurbitaceae	Magnoliaceae	Selaginellaceae
Cyperaceae	Moraceae	Tamaricaceae

Ma & Takahashi (2002)

- **Deficiency symptoms of silicon**
  - ➢ Plant leaves becomes soft & droopy
  - ➢ Withering of leaves & wilting of plants
  - ➢ Yellowing or brownish colour of lower leaves as well as necrotic leaves
  - ➢ Poor tillering and retarded growth

- Leaf tips wilting
- Smaller panicles with increased sterility
- Rice plants suffering from nutritional disorder as bronzing.

- **Function of silicon in different biotic and abiotic stress**
  - Silicon improves canopy photosynthesis.
  - Enhance resistance to biotic stress disease like blast and powdery mildew and pest like stem borer and plant hopper.
  - Italleviates abiotic stress like improves nutrient imbalance e.g. N Excess and P deficiency.
  - Silicon prevents physical stress like prevent lodging, increase resistance to low and high temperature, increase resistance to drought stress, radiation stress, high temperature and freezing.
  - plant grown with Si reduced transpiration rate due to which plants resisted water and salt stress.
  - Rice plant enhanced resistance to salinity when grown with Si, and also reduced absorption of Na.
  - Rice seedling grown with Si soil decreased disorders of Fe, Mn and Al toxicity.
  - Application of Si increased crop yield under dry as compared to wet condition.
  - Foliar spray of Si found better under water stress condition.
  - The toxic effect of heavy metals could be alleviated with Si application and helps in increasing crop growth and yield.
  - Silicon application also helps in maintaining nutrient ration within plant system.
  - The salinity stress on crop could be decreased with inclusion of silicon in nutrient management.
- **Interaction of silicon with other nutrient**
  - P: Si increases P in grain & straw in rice grown without P.
  - K deficiency reduces Si accumulation in epidermal cells of the leaf blades leading to increased susceptibility to blast.
  - Added Si increased P, Ca and Mg (Islam and Saha, 1969) and Zn (Lewin and Reiman, 1969) in rice.
  - However, it decreased Fe translocation & increased movement of Mn from straw to grain (Verma and Minhas, 1989).



Silicon Sources:

1. Organic sources

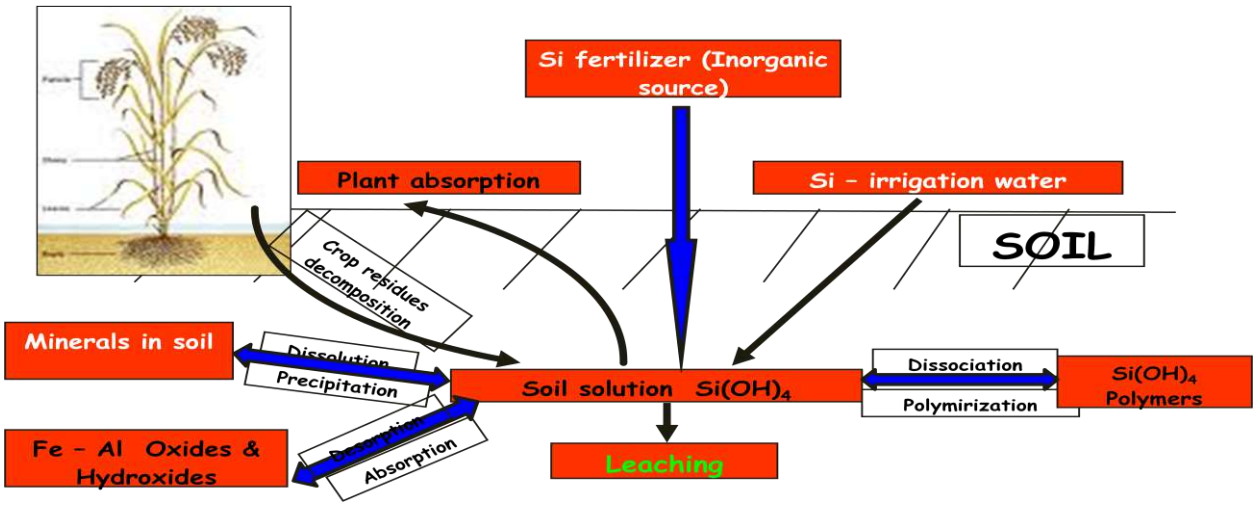
- Rice straw, chopped rice straw, rice hull, rice husk, rice straw compost are the major organic sources.
- In general,
  - ✓ Rice straw, rice straw compost and rice husk contain 4 – 10 % Si.
  - ✓ Based on FAO (2006), about 25 million tones is available for recycling of silicon from rice straw. Similarly 8 million tones of silicon is available for recycling from rice hull.

2.Inorganic sources

Name	Formula	Content
Blast furnace slag	$CaSiO_3$, $Mg SiO_3$	**14-19 % Si**, 25-32% Ca, 2-4% Mg
Converter slag	$CaSiO_3$, $Mg SiO_3$	**4-10 % Si**, 26-46% Ca, 5-9% Mg
Silico-magnesium slag	$CaSiO_3$, $Mg SiO_3$	**16-21 % Si**, 21-25% Ca, 0.5-2% Mg
Fused magnesium phosphate	-	**9% Si**, 9% P, 7-9% Mg
Calcium silicate	$CaSiO_3$	**14 –19 % Si**, 1-4% Mg
Potassium silicate	$KSiO_3$	**14.5% Si**, 17% K, 2.5% Mg

- **Other inorganic sources are**
  - Agrosil: Silicon Based Fertilizer With Sulfur &Calcium , ideal for soil application, contains around 46% silicon, 8% sulphur and 6% calcium.
  - Greensil: Water Soluble Silicon Fertilizer powder comprising 98% Si, ideal for photosynthesis of the crop & gives it protection from biotic and abiotic stresses. It further helps in preventing various diseases like leaf blight, Downy Mildew and Powdery Mildew.

Fig 1. Transformation Processes influencing silicon concentration in soil solution



A summary of the main reactions/transformations influencing Si concentration in soil solution is shown in Fig.1. Application of easily decomposable organic matter, weather condition, soil pH and type of minerals are the several factors that affect the availability of silicon by different ways.

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White death of Soil: Fear of farmers

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The term "white death" is a synonymously used for salt affected soils which is one of the serious problems for Indian farmers. It affects production of important crops like wheat, rice and oats depressing their production by as much as 50%. Salinity of soils is a wide spread phenomenon in irrigated and semi-irrigated regions of the world where irrigation is essential to increase agriculture production. Globally more than 900 million ha of land is affected by salts accounting for more than 6% world`s total land area. In India, salt affected soils occupy an area of about 6.94 million ha of which saline soils and sodic soils constitute roughly 40 and 60 percent respectively.

Figure Salt affected soils in India

TABLE 15.1. Statewise Distribution of Salt Affected Soils in India

States	*Area (million hectares)*
Uttar Pradesh	1.295
Gujarat	1.214
West Bengal	0.850
Rajasthan	0.728
Punjab	0.688
Maharashtra	0.534
Haryana	0.526
Orissa	0.404
Karnataka	0.404
Madhya Pradesh	0.224
Andhra Pradesh	0.042
Other States	0.040
	6.949

Source: Fertilizer news, Vol 21(9):pp(15-23)

According to current scenario, states like Punjab, Haryana and Gujrat are most affected by salinity and sodicity of soils. Soil salinity can be defined as salt content in the soil and the process of increasing salt content in soil or water is known as salinization. Salts are found naturally in soil and water bodies all over the world. The salt content of soil increases either by natural processes or by artificial process. Natural processes increase salt content by mineral weathering or by the gradual withdrawal of an ocean water leaving large amount of salts on soil surface. Mineral weathering is the process of breaking down of mineral rocks after coming in contact with Earth`s atmosphere, water and biological organisms. Artificial processes responsible for soil salinization are irrigation with high saline water and road salts. Poor drainage of water tends to increase the salinity of soils. Water utilized for irrigation inevitably contains some amount of salt. Some amount of water is utilized by the plants and some is returned to the atmosphere through evaporation and transpiration leaving the salts behind in the soil. Thus, irrigation naturally leads to the accumulation of salts in the soil which must be leached out either by rainfall or by suppling excess of water than required for irrigation. However, excess water supplied to the field must have proper drainage lest it would rise the water table creating waterlogging conditions. Among the anthropogenic causes grazing of domestic ungulates can alters the soil salinity by increasing the bare soil proportion. Salt ions which are mainly responsible for salinization are Mg^{+}, Na^{+}, Cl^{-}, K^{+} and Ca^{2+}. In urban areas salinity results from the combination irrigation and groundwater processes. Excess of these ions in the root zone of plants results in the partial or complete loss of soil productivity, the process referred as “soil salinization”. Accumulation of Na^{+} ions in the root zone of plants and soils are referred as “sodic soil”. These types of soils are more difficult to handle as they tend to have a poor structure which prevents water infiltration and drainage system.

HARMFUL EFFECTS OF SALINIZATION

Higher soil salinity causes severe physiological disorders in plants because of high concentration of electrolytes in the rhizospheric environment which ranges from a cytotoxic stress and denaturing effect of the ions themselves to osmotic stress and alteration of ion uptake balance thereby decreases the growth and yield of plants. Saline lands are not suitable for growth of traditional crops and fodders because of extreme salinity and other adverse factors. Salts in the soil find its way to the drinking water of animals thus affecting their health. Salinity in water is measured in Total dissolved solids (TDS). Slightly saline water contains 1000-3000 ppm TDS while the very saline water contains TDS 10,000 to 35,000 ppm. Brine contains TDS higher than 35000 ppm. Animals provided drinking water with higher salinity will result in temporary diarrhea. Water containing 3000-5000 ppm TDS is unsatisfactory for poultry. Sheep is the most tolerant animal followed by cattle and pig. Poultry is highly sensitive to the salinity of the water. Salinity damage roads, bricks and cause corrosion to the pipes and cables. It leads natural calamities like land degradation affecting the life of people seriously in hilly regions. It leads soil erosion ultimately affecting the growth of plants. Soil salinity also increased the leaching of Cd^{+}, Mg^{+}, and Zn^{2+}.

Some Remedies to Solve Soil Salinization

Reclamation and management of salt affected soils are important ways to solve soil salinity problem. It can be done by leaching of the excess of salts from the root zone of plants and by effective drainage system. Salt leaching can be done by different methods: Leaching, Flushing and Scrapping.

(i) Leaching – It is the best and most effective method in removing salts from soil. But the major conditions to carry out leaching in an area are that moisture content of soil should be low and water table should be deep. Then fresh water should be ponded on the soil surface and allow it to infiltrate. It is most effective when salty drainage water is discharged thorough sub-drains system that carries the leached salts out of the area under reclamation process. In India, leaching is most suitable during the summer months as water table is deep and soil is dry which allow carrying large quantities of fresh water diverted for reclamation process.

(ii) Flushing - Flushing can be described as using water in a manner that it washes away the accumulated salts on surface of soil and is sometimes used to desalinize soils having surface salt crusts. But this method does not have much practical significance as small quantities of salts are removed by this process.

(iii) Scrapping – Scrapping is the removal of salts from soil surface by mechanical means. Although, it showed very limited success but most farmers favor this process. But the major drawback is that it removes the salts temporarily and disposal of salts still possess a major problem.

Provision of adequate drainage measures is the only way to control the groundwater table i.e. using surface drainage, sub-surface drainage with filter materials and pump

drainage for maintaining water table. In surface drainage, ditches are provided so that excess water will run off before it enters the soil. However, the water intake rates of soils should be kept as high as possible so that water which could be stored will not be drained off. Field ditches empty into collecting ditches built to follow a natural water course. A natural grade or fall is needed to carry the water away from the area to be drained. In subsurface drainage system, If the natural subsurface drainage is insufficient to carry the excess water and dissolved salts away from an area without the groundwater table rising to a point where root aeration is affected adversely and the groundwater contributes appreciably to soil salinization, it may be necessary to install an artificial drainage system for the control of the groundwater table at a specified safe depth. Filter materials are used in sub surface drains to prevent the inflow of soil into the drains which may cause failure, and/or to increase the effective diameter or area of openings in the drains which increases inflow rate. Different types of filter materials are used like thin sheets of fiber glass and spun nylon and porous materials like sand and gravel. Pumping groundwater in areas where a suitable permanent aquifer exists is often an effective means of lowering the water table. Using amendments to reclaim soil salinization having excess neutral soluble salts and a high SAR would depend on soil infiltration characteristics and the electrolyte level of the irrigation water. Light textured soils with high infiltration rate are not likely to respond to gypsum application. In heavy textured soils with low electrolyte water, application of an amendment is desirable to hasten reclamation. Before using amendments for reclamation, it needs to be established which type of amendment will be used and its quantity to be applied. Reclamation of saline soils in a cost-effective manner by using appropriate combinations of irrigation management, soil management, and soil amendments then it can remediate the salinity problem otherwise nearly 50% of the land in the world may be left uncultivated.

CONCLUSION

Soil salinity presents a major challenge for the farmers all over the world. Farmers are depended on different types of fertilizers along with irrigation water for their crop production which results in soil salinization affecting human as well as animal health but if we can manage and reclaim saline soils effectively in a cost-effective manner by using appropriate combinations of irrigation management, soil management, and soil amendments then it can remediate the salinity problem otherwise nearly 50% of the land in the world may be left uncultivated.

Adjuvants: Enhancing agrochemical use efficiency

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Abstract

Adjuvants are special products that have the ability to influence the performance of pesticides and fertilizers. The use of adjuvants as management tools for agricultural chemicals can modify spray solutions by improving the physical characteristics, reducing or minimizing chemical losses, and maximizing efficacy by enhancing penetration. Adjuvants maximise product efficacy when conditions are less than ideal, when low spray volumes are used, or when product performance needs to be modified or improved. The higher dosage of chemicals has led to many environmental and health hazards. The ability to improve production efficiency will be closely tied to agrochemicals. As adjuvants have their utility in enhancing agrochemical performance and make chemicals to use very meagre. Adjuvants mixed with chemicals helps in proper spreading on the pest or plant surface and thus, a better action than conventional use of pesticides.

1. Adjuvant

Adjuvants (From Latin, *adiuvare:*) are commonly used in agriculture to improve the performance of pesticides. Broadly defined, "an adjuvant is an ingredient that aids or modifies the action of the principal active ingredient."

An adjuvant to aid is a material added to aid or modify the action of an agrichemical, or the physical characteristics of the mixture. Agricultural spray adjuvants are used to enhance the effectiveness of pesticides such as herbicides, insecticides, fungicides and foliar fertilizers.

The use of adjuvants with agricultural chemicals generally falls into two categories:

(1) Formulation adjuvants are present in the container when purchased by the dealer or grower;

(2) Spray adjuvants are added along with the formulated product to a carrier such as water. The liquid that is sprayed over the top of a crop, weeds, or insect pest often will contain both formulation and spray adjuvants.

2. History of Adjuvants

The history of adjuvants in agriculture begins 18th and 19th centuries when additives such as resins, tar, flour, molasses, and sugar were used with lime, sulfur, copper or arsenates which improve adherence and performance of active ingredients

by modifying the physicochemical properties of the spray solution. The first agricultural adjuvant was a soap solution. Soap solutions and kerosene were used to kill insect eggs or were added to arsenical solutions to increase toxicity to weeds. Sugars and glue were considered as stickers and many other materials followed as adjuvants.

In the modern era, soaps and mineral oils were replaced by nonionic surfactants. Nitrogen fertilizers like ammonium sulfate and urea ammonium nitrate were also used to enhance the herbicidal activity, while glycerin was introduced as humectants in 1930s. In the 1960s and 1970s, adjuvants such as crop oil concentrates were developed. Organo silicone-based adjuvants, nonionic surfactants, which have excellent wetting and spreading capability and enhance the penetration of post-emergent herbicides were developed later.

3. Importance of Adjuvants

The use of adjuvant materials with agrochemical application will provide measures to:

- Improves compatibility between different products into the tank mix.
- Increases the amount and distribution of pesticide on the target.
- Improves resistance to weather conditions reduces pesticide loss during application.
- Increases the amount of active ingredient that penetrates the plant and its translocation speed into the leaves
- Enhances the biological efficiency of the active ingredients

Spray adjuvants are generally grouped into two broad categories:

i). Activator adjuvants and ii). special purpose adjuvants.

Activator adjuvants:

- Commonly used to enhance postemergence herbicide performance
- It increases herbicide activity, herbicide absorption into plant tissue, and rain fastness; can also decrease photodegradation of the herbicide
- It can alter the physical characteristics of the spray solution
- It includes surfactants, crop oil concentrates, nitrogen fertilizers, spreader-stickers, wetting agents, and penetrants

Surfactant:

- Primarily reduces the surface tension between the spray droplet and the leaf surface
- Includes nonionic, anionic, cationic, and organo silicones
- It required with many post emergence herbicides

Crop oil concentrate:

- It contains petroleum-based oils plus some nonionic surfactant
- It increases herbicide penetration and reduces surface tension
- Commonly used with post emergence herbicides and atrazine

Vegetable oil concentrates:

- Serve the same function as crop oil concentrates but are derived from vegetable-based oil.

- Generally seed oils such as soybean, sunflower, cotton, canola, and linseed that are modified (e.g., methylated seed oil, MSO) to improve performance and adjuvant qualities

Nitrogen fertilizer:

- Can increase herbicide activity and Improves the effectiveness of weak acid-type herbicides.
- Ammonium sulfate can reduce problems with hard water.
- Generally used in combination with surfactants or crop oil concentrates.

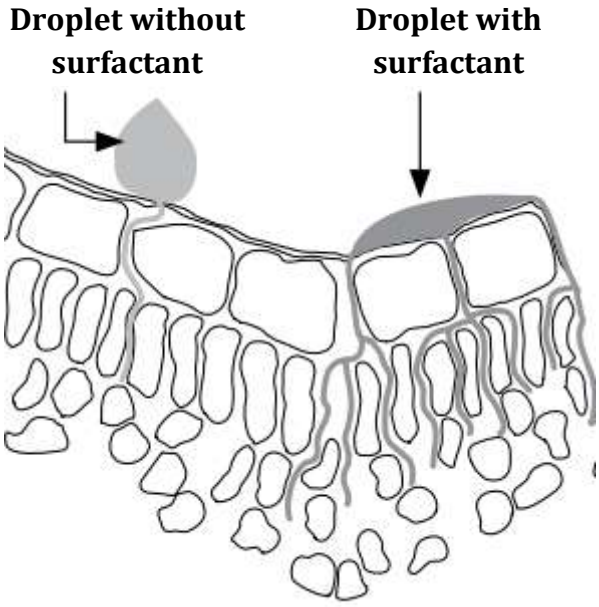
Blended adjuvants:

- Contain various combinations of special purpose adjuvants and/or activator adjuvants (e.g., NIS + AMS; AMS + drift inhibitor + defoamer).
- Serve multiple functions; functioning agents serve primary and secondary purposes.

Special purpose adjuvants:

- Widen the range of conditions under which a given herbicide formulation is useful.
- May alter the physical characteristics of the spray solution.
- It includes compatibility agents, buffering agents, antifoam agents, and drift control agents.

Figure.1. Effect of a surfactant on the spread and penetration of spray solution across and through the leaf surface



4. Adjuvants and water Quality

Water quality becomes less of an issue with robust chemical rates and/or lower water rates.

- Test the water quality throughout the season.
- Most pesticides perform best in slightly acidic conditions.

- Avoid or fitter muddy water.

Pesticide formulations are generally designed to be used with water as the primary diluents and carrier. Water, itself, is an active chemical and it is often overlooked that it normally comprises the largest percentage of the spray solution. Water quality can interfere significantly with the performance of pesticides. The main factors affecting water quality when using agricultural chemicals are pH, hardness, salinity and bicarbonates. It is important to be aware of the quality of each water source used. The pH and hardness can easily be tested with test strips in the field. Other factors such as bicarbonate levels have to be tested in a laboratory. Potential water quality problems can often be overcome with adjuvants.

- Water quality can change with time and measurements should be taken throughout the season
- Manage water quality with adjuvants where possible

a). Managing high pH

A pH value provides a measure of the hydrogen ion concentration of a solution and ranges from 0 to 14. The pH value stands for potential of Hydrogen and is the negate logarithm of the hydrogen ion concentration. In pure water the concentration of hydrogen ions is equal to 0.0000001, or 10^{-7} moles per liter = pH 7 = log10 (10^{-7}). This is considered a neutral solution. If the concentration of hydrogen ions increases the solution becomes acidic. Consequently the pH drops. For example, a strongly acidic solution with pH 2 represents a concentration of 0.01 or 10−2 moles per liter hydrogen ions. Acidic solutions have values below 7. Alkaline, or basic, solutions have values above 7 and contain less hydrogen ions than neutral solutions. Most pesticide formulations perform best in slightly acidic conditions around a pH of 5. This can create problems if the water source used is alkaline (for example the majority of bore water sources or water stored in concrete tanks).

b). Alkaline hydrolysis

In alkaline water some chemicals are broken down rapidly by irreversible chemical reactions, commonly referred to as alkaline hydrolysis. A most alarming example of rapid breakdown is the insecticide dimethoate. Half of the product is irreversibly destroyed in an alkaline spray solution of pH 9 in only 48 minutes.

c). Dissociation of acidic herbicides

Weak acidic herbicides such as glyphosate are least likely to be taken up into the plant if they are present as a strongly charged molecule. An alkaline environment (pH above 7) increases the amount of weak acidic herbicides present in the electrically-charged ionic form. To optimize uptake it is advisable to lower the pH. The pH of a spray solution is not only determined by the water source and chemical used. The leaf surface of many weed species, especially broadleaf weeds, is alkaline, e.g. Wild Radish. This can change the pH of a droplet once it starts interacting with the plant surface.

5. CONCLUSION

Adjuvants are helping to revolutionize the agrochemical usage, as they are the best tools for farmers to improve the application of right dosage and achieve more cost effective better targeted, environmentally acceptable pest control. Agricultural adjuvants play an essential role in the performance of most herbicides, fungicides and insecticides, and function by transforming the dosage from preventative, high-dose applications to low dosages, specifically targeted for curative applications with lower hazards.

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Common frauds in the sale of Livestock & Livestock Products

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FRAUDS IN THE SALE OF LIVESTOCK

(A). Alteration of Description

1. Castration of entire
2. Clipping of mane and tail
3. Docking
4. Colouring of white patches by hair dye
5. Bishoping
6. Covering chronic ulcers & fistulae with colored mud

Punishment

- Section 420 IPC : fine/ 7 yrs

(B). Frauds in the sale of milk

1. Reduction of fat
2. Addition of thickening agents
3. Addition of colouring agents
4. Addition of preservatives
5. Addition of urea
6. Accidental adulteration
7. Addition of heated milk

1. Reduction of fat

I. Watering
II. Skimming of milk
III. Skimming and watering

I. Watering

- Milk dilution by water
- Dangerous → germs from polluted water
- Density change → atleast 15% water addition
- 10% water → 0.003 g/cucm ↓ milk density

- Detection by:
    a. Specific gravity
    b. Solid-not-fat (SNF)
    c. Nitrates in milk

Specific gravity of milk : Lactometer method

Specific gravity = CLR/1000 + 1

SNF

% SNF = TS – F = CLR/4 + 0.21F + 0.14 ***(Richmond's Formula)***

% added water = 8.5 – SNF / 8.5 x 100

Nitrates in milk : sure test for watering

5 ml milk + (1 ml Diphenylamine + 100 ml Sulphuric acid)

↓

Blue colour

II. Skimming of milk

- Milk fat removed
- Easily detectable as:
- ↑ Specific gravity
- ↓ TF
- ↑ SNF
- % fat deficiency = 100 (3- F)/3

    where, F = % fat in milk sample (Gerber's method)

III. Skimming and watering

- Specific gravity → Normal
- ↓ Viscosity : Thickening agents added (starch, gelatin, cane sugar)
- Detection of thickening agents → sure sign of Double fraud
- Detection :
- Total solids in milk

    % TS = Wt. of solids after evaporation/ Wt. of milk taken x 100 ***(Gravimetric method)***

- ***TS = CLR/4 + 1.2F + 0.14 (Richmond's formula)***
- ***TS = CLR/4 + 1.2F (Babcock's formula)***
- ***TS = CLR/4 + 1.2F + 0.25 (Fleischmann's formula)***

    where, TS = % Total solids; F = % Fat

2. Addition of thickening agents

- Purpose :
    - ↑ Specific gravity

- ↑ Milk consistency

STARCH	GELATIN	CANE SUGAR
10ml milk	10ml milk	2ml milk
Boil & cool	10ml acid mercuric nitrate solution/ shake	1ml HCl + 0.1g Resorcinol
1ml 5% Iodine sol.	20ml water/ shake/ filter	Boil
Blue colour (+)	Opalescent filtrate + picric acid sol.	***Red colour (+)***
	Yellow ppt. (+)	

3. Addition of colouring agents

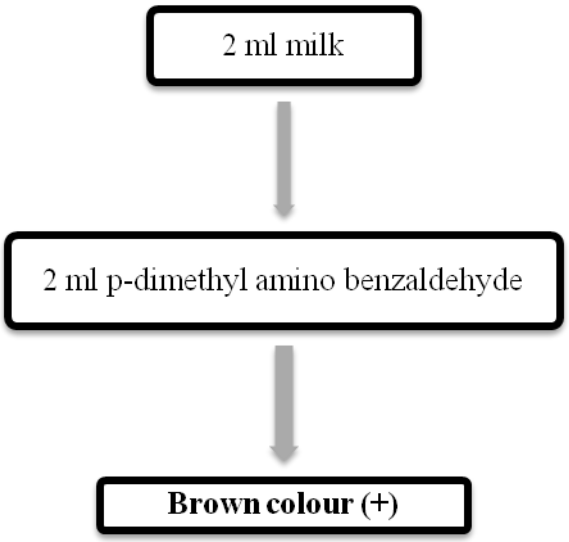
- Annatto & Coal tar dyes
- Purpose :
  - to make milk more attractive

Detection of Annatto dye in milk
10ml milk in test tube
10ml ether/ shake/ keep for 5 min.
Ether separates on top & becomes ***yellow (+)***

4. Addition of preservatives

- Boric acid/ Borax/ Formalin/ Salicylic acid/ Benzoic acid/ Hydrogen peroxide/ Sodium carbonate/ bicarbonate
- Purpose :
  a. Prolonging period of sweetness of milk
  b. Bacterial destruction
  c. Delaying milk curdling
- Harmful effects :
  a. Poisonous → unfit for human consumption
  b. Interference in normal digestion process

5. Addition of urea



6. Accidental adulteration

- Urine of animal
- Dung
- Hair
- Dust
- Dirty water
- Indication : foul taste & smell

7. Addition of heated milk

STORCH'S TEST	
5 ml milk	
1 drop 0.2% hydrogen peroxide sol. + 2 drops 2% paraphenylenediamine HCl	
Shake	
Blue colour (Heated at < 172° F)	Clear greyish-blue colour (Heated at ≥ 172° F)

Synthetic Milk

- artificially manufactured by combining different low-grade substances (vegetable oil, detergent, urea) → appearance of natural milk → lack milk's nutritional components and taste
- Origin : Milkmen in Kurukshetra (Haryana state) 15 years ago

HARMFUL EFFECTS	
Food poisoning / GI complications	Heart problems

Tissue damage	Cancer
Proteins destruction	Death

	SYNTHETIC MILK	**NATURAL MILK**
COLOUR	White	White
TASTE	Extremely bitter	Palatable
ODOUR	Soapy	Milky
TEXTURE	Soapy feeling when rubbed between fingers	No soapy feeling
pH	9.0-10.5	6.6-6.8
UREA TEST	+	Faint
SUGAR TEST	+	-
NEUTRALIZER TEST	+	-
VEGETABLE FAT TEST	+	-

Frauds in the sale of ghee

1. Addition of vegetable oils
2. Addition of hydrogenated oils
3. Addition of animal fats

1. Addition of vegetable oils

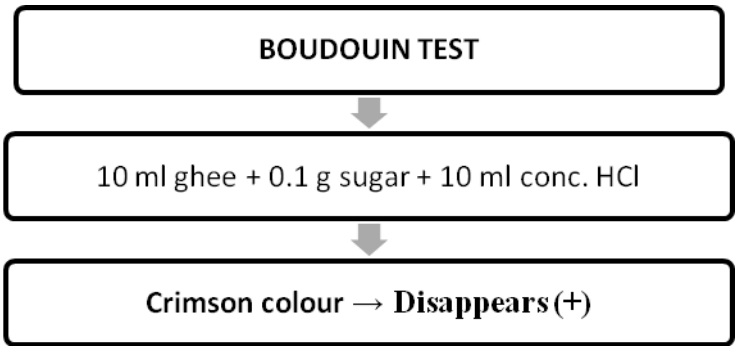
- Phytosteryl → (+) in vegetable fat → (-) in ghee
- Detection :

Phytosteryl acetate test	
Interpretation:	
Unadulterated ghee	MP = 114-115°F
Addition of vegetable oil	MP > 117°F

2. Addition of hydrogenated oils

- Sesame oil → (+) in vegetable ghee

- Adulteration with vegetable ghee if sesame oil (+) in pure ghee
- Detection :



3. Addition of animal fats

- Adulteration with mutton or beef fat
- Detection :

1 ml metled ghee + 15 ml mixture of acetate and alcohol
Water bath at 30°C/ 3 hrs
Deposition of crystals (+)

Frauds in the sale of meat

Falsification of Meat

- mixing meat of different animals

or

- mixing inferior/ undesirable meat with superior/ costly meat
- eg :
  i. Beef with horse flesh
  ii. Mutton with chevon
  iii. Rabbit meat with cat's flesh

Detection of Meat falsification

1. Physical examination
2. Chemical examination
3. Serological examination
4. Enzyme profiles

1. Physical examination

	MUTTON	CHEVON	PORK	DOG MEAT	BEEF	HORSE MEAT	POULTRY MEAT	FISH MEAT
COLOR	Dark red	Pale	White-grey	Dark red	Red-brown	Dark red	-	White
ODOUR	Ammoni--acal	Buck	Urine	-	-	-	-	-
FAT DEPOT	B/W muscles	Little in muscles	Mixed with muscle	Mixed with muscle	Mixed with muscle	-	Mixed with muscle	Finely distrib.
FAT COLOR	White	-	White	White	Yellow	Golden-dark yellow	-	-
BONE MARROW	Red	-	Pink-red	-	White-red	Greasy	-	-
CONSIST.	Firm	-	Soft	-	Firm	-	Firm	-

2. Chemical examination

- **Glycogen test**
  a. Horse meat → Glycogen ↑
  b. Also, flesh of fetuses/ starved calves/ dogs/ pig liver
- Test for animal fats
  I. **Linolenic acid test** : Horse fat → 1-2%
  1. Others → < 0.1%
  II. **Iodine value** : amount of iodine absorbed by UFAs in fat

S.NO.	ANIMAL	IODINE VALUE
1.	Ox	38-46
2.	Horse	71-86
3.	Sheep	35-46
4.	Pig	50-70

3. Serological examination

Precipitation tests

- commonly used
- *Principle* : Abs develop in blood of animal if given repeated injections of meat extract of another animal
- Abs are species-specific
- Done in raw meat only
- Differentiation of meats of distantly zoologically related animals
- Demerit : Not specific for closely related animals (horse & donkey; sheep & goat)
- **Raw meat + Antisera → Precipitin lines**
- (extraction with water/ saline) (raised in rabbits)
- Closely related meats → length of time req. for reaction

Chromatography

Paper chromatography

- Beef & Whale meat → No difference in aa except Histidine
- Histidine : Whale meat < Beef/ horse meat/ pork/ mutton
- Whale meat mixing → differentiation based on ↓ histidine

Gas chromatography

- Differentiation of horse meat/ pork/ beef → unsaponifiable matter

Thin layer chromatography

- Differentiation of cattle/ sheep/ whale meat → various contents of dipeptides

Electrophoresis

- Starch gel electrophoresis (SGE) : water soluble proteins
- PAGE : differentiation of meats of cattle/ pig/ horse/ kangaroo
- Electrophoretic patterns : Skeletal & Cardiac muscles → species specific

4. Enzyme profiles

- Muscle estrase enzyme patterns : SGE in water soluble extracts of superficial muscle
- Each age/ sex → species specificity of estrase enzyme patterns (mobility/ position of enzymic bands)

Food Adulteration Punishment

Section 272		
Imprisonment of either description for a term which may extend to 6 months	Fine which may extend to Rs. 1000	Both

Food Safety and Standards Act, 2006			
No injury	Non-grievous injury	Grievous injury	Death
6 months/ Rs. 1 lac	1 yr/ Rs. 3 lac	6 yr/ Rs. 5 lac	Not less than 7 yrs/ imprisonment for life/ not less than 10 lac

A Review on Medicinal uses of Aromatic plants

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Herbs contain substances known to the modern and ancient civilizations for their healing properties.Until the development of chemistry and particularly, of the synthesis of organic compounds in the 19 thcentury, medicinal plants and herbs where the sole source of active principles capable of curing man's aliments. They continue to be important to the people who do not have to access to modern medicines and, moreover, modern pharmaceuticals rely heavily on the same active principles, be they naturals or synthetic. The active principles differ from plant to plant due to their biodiversity, i.e to the plants genetic coding ability to produce them.

With thousands of active principles yet to be discovered or fully evaluated, it is no wonder that biodiversity is a fundamental topic on any nature preservation agenda. The genetic material of old and new herbs and plants are coveted for their potential in discovering, combining, manipulating and synthesizing new medicine. Thus , even if people are not aware of or the pharmaceutical industry does not stress the point, medicinal plants and herbs continue to be the source of medicaments and of new and revolutionary drugs.

MEDICINAL REMEDIES FROM HERBAL PLANTS:

Rosemary :

Rosmarinusofficinalis L. is an aromatic plant and its essential oil is used in high-grade perfumery, cosmetics and soaps. It also possesses carminative, stomachic and anti-spasmodic properties. Rosemary oil is used in aromatherapy. It has already been tested and proved for its effectiveness in preventing cancer in rats. Rosemary oil helps to relax muscles including smooth muscles of the digestive tract and uterus. The tea prepared out of the equal quantity of dried leaves of rosemary and tea dust gives a feeling exuberance. The tea is also taken as a tonic for calming nerves.it is also used as an antiseptic.it helps to improve memory and the herb is used for culinary purpose.Rosemarinic acid is anti-oxidant and anti-bacterial in activity.

Thyme:

Thyme is an aromatic perennial evergreen and it produces small white, lilac or pink flowers. Herb rich in phyto nutrients, vitamins and minerals which are essential for the overall growth and wellness of the body. Thyme contains thymol, a very important essential oil that has anti-fungal and antiseptic properties. Thyme also contains phenolic antioxidants like zeaxanthin, lutein, apigenin, naringenin, luteolin, and thymonin. Thyme leaves are rich in potassium, calcium, iron, manganese, selenium and magnesium – all of which are essential for normal body functions. Thyme is also a good source of vitamins, especially B-complex vitamins, vitamin-K, vitamin-C, and folic acid. Thyme helps with hair growth by improving blood circulation to the scalp. Applying thyme essential oil, or a mixture containing thyme in it helps facilitate delivery of essential nutrients to the scalp, thus encouraging hair growth. Thyme also prevents hairfall and thinning of hair, and is also effective in the treatment of dandruff, due to its antibacterial properties

Lemon balm:

Lemon balm tea was known to have powers of longevity. Today the tea is taken to treat colds and flu,lower blood pressure and for insomnia and indigestion. Balm is excellent carminative herb that relieves spasms in the digestive tract, and is used in cases of flatulent dyspepsia. Because of its mild anti-depressive properties, it is primarly indicated where there is dyspepsia associated with anxiety or depression, as the gently sedative oils relieve tension and stress reactions, thus acting to lighten depression. The volatile oils appear to act between the digestive tract and nervous system. It may be used effectively in conditions of migraine that are associated with tension, neuralgia, anxiety induced palpitations or insomnia. The essential oil of lemon balm acts upon the part of the brain governing the autonomic nervous system and protect the cerebrum from excessive external stimuli. This is a safe herb for the children, and tastes very good. Fresh leaves can be used to sooth insect bites,and a linement made with lemon balm will help heal cold sores.

Lavender:

*Lavandulaangustifolia*yields a highly effective essential oils with very sweet overtones, and can be used in balms, perfumes, cosmetics and topical applications. Essential oil of lavender has antiseptic and anti-inflammatory properties. It was used in hospitals during the first world war to disinfect floors, walls and other surfaces. These extracts are also popularly used as fragrances for bath products.

An infusion of lavender is claimed to soothe and heal insect bites. Bunches of lavender are also said to ward off insects. If applied to the temples, lavender oil is said to soothe headaches. Lavender is frequently used as an aid to sleep and relaxation. Seeds and flowers of the plant are added to pillows, and an infusion of three flower heads added to a cup of boiling water is recommended as a soothing and relaxing bedtime drink. Lavender oil is claimed to heal acne when used diluted 1:10 with

ater,rosewater or witch hazel; it is also used in the treatment of skin burns and inflammatory conditions.

Lemon verbena:

Lemon verbena or lemon beebrush contains the essential oil less than 1% is mainly characterized by the aldehydes neral and geranil (Citral).lemon verbena leaves are used to make herbal teas and can make refreshing sorbet.The fragrant flowers are also used in tea and culinary concoctions.

Sage :

Sage is used as a mild tonic, astringent, diaphoretic, antipyretic, dentrifrice, a carminative and for treatments of sore –throats. Sage is reported to cure female disorders and estrogenic substances are said to have been extracted form the dried leafy tops. The dried leaves are used as a fumitory.The herb has been used in mouth washes,gargles, poultices, tooth-powders, hair tonics and hair dressings

Sage oil is used in perfumes as deodorant,in insecticide preparations ,for the treatments of thrush and gingivitis and as carminative. The oil is also used as a convulsant. The sage oil is sometimes used as an adulterant for rosemary and lavender oil.Sage and sage oil exhibits antioxidant properties

Lemon grass:

It iaantive from srilanka and South India,lemon grass is now widely cultivated in the tropical areas of America and Asia. Lemon grass contains Gluosideacorin and essential oils. Lemon grass leaves are used as mosquito repellent. Lemon grass oil is used as a culinary flavoring, a scent and medicine. Lemon grass is principally taken as a tea to remedy digestive problems diarrhea and stomach ache. It relaxes the muscles of the stomach and gut, relieves cramping pains and flatulence and is particularly suitable for children. In India lemon grass oil is primarily used for the isolation of citral for manufacturing Vitamin-A. Citral is the starting material for the manufacture of ionones and is also used in flowers, cosmetics and perfumes. A small amount of oil is used, as such in soaps, detergents and other preparations

Citronella grass :

Citronella grass is a tufted aromatic perennial herb with fibrous root,smooth leaves and bearing a large inflorescence. The economic part of the citronella grass is roots and leaves. It contains citronellal, citronellol and geraniol. The oil is used mostly in perfumery, both directly and indirectly. Soaps, soap flakes, detergents, household cleansers, technical products, insecticides etc are often perfumed exclusively with this oil. It is also a valuable constituent in perfumery for soaps and detergents. Citronella is occasionally used in traces in flower compositions of the citrus, cherry, ginger, etc. However, the greatest importance of citronella lies in its role as a starting material for further derivations. Hydroxycitronella can be prepared from citronella and it is a key ingredient in compounding.Hydroxycitronella is one of the most frequently used floralizing perfume materials. It finds its way into almost every type of floral fragrance

and great many non-floral ones. For soap perfumes, a slightly rougher grade is used. High grade is used in flavour compositions.

CONCLUSION

Herbs continue to play an important role in the modern world.Herbal drugs,as such are found to be difficult in storage, preservation and occupies a lot of space, manpower and cost are involved. So, the extracts prepared from these drugs are easy in dispensing and marketability. These extractions of natural compounds directly from herbs and their conversion to usable forms by further processing transforms this material into a range of products which preserve one or more of its properties valuable for general health – care and comestic products at a vast value addition. So, everyone is interested in procuring the galenicals along with stringent test procedures to ensure its therapeutic value and free from toxic materials.

Successful intervention through NABARD project

on

"Popularisation of TANUVAS: Mineral mixture among the dairy farmers in Tirunelveli District"

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Livestock sector plays a vital role in ensuring the rural livelihood in India by providing food, income and employment to rural folks. The rural population of India is more than 833 million, accounting for 69 per cent of total population. Over 70 million rural households own cattle and income from cattle constitutes 20 per cent of their total earnings (Giridhar and Rajendran, 2013). With shrinking grazing lands and expanding urban cities, marginal dairy farmers have to depend more and more on commercial cattle feeds resulting in increased cost of milk production. The Veterinary College and Research Institute, Tirunelveli is one of the constituent units of Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Chennai, imparting scientific knowledge on livestock and poultry rearing through various extension methods. It also offers need based training programmes, farm advisory services, awareness programmes, etc., in Tirunelveli and Thoothukudi districts.

A need analysis was conducted among the dairy farmers of Tirunelveli district, during the training programmes and awareness camps organised at Veterinary College and Research Institute, Tirunelveli and it was found that lack of awareness on the importance of inclusion of mineral mixture in dairy cattle ration and high feed costs are the felt needs of farmers. A proposal was framed to popularize TANUVAS - Mineral Mixture as a low cost feed supplement in dairy cattle ration, to study the adoption of this innovative technology in the farmers' field and to study its impact on production performance among dairy cattle of the respondents.

The project was operated with the financial assistance of NABARD, Chennai, for one year from 29.04.2014 to 30.04.2015 at the Department of Veterinary and Animal husbandry Extension Education, Veterinary College and Research Institute, Tirunelveli.

The respondents for the project were selected from NABARD Farmers Club of Tirunelveli District. Ten NABARD farmers club were selected for the study and from each club, 50 dairy farmers were selected randomly which constituted a sample size of 500.

Awareness programmes on "TANUVAS-Mineral Mixture" were conducted in Melaseval, SokkatanThoppu, Thatchanallur, Kalakkudi, Ayansingampatti, Surandai, Sanganaperi, Vellalangulam, Duraisamiyapuram and Keelappuliyur villages of Tirunelveli district. After the conduct of each programme, two kgs of TANUVAS Mineral Mixture were distributed to each respondent in three phase manner in two month intervals. Hence, each respondent received 6 kgs of TANUVAS Mineral mixture and its impact was assessed.

IMPACT ASSESSMENT

An assessment was made to study the impact of TANUVAS Mineral Mixture on the production performance of dairy cattle. Milk samples were collected from dairy cattle of the respondents before feeding the TANUVAS Mineral Mixture and milk fat percent and SNF were recorded. Milk samples were collected from the same animals again , after feeding TANUVAS Mineral Mixture, i.e after two weeks to study the change in fat percent and SNF percent. Data were recorded and analysed statistically. It was observed that the milk yield and fat percentage also increased when fed with mineral mixture.

ADOPTION OF INNOVATIVE TECHNOLOGY

Fifty dairy farmers comprising 5 from each village were selected for the adoption study. An equal number of dairy farmers (50) not adopting mineral mixture supplementation, but have a similar socio-economic background were also selected from the same village as control group. These households were refereed as adopter and non-adopter respectively.

The primary data were collected from the adopters' and non adopters' households for the project period of 2014-15. Farmers practiced feeding limited greens plus straw and single or two ingredients of concentrates plus TANUVAS Mineral Mixture @ 30-40 gram per animals. It was observed that the average milk yield of selected dairy cattle was approximately 16 per cent higher in animals fed with mineral mixture. The difference in average milk yield between adopter and non-adopter farmers was found to be 1.69 litres.

FARMERS WORKSHOP

In order to disseminate the research findings and the outcome of the project to all farmers' a farmer's workshop on "Impact of TANUVAS - Mineral Mixture on Dairy Farmers" was organised by Veterinary College and Research Institute, Tirunelveli on 29.04.2015.

In this occasion, a Workshop Souvenir was released and TANUVAS - Mineral Mixture was distributed to the beneficiaries of the scheme. Three lectures and a discussion session were conducted for the benefit of the participants. A total of 30

beneficiaries i.e., three progressive farmers from each selected village participated in the workshop.

DOCUMENTATION OF SUCCESS STORIES

Success stories of benefitted farmers of the project were documented. Almost all the beenficiries revealed the result of increase in milk yield of 1 to 1.5 litres, besides fat percentage increase, better conception rate and reduced mastitis incidence and retained placenta problem. A documentary film on "Impact of the Project" has been developed and was released by the Secretary to Government, Animal Husbandry, Dairying and Fisheries Department, Tamil Nadu and the Vice-Chancellor, TANUVAS, Chennai on 20.06.2015.

FEEDBACK FROM THE PROJECT BENEFICIARIES

Thiru. T.Arumugam, Thenpothu Farmers Club :

Adoption of mineral mixture technology brought multiple benefits to him. Besides the increase in milk yield, quality of milk especially fat content increased. Better price and increase in milk yield brought increase in income. Animals became more resistant to diseases. Cow fertility improved due to the adoption of technology.

Thiru. S.Raju, Sivagurunathapuram Farmers Club ;

Adoption of mineral mixture technology resulted in an increase in milk yield of dairy animals and increase in resistance against diseases. The technology is cost effective and has increased the income significantly.

Thiru. T.Arumugam from Thenpothu village in Tirunelveli district, a beneficiary of TANUVAS - Mineral Mixture project

Photographs :

Awareness programme on TANUVAS Mineral Mixture – Input Distribution

Farmers Workshop on "Impact of TANUVAS Mineral Mixture among the Dairy Farmers" - Workshop Souvenir released

A documentary film on "Impact of the Project" released by the Secretary to Government, Animal Husbandry, Dairying and Fisheries Department, Tamilnadu and the Vice-Chancellor, TANUVAS, Chennai

Beneficiaries given TANUVAS - Mineral Mixture in the awareness programme

Rejuvenation of old Litchi Orchard

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REJUVENATION

The old and senile litchi orchards are not able to boost the productivity of crop vis a vis the demand of fruits in the country. Poor selection of planting material, indiscriminate plantation and poor management over the year has made many orchards unproductive or less economical. The term 'Rejuvenation' means renewal or young again. Perennial fruit trees notice decline both in quality and quantity of produce after some period of time due to improper canopy and orchard management. As a result of which orcharding becomes economically non- viable and non-remunerative. It has been observed in general that litchi orchards after attaining the age of 50-60 years, turns dense with compact top canopy covering most of the branches at the bottom and bearing fruits only on the high-tops. Such plants yield less vis-à-vis pose problems in proper management such as annual pruning, pest control and harvesting. To overcome the problem of unproductive or uneconomic of litchi orchards which is existing in abundance particularly in traditional litchi producing states like Bihar, Bengal, Uttarakhand, Jharkhand the farmers left with options of large scale uprooting and replacement with new plantations which will be a long term and expensive enterprise or go for rejuvenation of senile trees and utilize the existing established root system and capacity of plants to rebuild the canopy by activating latent buds present on main limbs and trunk which is comparatively cheaper and environmental friendly too. Therefore research efforts were initiated to standardize a technology for restoring the production potential of existing litchi plantations by a technique called ´Rejuvenation´ at ICAR,NRC on Litchi and perfect protocol have been developed and demonstrated at large scale not only in Bihar but other states successfully.

Importance of rejuvenation

- Helps in restoring the production potential of old unproductive and diseased orchards in shortest possible duration than any other technique.
- Helps in restoring the production potential, as well as in maintaining the manageable tree height with centre open canopy architecture
- Sustains the economy of farmer by sale of fuel wood after rejuvenation and additional space for growing various high value intercrops in interspaces for 3 – 4 years.
- **Objectives of Rejuvenation :**

- To convert the low yielding and inferior trees in to high yielding and superior trees with or without top working of improved cultivars.
- To exploit the better root system of an established plant which has survived over the year in exiting soil and climatic conditions.
- To increase the orchard income through sale of bi-products (wood) and intercropping in inter-space.
- To increase the orchard productivity and economical age of plant.
- To ease farm operations on managed tree canopy and cut down production costs.

Technology for rejuvenating old Litchi orchard

The rejuvenation technology embodies heading back (topping) of branches during August-September at a height of 1.0 to 1.5 m from the ground level depending on the structure of individual tree in the orchard. About 3 to 4 main branches with outward growth from the base are marked for pruning at the required height, with a plan of developing umbrella like or semi circular frame work of canopy to enhance bearing surface area. Pruning can be done either with manual saw or power operated saw in phased manner from the top. Care should be taken to avoid bark splitting or debarking at the cut end due to falling of heavy branches at the time of pruning. To avoid any external infection at the cut portion, it should be pasted with Bordeaux mixture or Copper-oxy-chloride (Blitox) immediately after pruning.

Steps in Rejuvenation of old Litchi orchard

The major steps in rejuvenation of litchi plants include

1)Selection of litchi orchard - Selection of unproductive litchi orchard through discussion with farmers and making farmer convinced for adoption of technology.

2) Training of the farmer/staff – Training of the farmers who can execute the operations. Procurement and knowledge of tools and implements for rejuvenation must be ensured before execution of program. Now a days custom hire options are also available in many areas.

3) Selecting right time (Aug- Sep under Bihar condition) - When there is near normal temperature and light environmental humidity which favors emergence of new sprouts and protects the tree trunk from splitting due to scorching sun or chilling winter.

4) Execution of rejuvenation operation - Cutting of main branches which are growing outwards at a height of 1.0 – 1.5 m leaving 3- 4 main limb as base which helps open centre canopy development.

5) Pasting of cut ends and entire trunk - Mud and fresh cow dung paste or blue copper or Bordeaux paste is applied to avoid any infection.

6) Fertigation and Floor Orchard Management - Ploughing of field and application of manures and fertilizers to the plant as per recommendation (1000 g N + 800 g P + 800 g K per plant) along with neem cake (2-4 kg/plant), farm yard manure (50-60 kg/plant) micro nutrients and bio-fertilizers in the tree basin. Regularly irrigate the plants and

maintain the orchard floor weed free. If possible suitable intercrops preferably legumes or high value crops can be grown.

Canopy Management and Thinning

Canopy management refers an interrelation of the physiology underlying the relationship between vegetative growth and production. Canopy management refers an interpretation of physiology of light penetration and interception which are critical components of overall tree productivity. Thus, the ultimate goal of canopy managements is to optimize carbon allocation in fruit sinks without disturbing growth and development in other parts of the tree. The influence of temperature, light, humidity and tree vigour on the productivity and quality of fruit and manipulation of tree canopy through training systems, pruning practices and use of growth retardants for the best utilization and harvest. Older plantations of seedling origin which have become senile can be adopted for top worked by grafting (budding) with scion of superior varieties to upgrade seedling plantation with superior commercial varieties .There is a tendency of over lapping of canopy between 10 and 12 years of age depending on the nature of variety unless the canopy is maintained by trimming and thinning. Plantations which have overlapping branches. This is possible by hedging of branches followed by shoot management to modify the tree structure and maintain canopy size. In case of litchi, studies indicate that the dense and overlapping shoots reduces the intensity of panicle emergence. As a result of thinning with proper management of new shoots helps in proper canopy formation and increase bearing surface area.

CULTURAL PRACTICES IN REJUVENATED LITCHI ORCHARD

1.Application of Manures and Fertilizers : After the tree is pruned the matter of spraying should be considered. Whenever San Jose Scale is present, it is absolutely necessary to apply a dormant spray. Either of two materials may be used to control the scale, lime—sulphur solution or a soluble oil of commercial lime- sulphur solution used at the rate of One gallon to eight of water, is to be preferred because Of its fungicidal properties. The manures and fertilizers should be applied through ring method. The dose per tree as an adult bearing stage i.e. 75-80kg well rotten FYM, 2 kg Neem / Castor cake, 2.00kg Urea, 1.50kg Single Super Phosphate and 500g Muriate of Potash should be applied preferably in two split doses one during August-September and another in February-March.

2. Irrigation in rejuvenated litchi orchard: The water relation of the plant is of extreme importance both for vegetative growth and for fruit production. Rejuvenated trees require immediate irrigation if any dry spell occurs, to avoid drying out of the trees. Irrigation is must after the manure and fertilizer application. Irrigation at regular interval of 8-10 days during hot summer season and 15-16 days during winter season helps faster vegetative growth and good canopy development. In areas of scanty rainfall or limited water supply, special methods of moisture conservation such as mulching may be practiced.

3. Repairing of wounds of rejuvenated litchi tree : Any wound on the tree if allowed to remain exposed may attract the organisms of diseases from the surrounding atmosphere. So they should be properly treated to encourage healing. If wound is small, simply painting with colour or any other disinfectant may suffice the purpose. In case of bigger wounds on the trunk, a special method of grafting called 'bridge grafting' is followed. Big hollows may be strengthened by scrapping off the inside diseased or rotten parts smearing the exposed portion with coal tar and filling them with bricks and kankar. These are finally plastered with cement.

5. Control of pests, diseases of rejuvenated litchi orchard : Unhealthy or diseased limbs should be cut off and pruned parts are suitably disposed. Bark eating caterpillars are prevalent in many orchards. Individual holes should be treated, cleaned and then a mixture of carbon bisulphide and chloroform (2:1) or any other insecticide should be injected in it. The plants should be covered with insecticide or fungicide before an attack is apprehended. Nematodes cause serious set back to several fruit trees, therefore, nematocides should be promptly applied. Among other steps included to check the effect of insects and pests are killing of weeds, loosening the soil around the tree or disinfecting it. Regular spraying of the orchard trees with insecticides and fungicides must form a routine practice.

Precaution in execution of Rejuvenation program

One has to be very careful in executing the rejuvenation program to avoid any failure or mortality of the plant. The major precautions are

1) Lopping of branches following by cutting of main trunk smoothly. There should not be splitting at cut ends and jerk to root system of tree as falling branches with heavy weight on top may exert equal and opposite pressure on trees base which may disturb root system of trees as litchi is comparatively shallow rooting plant.

2) Removal of branches immediately after cutting on the pests available on hole tree may hibernate/ pupate inside orchard soil and cause damage later on as in case of mango and many other fruit trees.

3) Timely orchard operation and plant care as the plant has been put under high stress due to removal of its all photosynthesizing leaves and supply system branches

CONCLUSION

For overcoming the problem of unproductive and uneconomic orchards existing in abundance, large scale unrooting and replacement with new plantations will be a long term. Therefore such senile and exhausted trees can be rejuvenated by pruning and top working techniques. It has been found that the yield obtained from the old trees (non rejuvenated) is high but fetching very less price in the market due to inferior quality particularly with respect to size and wastage due to attack of many physiological disorders and attack of pests-diseases. Fruit yield and physiochemical characters of mature fruits were found to be better in fruits obtained from rejuvenated trees. Maturity period is found to be slightly delayed in rejuvenated plants. Research and development have improved the productivity of old senile litchi orchards effectively and

the popularization of techniques for aged litchi orchard in our country. The technique has shown path for enhancing the production and quality of litchis year after year without much of environmental stress and cost involvement. It is of great importance for rejuvenation of the aged litchis and improvement of the litchi production management to enhance output and quality of litchi. Hence, with the scientific skill and approach, complete transformation have been brought about by changing the exhausted phase of the old senile litchi orchard to behave and bear like young commercial orchard with sustained performance. This transformation gave great impetus and boost to the enhanced quality litchi production having high economic returns.

Figure 1 OLD AND SENILE LITCHI ORCHARD

Figure 2 Rejuvenation of litchi orchard

Figure3 Profused emergence of sprout in litchi plant **Figure4 Bearing in rejuvenated plant after 3 years**

Ecotourism- a way through socio-economic development along with traditional knowledge and culture conservation: case study of Uttrakhand

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The majestic mountains, the high meadows, the rich biological and cultural diversity, the soothing climate and the untouched beauty of Nanda Devi Biosphere Reserve, has always attracted people around the globe for years. The strict conservation acts and policies, when it was National Park (1982) to a Biosphere Reserve in 1988, has not only created an economical distress for the Bhotia community but has also created a gap between the local people and the administrative authorities. It's time to revive the rich natural beauty, cultural heritage and the economic status of the people. It has to be a combine effort in the form of Ecotourism. This will not only highlight the natural trails of Uttarakhand, but will also promote the cultural diversity along with the conservation of indigenous traditional knowledge and will help curb migration.

Nanda Devi Biosphere Reserve is located in the northern part of Uttarakhand bordering with China. With a total area of 5860.69 square kilometres, it spreads across three districts, namely, Chamoli, Pithoragarh and Bageshwar. The Nanda Devi is the second highest peak of India, having an elevation of 7816 metres above mean sea level, and forms an integral part of the Himalayan range. From being a Sanctuary to National Park, it finally became a Biosphere Reserve on 18.01.1988.

As per the "Protection, Development, Maintenance and Research in Biosphere Reserve in India, GOI Manual, MoEF&CC", Biosphere Reserve is an international designation by UNESCO for representative parts of natural and cultural landscapes extending over large areas of terrestrial or coastal/marine ecosystem or a combination thereof. The major functions of a Biosphere Reserve being conservation, development, education and research support work, are partially fulfilled. Development is the key word to be focused upon as it's the only thing creating distress among the people. As per the guidelines, development means, to promote at the local level economic development which is culturally, socially and ecologically sustainable.

5148.570 square kilometres of buffer zone of Nanda Devi Biosphere Reserve is inhabited by the Bhotia Community, who are trying their level best to conserve their

traditional knowledge, religious and cultural diversity. On interviewing the people of selected villages, the concept of a Biosphere Reserve seemed lopsided. The prime focus was on the conservation aspect, but what about the development?

Lata is a buffer zone village of Nanda Devi Biosphere Reserve in district Chamoli. The area is predominantly inhabited by the Bhotia Community. There are two other communities in the same district, namely, Khasas and Doms.

View from Lata Village

The Bhotia of Mana village in the Mana valley and Niti, Gamsali and Bampa in the Niti valley are popularly known as Marcha, who amongst themselves speak a dialect of Tibetan origin. While Bhotia's in villages like Jelum, Malari, Reni, Lata, Dronagiri, Rweeng, Jumma, etc in the Niti valley are known as Tolcha, speaking Garhwali, a dialect spoken throughout the district (Ethno biology of High Altitude Himalayan Communities in District Chamoli: a conservation perspective, V.P.Bhatt, Scientist HRDI).

The prime occupation of the area use to be agriculture. The reason of it being in past tense is the man-animal conflicts, irrigation constraints and migration. The farming is generally done for subsistence of the family. There is a unique system of barter in the area where they exchange their produce with their relatives and friends for some other eatable which is not grown in their own region.

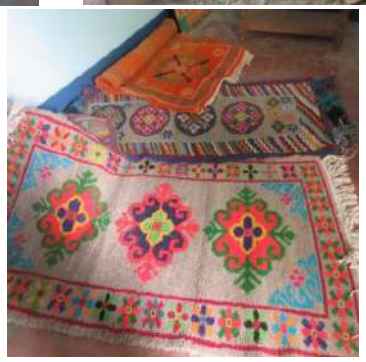
Agricultural fields at Bumpa Village

Some of the main crops of the area are Rajma/Chaimi (*Phaseolus vulgaris*), Genhu (*Triticum aestivum*), Phaphar (*Fagopyrum tatarium*), Wogal (*Fagopyrum esculentum*), Koda (*Eleusine coracana*), Urd (*Phaseolus mungo*), Potato (*Solanum tuberosum*), Fharan (*Allium consanguineum*), etc.

The second important occupation of the region is weaving of handmade dans (carpets), pankhi (woollen blanket), thulma (woollen quilt), woollen socks and clothes. They also make baskets from Ringal (Arundinaria species). This traditional art of weaving has diminished over the years. The new generation does not want to learn the art, as it has no market or demand-supply chain. Thus, development of their traditional art and craft lacks behind.

Basket weaving with Ringal

- Reni Village.



Weaving of colourful Dans at Reni and Malari Village

Cattle grazing at Gamshali Village

The elderly people of the area have a vast indigenous traditional knowledge of the floral diversity of the region. They have gathered this knowledge base while grazing their cattle in the forests and bugyals (meadows) for over 30 years. And that is how a new occupation was born, collection of medicinal and aromatic herbs. The people generally do the collection during the season time from the designated Van Panchayats.

Even after climbing a tough terrain and facing the wildlife, they are still being underpaid. This creates disparity and exploitation of the village people by the hands of buyers and middlemen. Once again, the young generation refuses to carry on with the knowledge which their ancestors have gained, as there is no lucrative money for the risk they undergo while collecting such herbs of great medicinal importance. Some of the medicinal herbs collected for trade and ethno botanical purposes are; Keeda jadi (*Cordyceps sinensis*), Atees (*Aconitum heterophyllum*), Gandranu/Choru (*Angelica glauca*), Laljari/Balchar (*Arnebia benthamii*), Hatajari (*Dactylorhiza hatagirea*), Katuki/kaduwi (*Picrorhiza kurrooa*), Ban-kakri (*Podophyllum hexadrum*), etc.



Laljari/Balchar, Gandranu/Choru, Katuki/kaduwi (respectively)

The region is amazingly rich in cultural diversity. They keep true to their roots, wearing their traditional bhotia dresses, following their rituals and celebrating various local festivals, puja's and mela's. The main festivals of the region are, Basant Panchami, Baisakhi, Nag Panchami, Nanda Astami, Durga Astami, Utreni and Phoolsakranti.


Nanda Devi Temple at Lata Village

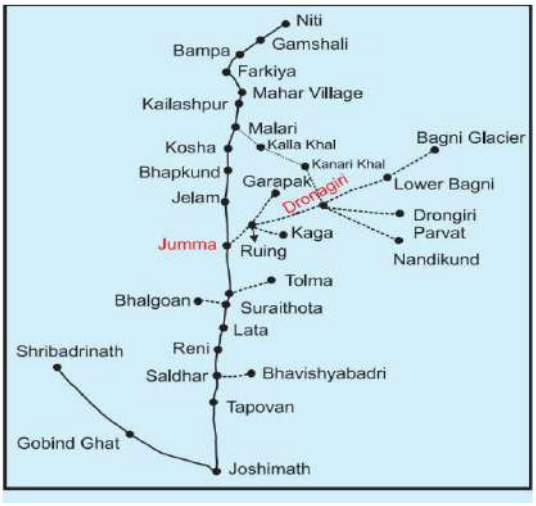
There are many temples dedicated to different deities like, Bhumyal Devta, Hiwaal Devta, Ghanyal Devta, Dharasi Devta, Dubari Devta, etc, but the main deity is goddess Nanda Devi. The Nanda Devi temple at Lata is the major temple of Niti Valley. There are various traditional dance forms as well, like, Jhumela and Dhakudi are performed durong Baisakhi mela, Podha dance is done during festivals and winters, Sharo dance is a dual dance competition, etc.

It is disappointing to see the land of Gaura Devi (pioneer of Chipko Movement) suffer like this. Though the people have their source of earnings but the level of exploitation and difficulty they have to face is leading to the migration of young people towards the nearby towns like Joshimath, Gopeshwar, Karanprayag, etc. The lack of medical and educational facility worsens the migration. If their own young generation would not want to learn, conserve and spread their culture, then who will? And in the end it all comes down to the socio-economic development which the people in the buffer zone of Nanda Devi Biosphere Reserve crave.

Eco-tourism can play a vital role during this phase of migration and economic discomfort. It plays a wholesome approach where not only local people can be involved but at the same time their culture can also be promoted. In the present scenario, trekking, natural getaways and home-stays have become a hot topic for the people.

Some of the famous treks in the Niti Valley are:

1. Nanda Devi Getaway trek – Dharansi Pass (Village Lata)
2. Dronagiri – Bagni Glacier Trek (Village Jumma)
3. Bhyundharkhal Trek (Village Gamshali)
4. Guptkhal Trek – Expedition trek to Badrinath – Mana



Sulphur Hot Spring at Tapovan

People have a misconception that it is prohibited to enter these areas, as now they come under the jurisdiction of Nanda Devi Biosphere Reserve. But, these trekking routes are still very much active and just require a permit from the SDM (Sub – District Magistrate) of Joshimath. There are some other routes as well which can be further explored, like, Tolma village and Jhandigar, Lata Kharak, Bhavishya Badri Temple, etc.

Trekking can give the local young people a chance to employment in the form of mountaineering/mountaineers. They will be more eager to learn their traditional knowledge regarding the flora and fauna and can become guides to research scholars and tourists.

View from Rulibagad

Another upcoming concept is that of a home-stay, where village people can offer their houses or rooms on rent to the tourists. Thus, the tourist will be living with the people and learning about the authentic cuisine, culture, language and the diversity of Uttarakhand. For example, there is Dreamcatcher Adventure Home-stay at Village Lata, owned by Mr.Mohan Rawat (professionally a guide for the last 30 years).

Niti Village

Thus, Eco-Tourism becomes a solution for economic upliftment and conservation of traditional knowledge and culture. What one needs, is to be cautious about the ethics of being amongst a different community and out in the wild. In this highly populated and polluted world, the focus of weekends and holidays are shifting towards nature. Uttarakhand should not lack behind in curbing the trends of today.

Cha (salted chai) and Jaan (made of fermented genhu and jhangora)

It is the right time to promote "Responsible Eco-Tourism", where people get to see the real beauty of Uttarakhand and the villagers get their fair chance on employment. Conservation and propagation of cultural heritage by all the stakeholders will help the world know more about the existence of ethnic and tribal people. The government authority is the guiding hand for the socio-economic development, as it is important to see through any illicit work in the region. The Nature is for all and it should be protected, conserved and at the same time promoted by all.

Aeroponics: A Review on Modern Agriculture Technology

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Abstract

Aeroponics is a promising soilless farming method for solving future food crisis and is relatively a new way of growing plants that is getting increasingly popular with many people because of the speed, cost and novelty. Aeroponic farming is a form of hydroponic technique and a type of vertical farming. The word aeroponic is derived from the Latin word 'aero' (air) and 'ponic' means labour (work). This farming system empowered the producer to precisely control root zone nutrients, water regimes, and environmental conditions and have complete access to the roots throughout the life of the crop. This aeroponic farming is superior in terms of excellent aeration, water use efficiency, less time and space requirement, seasonal independence, disease free plant propagation, and large scale plant production etc. than the conventional methods of propagation. Aeroponic techniques have proven to be commercially successful for propagation, seed germination, seed potato production, tomato production, leaf crops, and micro-greens. Vegetable crops like potato, yams, tomato, lettuce and some of the leafy vegetables are being commercially cultivated in aeroponic system. Aeroponics appeared to be a highly feasible method for the production of both aerial parts and roots.

NEED OF AEROPONICS

The current world population of 7.2 billion is projected to increase by almost one billion people within the next twelve years, reaching 8.1 billion in 2025 and 9.6 billion in 2050. With the increasing population growth the demand for the more food and more land to grow food is ever increasing. As the world population continues to grow, the rising demand for agricultural production is significant. Prime agricultural land can be scarce and expensive. Aeroponics is a technological leap forward from traditional hydroponics. Aeroponics-farming are also needed due to the many drawbacks of the traditional field farming system. Some of the drawbacks of the traditional farming system are 15 hours to harvest the crops, long time to harvest hence being sold for more expensive prices to earn back the time. Another factor is soil used in traditional system, decomposition of organic materials takes up long time. There is a high risk of getting soil disease. Pesticides are used, which is harmful for health. Whereas, in a developing country like

India, it is very important to use resources like water, sunlight, soil and money very efficiently.

HISTORY

Aeroponic research began in the 1920's and progressed steadily as a soilless growing method. In the early 1940s, the technology was largely used as a research tool rather than an economically feasible method of crop production. W. Carter in 1942 was the first researched air culture growing and described a method of using water vapor at the plants roots to deliver nutrients to facilitate examination of roots. In 1944, L.J. Klotz was the first to discover vapor misted citrus plants in a facilitated research of his studies of diseases of citrus and avocado roots. In 1952, G.F. Trowel grew apple trees in a spray culture. The first commercial aeroponics setup was the Genesis Rooting System, commonly called the Genesis Machine, by GTi in 1983. The device was controlled by a microchip and simply connected to an electrical outlet and a water faucet. During the 1990^{s}, NASA carried out a series of tests in space and on earth growing biomass with no soil and very little water and this method proved to be very productive. NASA research has shown that aeroponically grown plants have an 80 per cent increase in dry weight biomass (essential minerals) compared to hydroponically grown plants. Aeroponic techniques have been given special attention from NASA since a mist is easier to handle than a liquid in a zero-gravity environment.

INTRODUCTION

Aeroponics is an alternative for people with limited spaces to grow plants. An aeroponic system is defined as an enclosed air and water/nutrient ecosystem that fosters rapid plant growth with little water and direct sun and without soil or media. It is an effective and efficient way of growing plants for it requires little water (requires 95 per cent less water than traditional farming methods) and needs minimal space than even the most efficient system hydroponic system.

Plant grown in these aeroponic system also been shown to uptake more minerals and vitamin, making the plants healthier and potentially more nutritious. The suspended aeroponic plants receive 100 per cent of the available oxygen and carbon dioxide to the roots zone, stems, and leaves, thus accelerating biomass growth and reducing rooting times. The higher biomass yield of aerial parts from the aeroponic treatment indicated that this production technique should not be limited to root crops, but should be considered for other types of crops as well. Furthermore, using aeroponics, planting densities can be increased since plant-to-plant competition for nutrients and water is essentially eliminated. Any species of plants can be grown in a true aeroponic system because the micro-environment of an aeroponic can be finely controlled.

Aeroponic systems for seed production have been established following increased demand for more efficient high quality seed production methods. Aeroponic bio-pharming is used to grow pharmaceutical medicine inside the plants. Using aeroponics for cloning improves root growth, survival rate, growth rate and maturation time. Studies have shown that, the mean tuber yield under aeroponics is better than when the

same material is left to produce tuber under conventional means. Some researcher reported that, the aeroponics system increased stomatal conductance of leaf, intercellular CO_2 concentration, net photosynthetic rate and photochemical efficiency of leaf.

TYPES OF AEROPONICS:

a. Low-pressure Units: In most of the low-pressure aeroponic gardens, roots of the plant are suspended above a reservoir of nutrient solution or a channel which is inside and is connected to a reservoir. The nutrient solution is delivered by a low-pressure pump through jets or by ultrasonic transducers, which drips or drains the nutrients back into the reservoir. When plants grow to maturity, then the units suffer from dry sections of the root systems and thus adequate nutrient uptake is avoided. These types of units lack features to purify the nutrient solution, removal of debris and unwanted pathogens because of cost. These units are usually suitable for bench top growing. And it is also used for the demonstration of principles of aeroponics.

b. High-pressure Devices: In high-pressure aeroponic devices, mist is created by high-pressure pump(s). And it is generally used in the cultivation of high value crops. This method includes technologies for air and water purification, nutrient sterilization, low-mass polymers and pressurized nutrient delivery systems.

c. Commercial System: The commercial system has high-pressure device hardware and biological systems. An enhancement for extended plant life and crop maturation is included in the biological systems matrix.

Working:

Aeroponic system is an endless process in a confined space and therefore it cuts down agricultural labour. Aeroponics are based on the possibility of cultivating vegetables whose roots are not inserted in a substratum (the case with hydroponics) or soil, but in containers filled with flowing plant nutrition. The basic principle of aeroponic growing is to grow plants suspended in a closed or semi-closed environment by spraying the plant's dangling roots and lower stem with an atomized or sprayed, nutrient-rich water solution.

The set up for aeroponic includes a proper monitoring and control system for water and nutrients distribution for utilizing the aeroponic cultivation at its best.A distribution system of pipes, spray nozzles, a pump and timer distributes the spray from a nutrient solution storage tank is required. It uses a small internal micro jet spray that sprays the roots with fine, high pressure mist containing nutrient rich solutionsfrom the nutrient reservoir as a fine mist in the rooting chamber.There is a programmable cyclic timer which is used to trigger the high-pressure aeroponic pump to go on. Nutrients are mixed in with water in a reservoir basin, this is than filtered and pumped into a pressurized holding tank that is intermittently misted on to the root system.

Developed root hairs help in absorbing nutrients from the moisture. It is also easier to administer all sorts of nutrients to the plant, via the root system.Since the spray particles are small in size, there is negligible wastage of nutrient solution. And with an ample amount of oxygen supply, root rot is completely avoided.

The misting is usually done every few minutes around the hanged roots. The system normally turned on for only a few seconds every 2-3 minutes. Because the roots are exposed to the air, the roots will dry out rapidly if the misting cycles are interrupted. A timer controls the nutrient pump much like other types of hydroponic systems, except the aeroponics system needs a short cycle timer that runs the pump for a few seconds every couple of minutes. However, the chamber must be lightless materials from everywhere, so that the roots are in darkness functionally good also to inhibit algal growth that impedes the growing plants and pollute the system.

The droplet size of a nutrient mist is a crucial element in aeroponics. An oversized droplet may reduce the oxygen supply. An undersized droplet may stimulate root hair growth which prevents lateral root growth which influences the efficiency of an aeroponic system. The water droplets must be big enough to carry the nutrients to the roots in sufficient quantity, but small enough to not immediately precipitateout of the root mass. Unused solution drips downinto the baseof the unit is strained, filtered, and pumped back into the reservoir. Aeroponics system is that of easy monitoring of nutrients and pH. In aeroponics there is the minimal contact between the support structure and plant, due to which the unconstrained growth of the plant is possible.

DIFFERENT COMPONENTS OF AEROPONICS:

1. **Nutrients used in aeroponics: Mainly** N-NH_4 (0.54 g/L), N-NO_3 (0.35 g/L), P(0.40 g/L), K (0.35 g/L), Ca (0.17 g/L), Mg(0.08 g/L), Na(0.04 g/L), Fe (0.09 g/L), Zn (0.03 g/L) and B(0.03g/L) are commercially being used in most of the crops.
2. **Water used in aeroponics:** Water to be used in aeroponics should have a low EC, not exceeding one mS/cm. Water pH is also a useful indicator. Water sources with a pH of over eight are questionable for aeroponics. It is useful to have a water chemical analysis; even if EC and pH measures fall into acceptablelevels.The other problem we may have to face is water biological contamination. Water from deep wells isusually not contaminated. Water from superficial wells, especially near urban areas, is likely to be contaminated with coli form bacteria, including Pectobacterium. Water from suspicious sources shouldhave a microbiological analysis. Special filters can minimize this risk. If available, water should be filteredbefore going into the nutrient tank. Boiling is also another alternative if no other is available.
3. **The plant material used in aeroponics:** Optimum plant material should be used for aeroponics. *In vitro* plants are preferred because of sanitaryreasons. However, they need to be handled with proper care by experienced technicians. These plantsshould be the appropriate age and size and should go through a thorough acclimatization periodbefore going into the greenhouse. Other plantmaterials, such as rooted cuttings and tuber sprouts, should be clean and disease free. The presence ofany kind of symptom should be sufficient reason to discard the whole batch of plants. This should benoticeable when transplanting into the boxes. The underground part of the tissue coming from thesand trays should be completely

clean and sand free. Before placing into aeroponics, plants should be managed in a clean greenhouse environment.

SOME OF THE KEY BENEFITS OF AEROPONICS:

- **Round the year cultivation:** Since plants are grown in a controlled environment crops can be grown year-round without being dependent on the weather or atmosphere conditions outside.
- **Fast plant growth:** Plants grow fast because their roots have access to a lot of oxygen.
- **Easy system maintenance:** In aeroponics, all you need to maintain is the root chamber (the container housing the roots) which needs regular disinfecting, and periodically, the reservoir and irrigation channels.
- **Less need for nutrients and water:** Aeroponic plants need less nutrients and water on average, because the nutrient absorption rate is higher, and plants usually respond to aeroponic systems by growing even more roots.
- **Mobility:** Plants, even whole nurseries, can be moved around without too much effort, as all that is required is moving the plants from one collar to another.
- **Requires little space and high yield:** Aeroponic systems can be stacked up in layers to build vertical farms that take up much less space than traditional farming methods.
- **Great educational value:** Plants and root growth study in laboratories is easier for students and researchers.
- **Proper root growth:** In this system, plant roots have proper space to grow well. So they don't stretch or wilt.
- **No transplantation shock:** Plants can be shifted to any growing media system without any transplantation shock after root development.
- **Easier fruit harvest:** Fruits produced from the system are easier to harvest.
- **Disease free produce:** Due to clean and sterile growing conditions, plant diseases and infections reduce up to agreat extent.
- **Production at moon stations:** Using this technique, fruits can be grown at zero gravity i.e at moon stations.
- Potentially healthier and nutritious plants can be grown at homes; indoors or at roof top.
- Nurseries can propagate seeds and cuttings into healthy, harvestable plants in a fraction of time of traditional methods.
- Aeroponics systems can reduce water usage by 98 per cent, fertilizer usage by 60 per cent, and pesticide usage by 100 per cent, all while maximizing crop yields.
- Power loss for a small period does not cause any damage to plants.

Key drawbacks of aeroponic technology

Every system has its drawbacks, and aeroponics is no exception.

- Dependence on the system: A typical aeroponics system is made up of high pressure pumps, sprinklers and timers. If any of these break down, your plants can be damaged or killed easily.
- Technical knowledge required: Initially some training is required for system maintenance. You need a certain level of competency in running an aeroponic system. Knowledge of nutrients amounts required by your plant is essential, because you don't have any soil to absorb excess/wrong nutrients supplied.
- Sanitary conditions of the root chamber: The root chamber must not be contaminated, or else diseases may strike the roots. So you need to disinfect the root chamber every so often. Hydrogen peroxide is often used as disinfectant.
- High cost: Most aeroponic systems are not exactly cheap. Aeroponic systems may cost many hundreds of dollars each.
- Power loss: For a long time period power loss may cause irreversible damage.

CONCLUSION

Water plays an important role in the world economy. Approximately 70 per cent of the fresh water used by human goes to agriculture. Out of that 45 per cent is wasted due to gaudy irrigation techniques. By using aeroponic systems, we can save 98 per cent of total water because of recirculatory system. Fresh, clean, healthy, efficient and rapid food production can be obtained from aeroponic systems throughout the year. This soil-less culture can overcome all the constraints that are present in soil culture production. Enhanced disease-free yield leads India to be at top growers and exporters in near future. Aeroponic system has the potential to produce enhanced vegetative growth without use of any artificial hormones, pesticides or insecticide. Aeroponics is still a good way to learn how to master plant growth and learn about their needs, within a controlled environment. For urban dwellers that live in apartments, sometimes aeroponics is the only practical way to garden. And on arid lands, aeroponics circumvents this problem, and provides the best means of growing plants effective.

FUTURE PROSPECTS

Soilless cultures consider as a new developed technique for agriculture development but it is not simple technique. However, there is lack of technical background of the new technique among growers and horticulturists in many countries and well trained employs are needed. Moreover, most substrates are internationally markets, so they are expensive. Therefore, it is better to look locally about not expensive good substrates. The growers can adept the soilless systems according to their needs, the place of the system and according to their potential cash. The system in any case need to take strong care and observation for the parameters needed for the good growth of the plants such as nutrient concentrations, light, oxygen around the plants root zone, water quality, pH, disinfection, temperature of the solution and more. Aeroponics helps conserve water, land and nutrients, so the aeroponics system is the way of the future, making cultivation of crops easier.

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Antimicrobial Resistance (AMR): Myths and Facts

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Antimicrobial resistance means when a microorganism is no longer sensitive to previously effective antimicrobial drug. This can be due to natural or acquired characteristic of microorganism. It is a global threat causing thousands of human and animal deaths as it makes the treatment ineffective as AMR pathogens are able to survive during an antimicrobial therapy.

Let's bust a few myths together:

Myth: Antibiotics are "**panacea**" and they can cure all kind of diseases.

Fact: Antibiotics are not panacea and they can only cure bacterial infections and are not effective against viral, parasitic, physiological and metabolic diseases.

Myth: Every sick animal requires antibiotic to be healthy.

Fact: Not all sick and injured animals need antibiotics. A proper diagnosis by veterinarian can predict the requirement of antibiotics hence an individual should always seek and follow veterinarian's advice.

Myth: If a healthy animal or poultry is given antibiotics, they grow fast and remain healthy.

Fact: Antibiotics are not growth promoters hence they should not be given as a feed additives to healthy individuals as they can even have some side effects. Proper diet (protein, carbohydrate, fat, minerals and vitamins), good management practices and maintaining hygienic conditions are responsible for proper growth of animals and birds.

Myth: Layman/ animal owner or a farmer can give antibiotics to a sick animal.

Fact: Antibiotics are the drugs to cure infected animals so they should always be prescribed only by a registered veterinary practitioner and in no situation any animal owner or farmer should give antibiotics to animals or poultry without proper prescription of a veterinarian.

Myth: Any individual/animal owner or farmer can decide to stop the antibiotics when animal appears to be getting better.

Fact: Antibiotic course should start and stop only as prescribed by a veterinarian. A veterinarian must be consulted if animal's condition changes during the course of treatment. Using antibiotics incorrectly can prevent animal's recovery and encourage AMR to occur.

Myth: If the dose of the antibiotics is doubled, the animal gets better fast.

Fact: Every antibiotic has its unique mechanism of action, dose and dynamics and a veterinarian knows its properties. Hence everyone must strictly follow veterinarian instructions while using antibiotics. In fact increasing the dose will not reduce the recovery time instead it can create problems of persistent infections, antibiotic's side effects and its residues in animal products.

Myth: Leftover antibiotics can be used from one to another animal.

Fact: No, leftover antibiotics should be never used between different animals or in same herd. Since similar clinical signs can be seen in different diseases or by the different causative agent. Therefore, antibiotics must be given to animal only after proper diagnosis and prescription of a veterinarian. Antibiotics should never be obtained by any other means.

Myth: Only the incorrect use of antibiotics leads to the origin of antibiotic resistance.

Fact: Since most of antibiotic originated from various non-pathogenic microorganisms, hence these microorganisms are naturally resistant towards them. Recently, scientists reported the evidence of antibiotic resistance detected in 1000-year old mummies while the first modern day "antibiotics" was developed in the 1920's leading to the inference that incorrect use of antibiotics is not a sole cause of resistance but some other factors are also responsible for it.

Myth: Antibiotic resistance means that an animal/human/individual has become immune to antibiotics.

Fact: Antibiotic resistance has nothing to do with the host immune system. It is a property of bacteria that has made it insensitive towards antibiotics enabling it to spread diseases in the presence of antibiotics.

Myth: I can do nothing about AMR as it is a personal problem of humans.

Fact: AMR is a global concern and according to one health concept WHO, OIE and FAO are running a tripartite partnership program. In addition to above measures, WHO is conducting a global action plan to combat resistance. An individual can play an important role in fighting AMR by preventing infection in animals by getting them timely vaccinated, providing good care and maintaining proper sanitation and hygiene. One should also not ask for antibiotics from a veterinarian when they are not needed.

Myth: Antibiotic resistance cannot be transmitted from animals to humans or vice-versa.

Fact: Antibiotic resistance is a phenomenon or property (natural/ acquired) of pathogens. Since, same pathogen can transmit disease from animals to humans or vice-versa; the resistance properties can also be transmitted.

Myth: There is nothing I can do to lower the risk of AMR.

Fact: The antibiotic resistance being reversal phenomenon- proper diagnostic practices, wise use of antibiotics, maintaining proper sanitation and hygiene and finding alternatives of antibiotic, the risks associated with resistance can be lowered down, effectively.