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Landscaping Industries

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The necessity of landscaping of industries In India

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INTRODUCTION TO INDUSTRIES

Industries are the places of production of goods or services within an economy. The industrial revolution started in the eighteenth century, is still place today. It involves a series of inventions leading to use of machines, inventions and power in the manufacturing process. The industrial revolution changed human life drastically. Man is the architect of his own future. Human wants are never ending. Discovery of new products and production of luxuries to suit changing life style are accompanied by process of industrialization. Thus we are in the phase of Rapid Industrialization.

Today industries are not only the places where goods are produced but also the places which leads to degradation of environment. These are becoming the source of pollution which contaminates the air, soil, water on earth which are the basics for our lives. In modern times pollution has become the biggest menace for the survival of the biological species. Earth was a beautiful landscape but man has ruthlessly exploited for his greed especially in the last century.

Pollution is defined as an undesirable change in physical, chemical & biological characteristics of air, water and land that may be harmful to living organisms, living conditions and cultural assets. The substances, which cause pollution, are called pollutants. Industries create pollution by releasing some harmful substance in to atmosphere called SPM [Suspended Particulate Matter]. These are finely divided solids or liquids that may be dispersed through air by combustion process in industries or by natural sources.

CLASSIFICATION OF INDUSTRIES

Based on SPM, industries are classified as follows:

Low polluting industries: Industries which releases low amount of particulate matter in to atmosphere. Ex; plywood industries, small home industries etc.

High polluting industries: - Industries which releases high amount of particulate matter in to atmosphere. Ex; petroleum industry, chemical industries etc.

Government mulls new system for categorizing industries by pollution parameters-

The proposed classification will be on the basis of a composite score – 40% weightage for air pollution, 40% for water quality & 20% for nature of waste. Industries which scores more than 60 given red colour with consent of 5 years, which scores 30 to 59 given orange colour with 8 years of consent, which scores 15 to 29 given green colour with one time for the life cycle of the unit. Less than 15 will be considered as non polluting and will not required any consent.

TYPES OF POLLUTION CAUSED BY INDUSTRIES

When do we say a industry is polluting the atmosphere?

Industries are said to be polluting the atmosphere when the amount of particulate matter released from crosses the TLV [Threshold limit value].

POLLUTANTS	TLV/TOLERANCE LIMIT
CO	32 ppm
SO_x	0.25 ppm
NO_x	0.50 ppm

Ex; 2 Tolerable limit of sound in industrial areas during day time is 75 decibel and at night time is 70 decibel.

Guidelines under industries (development and regulation) act.

- ✓ Industries should be located at least 25km from ecologically sensitive areas.
- ✓ 1/2km from high tide line in coastal areas.
- ✓ No agricultural land & forest area into non forest area should be converted to industrial site.

The present situation of industries today in India/world are Industries do not follow any regulations, goes on polluting the atmosphere, no greenery around industries and look barren, no green belts in industrial areas and do not care for public health.

Pollution created by industries are categorised as follow: Air pollution, Water pollution, Noise pollution & Thermal pollution.

MANAGEMENT OF INDUSTRIAL POLLUTION

The waste generated in industries can be managed effectively by following ways. They are land fills, incineration, volume reduction, resource recovery techniques and mechanical biological treatments. Modern incinerators includes pyrolysis, gasification and plasma gasification. Volume reduction includes compaction, shearing and grinding. Resource recovery techniques includes are recycling and composting and digestion.

All the methods stated above are has both pros and cons. More over they may be costly and may not be adopted in all industries. They may be costly and

laborious. They do not solve the health problem of workers even. So we need to go for management methods which are cost efficient. Acceptable by all and which protects the environment to a maximum extent. Such methods are establishing green belts and Bio aesthetic planning of industries

GREEN BELTS

A green belt is a policy and land use designation used in land use planning to retain areas of largely undeveloped, wild or agricultural land surrounding or neighbouring areas. The concept of green belt as a source of pollution abatement recognized initially by three nations: U.S.A., Britain and Kenya. In 1898, a British Social Reformer, Ebenezer Howard, advanced the concept of green belt. A more elaborate plan was created in 1944 by Patrick Abercrombie, who proposed a belt, five or more miles wide, consisting of both public open spaces and private holdings. Concept of green belt is little more varying from town to town.

In America, Greenbelt meant a wide band of rural land or open space separating or interrupting urban development. The central goal of Roosevelt's greenbelt programme was not to create better urban communities, but rather to generate jobs in a declining national economy. In Kenya, greenbelt movement has been started through an agro-forestry project founded and run by women's association.

In Germany and the Netherland, there are fixed criteria for the width of greenbelt to be developed around the identified activity zone, depending on the source. Thus, in Germany, the width of GB varies from 100m around commercial centres to 2000 m around heavy industries. In Netherlands, the required GB width varies from than 500 m for heavy industries to 50 m for light and non polluting industries.

Objectives of erecting green belts:

Objectives of green belts development range from the micro level air pollution abatement to enhancement of socio-economic status of the region, attenuation of air & noise pollution, serve as a measure, to reduce the soil erosion & aesthetic enhancement of the area, it enhances the socioeconomic status of the region by generating employment avenues & also participates in environmental protection and the width of the GB and the species used for planting varies from industry to industry depending on nature & concentration of air pollutants.

Selection of Plant Species for green belts:

An ideal tree for planting in the green belt must possess the following characteristics are Fast growth rate for quick development of canopy, strong branches, thick & durable canopy which can withstand storm, large leaf size for greater retention of pollutants, dense foliage for better trapping of pollutants preferably perennial & evergreen species for extended life of the green belt, the species should be indigenous, able to maintain the ecological & hydrological

balance of the region. Leaves with hairy, resinous, scaly & coarse surfaces could capture more particles than smooth leaf.

Green belt for environment protection around industries:

60-70% pollution of world is by industries. Western countries are the major contributors of this pollution. Our industrial surroundings are smoky filthy and unfit for living. There is no control over poisonous gas, effluents, solid waste discharged by industries. Due to above reasons health of workers get lost. For above situation management is the culprit and workers are the victims. So priority should be given to solve such burning problem. Our industries are much bad when compared to industries of other countries. Our country borrowed the technology from western countries.

Methodology for Green Belt Design:

Class	Industry	Width of GB (m)
I	Heavy industry with high potential of air pollution	>500
II	Heavy industry with low potential of air pollution	200 to 500
III A	Medium industry with high potential of air pollution	100 to 200
III B	Medium industry with low potential of air pollution	100 to 200
IV A	Light industry with high potential of air pollution	50 to 100
IV B	Light industry with high potential of air pollution	50 to 100
V	Service industry	10 ti 50
VI	Workshops, handicrafts, etc.	< 10

Some notable green belts in world:

- Australia: Adelaide parks land.
- Canada: Ottawa green belt.
- US: Barton creek green belt.
- Salten island green belts.
- U.K: London metropolitan green belt.(5133 sq km). UK is pioneer in green belts establishment.16,716 sq km area is under green belt.

LANDSCAPING OF INDUSTRIES:

In modern times, a factory should not become a place of only machinery, dust, pollution & noise, but should also but provided with laid out parks & gardens. This is not needed from the point of beautification, but also to fight pollution & dust.

Objectives of landscaping of industries are to prevent all forms of pollution created by the industry. To protect the health of workers and employees working in it. To provide ample shade and coolness so that workers get relaxed from the

stress of hot interiors. To bring down the temperature around the factory premises. To enhance the aesthetic look to the industry. To increase property worth of the industry. To reduce the health hazards of people created by the industry etc. To absorb the harmful gases which are produced in the industries.

Steps for planting trees are dwarf trees with round canopy followed by medium & tall trees with cylindrical canopy are ideal for GB of industrial areas because all plants are exposed to the pollutants. This helps to divert the emissions upward as plants act as a physical barrier. Trees of the front rows act as absorptive layer while the core area cleans the air.

APTI (air pollution tolerance index)

Trees which have a high air pollution tolerance index (APTI) can catch and contain dust or smog, absorb pollutants and improve the ambient air quality. These trees can be planted especially around the industrial areas. This will create a curtain of sorts, which would absorb the pollutants and save the adjoining residential areas from their harmful effects. APTI is calculated as:

APTI = A (T+P) +R/10.

Where, A = ascorbic acid content in mg/g of dry weight, T = total chlorophyll in mg/g of fresh weight, P = pH of leaf extract & R = relative water content (%).

Trees are divided into four groups based on their APTI for an effective check on pollution.

S.No	APTI value	Response
1	30 to 100	Tolerant
2	29 to 17	Intermidate
3	16 t0 1	Sensitive
4	< 1	Very sensitive

Plants suitable for green belts purpose (for Indian conditions) are amla, bamboo, bael, banyan, cashew, casurina, guava, mango, shivan, shishum, tamarind, thuja, walnut, white shiris and neem. Neem, Silk cotton, Indian laburnum, Gulmohar, Pipal, Jacaranda, Pagoda tree, Peepal,Tamarind absorbs dust, temperature & emissions from traffic and industries. Babool, Subabool, Arjun, Gulmohar, Jacaranda, Siras, Amaltaas, Eucalyptus, Kadamb used to restore and landscape garbage dumps. Tamarind, Neem, Ashok, Silver oak, Butea monosperma, Cassica are directed to absorb noise pollution. Acacia, Bel-Pathar, Ulu-Neem, Siras, Neem, Bougainvillea, Sheesham, Peepal, Mahua, Hibiscus suitable for areas where gaseous pollutants are dominant.

Ornamental flowering trees:

- **For dry localities -** *Acacia auriculiformis, Butea frondosa, Plumeria alba, Pongamia glabra, Cassia fistula, Jacaranda mimosaefolia, Melia azadirachta.*
- **Moist localities -** *Bauhinia purpurea, Brownea ariza, B. coccinea, Cassia javanica, C. marginata, C. nodosa, Milletia auriculata.*

- **Arid regions -** *Butea frondosa*(Dhak), *Cassia fistula* (Amaltas), *Casuarina equisetifolia* (Beefwood tree), *Eucalyptus citriodora, Morus indica* (Mulberry), *Phoenix dactylifera.*
- **Salt resistant trees** - *Azadirachta indica* (Neem), *Butea frondosa* (Dhak), *Bassia latifolia* (Mahua), *Psidium guava* (Amrood).

Scheme of planting:

- Tall & hardy trees such as *Casuarina equisetifolia, Eucalyptus & Silver oak* should be planted all around or in direction of winds to stop the spread of dust & smoke.
- Staggering manner of planting plants bring down the noise from factory to the surrounding outside.
- A buffer zone may be created by afforestation between factory & residential colony.
- Afforestation can be done with hardy ornamentals such as *Acacia auriculiformis, Dalbergia sissoo* & other shade trees.
- Besides planting of trees, a factory area can also be beautified with rockeries, statues, water pools, fountains, etc.
- Bougainvillea & Canna are hardy & beautiful plants suitable for planting in factory area.
- Lawns laid in vacant lands not add to beauty but also cut down dust.
- Potted plants can be placed near canteen administration building etc.

Plants for indoor air pollution abatement:

Common indoor plants may provide a valuable weapon in the fight against rising levels of indoor air pollution .North American Space Agency (NASA) scientists are finding them to be surprisingly useful in absorbing potentially harmful gases and cleaning the air inside homes, indoor public spaces and office buildings. The indoor pollutants that affect health are formaldehyde, Volatile Organic Compounds (benzene and trichloroethylene or TCE), airborne biological pollutants and carbon monoxide and nitrogen oxides. Gerbera daisy, English Ivy, Mother in law's tongue, Peace lily, Areca palm, Bamboo palm, Dracaena, Philodendron, Boston fern, Date palm etc.

CONCLUSIONS

Pollution is a serious threat to mankind, which causes great loss to human as well as other organism. The major impact of pollution is climate change, unseasonal rainfall, and depletion of ozone layer so on. This can be prevented by planning of green belts around the industries. We burrowed the technologies from other countries and it's high time to plan green belts like other countries.

Assessment of Various Factors in Indoor and Outdoor Environment

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Abstract:

The endeavour of predicting future weather conditions at a given time and place relies heavily on the weather instruments. Foreseeing weather a few days in advance may prove as a safety measure to the farmers and livestock owners, as they plan their agricultural activities based on the upcoming weather. People also plan their leisure time based on the weather forecast. In this context, meteorologists continuously assemble information's about the weather conditions everywhere on Earth to make an accurate weather forecast. This requires a brief knowledge about the weather instruments, which are therefore discussed in this article.

Keywords: Weather forecast, agriculture, meteorologists, weather instruments

INTRODUCTION

The success or failure of any agricultural enterprise depends on the so called most important factor 'weather'. The effect of weather on soil, plant growth as well as on every phase of animal growth and development has been very well documented in various papers and need not to be discussed here. Around 3/4th of the annual loss in farm production, either directly or indirectly has been reflected in various studies. However, these losses can be reduced on a fairly large scale by adjustments through timed and strictly correct weather forecasts. Weather forecast is any progressive information about the likelihood of weather in future obtained by appraising the present and past meteorological conditions of the atmosphere. With reference to agriculture, it is grouped into short-range forecast (upto 48 hours), medium-range forecast (3-10 days) or long-range forecast (1 week to entire season), making significant contributions towards the farm operations and planning of agricultural activities. The science of weather forecasting has progressed and gets better and better with newer and advanced technologies. The

meteorologists rely on data from satellites, ships, airplanes, weather stations and buoys, and devices dropped from airplanes or weather balloons. The weather instruments to sample the state of atmosphere at a given time are reviewed in this article. These instruments are placed indoors and outdoors as a suite of sensors which together furnish an entire picture of weather conditions.

BASIC WEATHER INSTRUMENTS:

Below is a beginner's list of the basic weather instruments found in weather stations and what each one measure:

1. **Thermometer:** Galileo is credited for the invention of thermometer. Thermometer measures the daily high and low outdoor and indoor temperatures in degrees Fahrenheit and degrees Celsius. The electronic thermometers are handy with temperature sensors to measure and record high and low temperatures.

(Anonymous, 2019d)

2. **Barometer**: Evangelista Torricelli is credited for the invention of barometer. Barometer measures atmospheric pressure in milli-bars. The low and falling pressure indicates approaching rain while high and rising pressure hints sunny weather.


(Mikulka, 2017)

3. **Hygrometer**: Leonarda da Vinci is credited for the invention of hygrometer. Hygrometer measures the humidity or amount of water vapour in the air using degrees Fahrenheit and degrees Celsius. Sling Psychrometer, a type of hygrometer measures the humidity of air through evaporation with the use of one dry and one wet bulb thermometer.


(Daniel, 2004)

4. **Anemometer**: Leon Battista Alberti is credited for the invention of anemometer. Anemometer measures the speed of wind in miles per hour. A general anemometer has three cups fixed to a mobile shaft. Faster the wind current, faster the cups spin around, and the actual speed of the wind appears on a dial.


(Barani, 2012)

5. **Wind vane/ weather vane**: A wind vane measures the direction of wind at any given point of time. A weighted arrow spins around a fixed shaft and indicates east, west, north or south, typically marked on separate fixed shafts parallel to the arrow.

(Anonymous, 2019e)

6. **Rain gauge/ Udometer/ Pluviometer/ Fluviograph**: Sir Christopher Wren is credited for the invention of rain gauge. A rain gauge measures the amount of rainfall. The standard rain gauge consists of a long, narrow cylinder and measures rainfall up to 8 inches. It can also be measured in millimetres.


(Famartin, 2013)

7. **Hail pad**: A hail pad measures the size of hail that falls during a storm. A standard hail pad consists of florist's foam wrapped in an aluminium foil. The falling hail strikes the foil and creates depressions to be measured after the storm.

(CoCoRaHS, 2004)

8. **Campbell Stokes recorder**: The Campbell Stokes recorder records sunshine. Sunlight falls into one side of a glass ball and leaves through the opposite side in a concentrated ray. This concentrated ray of light burns a mark onto a thick piece of card. The extensiveness of the burn mark indicates how many hours the sun shone during that day.

(Bidgee, 2007)

9. **Weather station**: A weather station consists of clusters of electronic sensors into a single product viz; thermometer, barometer, hygrometer, anemometer, rain gauge, ultraviolet light sensor, a solar radiation detector and a visibility sensor.

(Garytx, 2007)

10. **Weather balloon**: Leon Teisserence de Bort was the first person to use weather balloons. These are mobile weather stations that carry scientific instruments into the upper atmosphere and are equipped with suites of sensors to measure weather variables like atmospheric humidity, temperature and pressure. These information's are relayed to ground-based receiver stations to be stored and analysed. Moreover, by tracking the balloon's position using radar or installing GPS systems on each balloon, one can obtain the wind data. The latex balloons may reach up to 6 feet wide and are filled with helium or hydrogen gas. The sensitive instruments during its flight are encased and protected within balloon by an instrument called "radiosonde".

(U.S. Navy, 1958)

11. **Pyranometer**: Pyranometer measures solar irradiance on a given planar surface. It is World Meteorological Organization's standard instrument and covered under the ISO 9060. The world radiometric references are required to calibrate the device which is maintained by the World Radiation Centre in Switzerland.

(Hukseflux, 2012)

12. **Disdrometer**: Disdrometer measures the raindrop size, distribution and its velocity. The various forms of disdrometers are; Impact disdrometer which directly measures the kinetic energy of raindrops, Acoustic disdrometer that use piezoelectric sensors and diaphragms to determine raindrop kinetic energy and, Optical disdrometer that use light to measure raindrops in a non-intrusive manner.

(Salsb, 2005)

13. **Transmissometer/ Telephotometer/ Transmittance meter/ Haze meter**: Transmissometer measures the visual range of the atmosphere and seawater. The narrow beams of energy, usually a laser are relayed from the instrument to a receiver (detector) set distance away. Any photons that are absorbed or scattered by the air between the source and detector will not reach the detector. By determining the path transmission and extinction coefficient the local visibility can be determined.

(JK047, 2008a)

14. **Ceilometer:** Ceilometers measures the height of clouds or cloud bases and cloud thickness by using lasers or other light sources. Ceilometers have been reported fatal to birds as they get disoriented by the light beams emitted from them.

(JK047, 2008b)

15. **Stevenson screen/ Instrument screen:** It forms enclosure around the meteorological instruments and protects them against precipitations and direct heat radiations from the sun while allowing sufficient air to circulate through to the instrumentation inside.

(Cambridge Bay Weather, 2005a)

16. **Buoys:** The instrument was first deployed in 1927 and became very popular during WW2. Weather buoys gather weather and ocean data around the world. They are equipped with instruments to measure weather variables like local temperature, wind speeds, atmospheric pressure etc. It has also helped in studying the El-Nino systems.

(Lamb, 2005)

17. **Dewcell:** Dewcells are specialized hygrometers used to determine the dew point at any one point and time. Each one consists of a small heated element surrounded by a solution of lithium chloride. Lithium chloride absorbs moisture from the air that increases the conduction potential across the heating element. This causes the heat to increase which evaporates moisture from the solution. Within each dewcell lies a thermistor composite that changes electrical resistance with changes in temperature from the heating element. This process will continue until an equilibrium is reached, hence the dew point is ascertained.

(Cambridge Bay Weather, 2014)

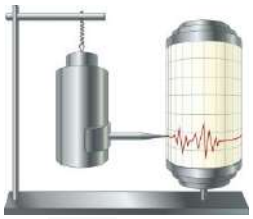
18. **Snow gauge:** The snow gauge measures solid precipitation (snow). Snow gauge comprise of a copper catchment container and the funnel shaped gauge. When snow is collected, the container is removed. The snow is then melted while it is still in the container, and then poured into a glass measuring graduate. The depth of snow is in centimetres while the melted snow is measured in millimetres.

(Cambridge Bay Weather, 2005b)

19. **Hydrometer:** It measures the relative density or the specific gravity of liquids. A hydrometer comprise of a sealed hollow glass tube with a wider bottom portion for buoyancy, a ballast of lead or mercury for stability, and a narrow stem with graduations for measuring. The sample liquid is poured into a graduated cylinder, and the hydrometer is gently lowered into the liquid until it floats freely. The point at which the surface of the liquid touches the stem of the hydrometer correlates to relative density.

(Buster, 2019)

20. **Seismometer:** It measures ground movement caused by earthquake or explosions. It consists of a mass attached to a fixed base. During an earthquake, the base moves and the mass do not. The motion of the base generates an electrical voltage which is recorded on paper, magnetic tape, or another recording medium as seismograph.



(SEIS, 2016)

21. **Sun-dial:** It measures the sunshine duration and is 4 inches in diameter. The sunrays are focused upon a sensitized card, graduated in hours. A line forms on the card when it gets sufficiently heated, however this is not the case when the rays are dim or hazy.

(Wilco, 2007)

22. **Doppler radar:** The instrument utilises the doppler effect to generate velocity data about objects at a distance. It analyse the reflected microwave signal off a desired target as how the targets motion has altered the frequency of the returned signal. Further prediction of severe storms and tornadoes are also made using doppler radar.

(NOAA, 1950)

23. **Lightning detector:** Alexander Stepanovich Popov is credited for the invention of lightening detector. A lightning detector detects lightning produced by thunderstorms. There are three primary types of detectors. The ground-based and mobile detectors utilise the radio direction-finding techniques to detect the direction and severity of lightning from the current location. Space-based detectors on satellites directly observe the intensity and location of lightning range.

(NASA, 2006)

24. **Compass:** A compass is a navigational instrument for finding directions. A diagram called compass rose shows the directions east, west, north and south on the compass face as abbreviated initials. Compass also display markings for angles in degrees. East corresponds to 90°, west to 270°, north to 0° and south to 180°.

(Bios, 2005)

CONCLUSION

A large collection of weather instruments are available to measure wide varieties of weather conditions. Many times at short intervals, multiple weather instruments are combined into a single product to measure weather conditions. By integrating multiple environmental measurements, one can get a thorough view of the conditions outdoors and indoors and also generate reliable weather forecasts. A reliable assessment of the environment has been credited to provide the comfort area for living beings enhancing their survivability, growth and performances.

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Genetic improvement of goat through genomic selection

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Goat is generally portrayed as a "poor man's cow" and play critical socio-cultural roles in many communities. They contribute greatly to the agrarian economy, especially in areas where crop and dairy farming are not economical, and play an important role in the livelihood of a large proportion of landless as well as small and marginal farmers (Kosgey and Okeyo, 2007). Goats are important especially for the livelihood of the poor in rural areas because of the milk, fibre and meat production with low maintenance cost and their adaptation to extreme climatic conditions.

Asia constantly holds the first place having a contribution to the total goat population of 59.38% and an increase of goat number during the period 2000-2013 by 30.23% (FAOSTAT, 2013). Among Asian countries the largest goat population exist in China, India, Pakistan and Bangladesh. India has world's second highest share of 135.17 million of goat population after China, with 34 recognized breeds in India (http://www.nbagr.res.in/reggoat.html).

Table-1 Goat population in the World (heads) in the years 2000 and 2013

	Goat population heads		Change %	Contribution %
	2000	2013	2000-2013	2013
Asia	458 521 280	597 151 616	+30.23	59.38
Africa	236 852 594	351 978 256	+48.61	35.00
Oceania	2 396 231	3 972 060	+65.76	0.39
Europe	18 940 725	16 487 290	-12.95	1.65
E.U. (28)	14 509 183	12 411 308	-14.46	1.23
Americas	34 921 551	36 013 781	+3.13	3.58
World	751 632 381	1 005 603 003	+33.79	100

(FAOSTAT, 2013).

Systems for conventional breeding programmes in Goats

Genetic selection plays a very important role in goats to improve their production efficiency and has become more competitive with other livestock industries. Conventional system of genetic evaluation of goats is mainly based on

efficient performance and pedigree recording. In an attempt to increase the efficiency of productivity of Goats, many developed countries have implemented breeding programmes based on estimated breeding values (EBVs) using performance and pedigree data. The maturity in mixed model approaches has resulted in more accurate estimates of EBVs accelerating the rate of genetic progress and the profitability. Some examples of established well-structured genetic evaluation systems of goats that underpin genetic improvement include French goat genetics (http://en.france-genetique-elevage.org) and Canadian dairy goat breeding programme (http://www.goatgenetics.ca/). These improvement programmes for goats are mostly focussed on meat and dairy production, and more recently, breeding objectives have also included other functional traits such as reproductive performance and disease resistance/tolerance but little emphasis on carcass and meat quality traits. Many authors reported a substantial genetic gain in goats for growth-related or milk traits has been achieved using traditional breeding methods. But a relatively lower rate of progress is possible for some important traits that are difficult or expensive to measure (e.g. resistance to diseases, carcass traits, etc.), measured late in life or sex limited traits (Molina *et al*., 2018).

Genomic selection

The advancement of next-generation sequencing technologies in goats opened the use of Genomic selection (GS) for breeding programmes especially for traits measured late in life and carcass traits. It has been successfully used for the genetic evaluation of different species. GS consists of estimating the SNP marker effects in a set of genotyped and phenotyped animals, called the reference population. It is followed by prediction of genomic estimated breeding values (GEBV) for selection candidates (validation data set) by estimating marker phenotype association. The possibility of using a whole-genome set of markers to improve the accuracy of breeding value prediction was first described by Meuwissen *et al.* (2001). Key factors of success of GS are structure of the reference and validation populations, definition of input variables, genomic prediction models, validation methods, imputation efficiency, genotyping strategies, and routine genomic evaluation.

The basic principle of GS is that each quantitative trait loci (QTL) that affects a trait will be in linkage disequilibrium (LD) with at least one single nucleotide polymorphisms (SNP) marker, and the estimation of the markers' effects will lead to accurate prediction of merit. LD is defined as a non-random association of alleles at two or more loci. Use of SNPs as markers enables all QTLs in the genome to be identified through the mapping of chromosome segments defined by adjacent SNPs. The marker density required for GS depends on the extent to which LD persists across the genome and how it varies between populations. A low LD level would require a higher marker density to enable markers to capture most of the genetic variation in the population. The higher the level of LD, the more precisely the markers can be used to predict the effects of QTL, since there will be

greater certainty that the alleles are predicted correctly, consequently the estimates of genomic breeding values (GEBV) can be predicted with greater accuracy (De Sousa and Braga Lobo, 2019).To obtain good accuracies of predictions using multi-breed populations it is required not only high LD between the markers and the quantitative trait loci (QTL) in each breed, but also high consistency of gametic phase between the markers and the QTL across breeds.

Application of Genomic selection in goats

In early 2007, the development of next-generation sequencing (NGS) allowed de novo sequencing of goat genomes and development of high-density SNP chips. The International Goat Genome Consortium (IGGC; www.goatgenome.org) was created in 2010 and promoted international effort toward the development of a 52K SNP chip for goats (Tosser-Klopp *et al*., 2014) commercialized by Illumina- SNP50 BeadChip. The availability of high throughput DNA methods and tools in recent years has opened up the use of genome-wide information for goat breeding. The feasibility of genomic selection in small ruminants has been evaluated recently in dairy goats in France and the UK. Reference population sizes are rather limited in goats when compared with cattle, around 2,400 and 2,700 UK and French goat populations, respectively. Despite small reference populations, genomic best linear unbiased prediction (GBLUP) resulted in greater accuracies of EBV than pedigree-based BLUP although for some traits and population, the increase in accuracy was small. The gain in GEBV accuracy in the French and UK dairy goat populations was 0.06 for milk yield and 0.14 for fat and protein content (Carillier *et al.,* 2014: Mucha *et al*., 2015). The gains of reliability provided by molecular information were lower for goat compared to cattle with respect to reference population size, which is probably due to lower linkage disequilibrium (LD) due to higher effective population size and inclusion of crossbreds in sheep and goats. The extent of LD estimated by average r^2 (reliability) values between adjacent markers (50kb) ranged from 0.10 to 0.18 for Saanen and Alpine goat populations. LD results indicate, for some breeds, the addition of new genotypes is mandatory and that a denser SNP panel than the current 50K Beadchip could be beneficial. Mucha *et al*. (2015) demonstrated that genomic selection can be successfully implemented in small populations of goats. Genomic selection in UK dairy goats proved that the initial investment can be outweighed by economic benefits from improved accuracy of breeding value estimation and lower costs associated with only rearing sires that will be used for breeding. The application of GS in the various management systems described especially the low-input small holder system and the fragile growth sectors should be accompanied by a cost-benefit analysis.

Accuracy of methods that use only phenotypes of the genotyped animals and ignore records of the nongenotyped part of the population (e.g., GBLUP and BLUP-SNP) is limited because of small size of reference population. Therefore, an alternative approach that integrates all of the available phenotypic, pedigree, and

genomic information in a single-step procedure to calculate genomic breeding values is the recommended method for such small reference populations (Legarra *et al*., 2009). This method allows for simultaneous evaluation of all animals (with and without genotypes). The single-step approach improved prediction accuracy of candidates from 22 to 37% for both Alpine and Saanen goat breeds compared with the two-step method. With a large enough training population, genomic selection could potentially be implemented within breed with the current 50 k panel, but some breeds might benefit from a denser panel (Brito et al., 2015). Carillier *et al*. (2014) found that the multi-breed genomic evaluation showed better accuracy results than the within-breed one. However, for a multi-breed genomic evaluation, a denser SNP panel also seems to be required.

The implementation of genomic technologies in goats was challenging. Even though it had become routine in many farmed livestock species such as dairy and beef cattle, small ruminants such as goats were lagging behind for a number of reasons. Development of genomic evaluations in goats has also been slow due to lack of exchange of genotypes between countries. The increase in accuracy of prediction of animal breeding values is low and do not justify the costs for genotyping animals in developing countries. Compared with the use of genomic information for cattle, higher cost of genotyping relative to the value of the animal is still a strong economic barrier to the uptake of such new technology in goat breeding. De Sousa and Braga Lobo, (2019) reported that dairy goat population in many parts of the world have low LD and selection by molecular markers would produce inefficient results in these populations. The low linkage disequilibrium observed in many dairy goat populations around the world difficult the application of genomic tools for selection in goats. Larroque *et al*. (2014) also reported that the lower improvement in accuracies of the goat GEBV with respect to those of Holstein dairy cattle could be in part due to a lower level of LD when using a similar SNPs chip density. The Caprine Assembly development is still in a draft stage and future refinements will provide a more accurate physical map that will improve LD estimates. The relatively high economic efficiency of GS in the dairy cattle is derived mostly from the large reduction in generation interval (Konig *et al*., 2008). In goats, the reduction in generation interval is not as large and the relatively higher cost of genotyping limits the cost-effectiveness of GS in India.

Goat genetic improvement in India

In India, Genetic improvement programme is mainly focussed on identification indigenous descript breeds of goat through selective breeding for better yielding breed stock. But to improve the economically important traits, as an an alternative approach traditional selection methods complemented with gene assisted or marker assisted selection (MAS) can be used in India. The candidate genes regulating the growth, production and reproduction could be targeted for enabling the selection of animals using MAS for these performance traits. Naicy *et al*. (2018) reported significant association of NGF gene with growth traits in two

indigenous native goat breeds of Kerala, viz., Malabari and Attappady Black. It emphasized the importance of caprine NGF as a candidate gene for marker assisted selection for growth traits in goats. Bosewell *et al*. (2018) characterized of the caprine SLC11A1 gene and detected SNPs which benefit the use of this gene as a candidate gene for disease resistance in goat breeding programs. Silpa *et al*. (2018) found a significant association of potential SIRT3 polymorphisms with litter size in indigenous goat breeds of India highlight the role of SIRT3 in reproduction traits. Thus recent developments in goat genomic variations and major genes studies paved the way for using genomic selection as a tool for genetic improvement of goats in India.

CONCLUSION

Availability of molecular tools and approaches have enabled the understanding of genetic basis for goat diversity and adaptation in different areas, initially through the use of microsatellites and more recently SNP genotype and full genome sequence data. Incorporation of genomic data in selection criteria opens new perspectives for breeding programs in goats, as it improves genetic gain Genomic selection (GS) along with phenotypic and pedigree data using mutitrait models has the potential to accelerate genetic progress in short time for many valuable traits (growth, meat , production, carcass measures, disease resistance traits, meat quality etc.). However, introduction of GS should be financially beneficial to farmers and would increase nutritional and livelihood security of farmers.

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Aquaponics system: A great venture in modern aquaculture technique

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ABSTRACT

Aquaponics is a type of integrated farming system that creates a bridge between traditional aquaculture and hydroponic vegetables, flowers or herb production. Aquaponics system can be used as a working model because it is a means of sustainable food production. Briefly, we can say that it is an eco-friendly system for food production using aquaculture and hydroponics to culture fish and crops without soil. This is a recirculatory system where toxic water from fish culturing unit is transferred to the hydroponic system. The water coming from the fish culture unit contains various uneaten food material and excretory and metabolic wastes as well as mineral nutrients for plants. Plants utilize and absorb those nutrient-mineral from that water and make that water re-usable for a fish-culture unit. So, there is no issue of replacement and disposal of wastewater. So, this method consumes only $1/10^{th}$ of water in comparison to other traditional aquaculture techniques. This environmentally friendly and cost-effective culture method will be one of the major sustainable ways of food production in a future generation to achieve food security.

Keywords: Aquaponics, aquaculture, fish, hydroponics

1. INTRODUCTION

Aquaponics is a type of aquaculture system which combines two different conventional terms. It is the combination of conventional aquaculture and hydroponic subsystem. Conventional aquaculture is the practice of cultivating aquatic animals like fish, snails, etc. On the other hand, hydroponics is the process

of growing plants in the water without soil. Both the subsystem co-exists here in a symbiotic interaction with each other. The uneaten foods and excretory products which are produced during the rearing of the aquatic animal, that accumulate in the water, increase the toxicity of the aquaculture system in case of the traditional aquacultural system. But this water also contains high amounts of nutrients which are useful for plants. So, if we transfer water from the aquaculture system to the hydroponic system, the by-products are broken down into nitrites which are absorbed by the plants. After the utilization of nutrients, we can recirculate the water into the aquaculture system.

2. TRADITIONAL HYDROPONICS

- ✓ In traditional hydroponics systems, the supply of balanced nutrition is very much crucial to maintain a well-nourished system. This system largely depends upon the careful application of man-made expensive nutrients, made from mixing various chemicals, salts and trace elements together.
- ✓ The condition, strength, and capacity of this system should be checked and monitored carefully so that pH and total dissolved solids are maintained well.
- ✓ In a hydroponic system, salts and other toxic chemicals formed are accumulated in the water, makes the water toxic for the plants. So the water should be discharged regularly to make the system clear and purified and well-balanced.
- ✓ Discharge and replacement of wastewater are one of the major problems in a hydroponic system as wastewater disposal; the location is very much vital.
- ✓ This traditional hydroponic system is very much vulnerable to a disease called “pythium” which causes root rot diseases of the plant.
- ✓ Due to careless release and discharge of the water from this system, enters into open streams where pollution and destruction of waterway occurs.
- ✓ Because of the unhealthy environment, fish diseases are very common in the hydroponic system.

3. WHY AQUAPONICS SYSTEM

- ✓ Aquaponics system truly depends upon the continuous recycling of nutrient-rich water.
- ✓ Because of the recycling of water, there is much less toxic run-off from either hydroponics/ aquaculture system.
- ✓ Any type of culture system may be of soil-based gardening or hydroponics or aquaculture system requires a huge amount of water, the supply of which is a very much crucial factor. But the aquaponics system requires very less amount of water than another culture system.
- ✓ An aquaponics system is very much environmentally friendly. So, it can be put anywhere, like in the living room, in our basement or even in a greenhouse also.

- ✓ An aquaponics system is very much flexible system, so it can be established in any budgets and size from the backyard garden to full-scale farms.
- ✓ The best opportunity of an aquaponics system is that plants and fishes both can be harvested from the same system.
- ✓ Aquaponics system can be the best solution to fight against negative aspects for both hydroponics and traditional aquaculture system.

4. SPECIAL FEATURES OF AQUAPONIC SYSTEMS IN COMPARISON TO OTHER AQUACULTURAL SYSTEMS

- ✓ Aquaponics systems provide opportunities for common people to consume fresh and organic fishes and vegetables.
- ✓ Aquaponics systems ensure the production of incredible amounts of plant and animal protein yield through very less investment.
- ✓ The system does not occupy very big space for its establishment.
- ✓ The construction and maintenance cost of the aquaponics system is very less.
- ✓ Aquaponics systems can provide huge employment opportunities for the surrounding people.

5. PRIMARY METHODS OF THE AQUAPONICS CULTURE SYSTEM

- ❖ **Deep Water Culture (DWC) technique:** Deepwater culture technique is mainly a raft-based growing culture system. This is one of the most appropriate methods for growing green salad and other fast-growing but low-nutrient plants. This technique most commonly used in larger commercial-scale systems. In this technique, foam raft is used, which is in the floating condition in a channel that is filled with fish effluent water. This water has been filtered many times to remove solid wastes. There are many holes in the raft in which plants are placed and the roots freely dangle in the water.
- ❖ **Media-based aquaponics:** This technique uses some inert planting media such as expanded clay pellets or shale. This method provides a synergistic effect because of the result of both filtration systems as biological filtration which is responsible for conversion of ammonia to nitrates and mechanical filtration which is responsible for the removal of solid wastes. This system is very much advantageous cultivating large fruiting plants as well as for the leafy green, herbs and other varieties. Example: Harmony, the aqua urban 60-gallon system and the aqua Bundance system.
- ❖ **Nutrient-Film Technique:** This aquaponics system was developed in the mid-1920s in China by Dr. Alan Zhang Jr. The efficiency of this system is dependent upon the use of right channel slope, right flow rate and the right channel length. This method is always recommended and practiced because of its design represents a system where all the requirement of the healthy plant growth can be met at the same time. In this system, a stream of nutrient-rich water is circulated over the roots of the plants through a narrow channel

like PVC pipe. Few numbers of small holes are drilled in this pipe, through which plants are placed and the root of which freely dangle in the water stream. The plants that need very little support like strawberries and other herbs are the perfect choices for culturing in this type of system. NFT is a good way to utilize unused space very efficiently.

- ❖ **Vertical aquaponics:** This technique has the ability to grow a huge amount of food within a very small area. Plants are arranged in a tower system by placing on the top of each other. Example: Aquatica.

6. AQUAPONICS CULTURE STAGES

- ✓ **The first stage of Aquaponics:** Fishes are fed normally and intensively to make them achieve their full growth. Their normal physiological processes will carry out continuously. They produce an excretory product like ammonia into the water.
- ✓ **The second stage of Aquaponics:** One pump fitted there to lift the water from the fish tank to the grow bed.
- ✓ **The third stage of Aquaponics systems:** This stage is the most vital stage for the proper maintenance of the health of the aquaponics system. The water, which comes from fish tank, contains a huge amount of excretory products which are toxic for the fish. At the same time, this water contains a large amount of nutrient which can be utilized by the plants. So the water coming from the fish tank passes through the porous media filter to make it clear and purified. Then the water passes through the roots of the plants before discharging back into the tank.
- ✓ **The fourth stage of Aquaponics systems:** The plant roots absorb the water and nutrients that they need to grow. So the water becomes clean, clear and purified after absorbing all the nutrients from water by the plants. After purification of the water should return back to the tank where fish live, feed and grow.

7. DIFFERENT FORMS OF AN AQUAPONICS SYSTEM

(i) Home aquaponics systems:

Home aquaponics systems are a unique way of production of fresh, high-quality fish and vegetables for common people for household purposes. This kind of system also provides huge scope to fill one's leisure time with their great hobby of gardening. This technique is very much relaxing and there is the immense scope of the year-round availability of the produced yield. Home aquaponics is a natural, sustainable and rewarding and contributes to the overall good health and wellness of the common people. This technique is highly productive and very easy to operate and ensure continuous harvests.

This is totally science-based design and environmentally friendly technology which ensure a positive return to the investment of the common people.

Ingredients-

- ✓ Small fish tank
- ✓ A little number of fishes
- ✓ Nice amount of vegetables

(ii) Commercial aquaponics system:

Commercial aquaponics is a growing young sector of agriculture with great potential. In spite of less number of total commercial aquaponics systems, the growth of this sector exponentially increasing because entrepreneurs deeply realize that, local food production is a profitable business, which is very much important for safety and availability of food

This types of system enhance the supply of fresh, local and high-quality fresh fish and vegetables throughout the year.

Commercial aquaponics is science-based highly efficient designs that use high-quality components, so there are no chances of re-investment.

This kind of aquaponics system can fulfill the need of the staple food for the common people of the village in a developing country.

In most of the commercial aquaponics systems, growers use a greenhouse to protect the plants and fish from harsh environmental conditions and pest insects. The production of the output can be very high in a commercial system when plant spacing is maximized and fish are fed a proper and balanced diet.

Ingredients:

- ✓ Huge sized grow-beds
- ✓ A huge amount of growing fishes
- ✓ Great aquaponic food production

8. ADVANTAGES OF AQUAPONICS SYSTEMS

i. **Remarkable reduction in the water usage in culture practices:** All the water is recycled within a closed system in this culture method which is not done in traditional soil methods plant growing Under normal condition, it is not mandatory to replace, discard or change any water. It has been documented that, water consumption in this type of culture practices 90% less than traditional culture systems.

ii. **Environmental benefits of aquaponics are really outstanding because of the usage of organic food without wastage:** Aquaponics systems are environmentally friendly as it provides huge scope to produce fresh vegetables and fish organically without the production of waste. In these types of culture techniques, waste nutrients of fish or aquatic animals are absorbed and utilized by plant efficiently and properly.

iii. **Aquaponics system is very cost-effective method:** One of the major advantages of an aquaponics system is that ensures economical independence throughout life. In this system, fish provides a flow of nutrients to the plants. So, there is no need to replace and discharge nutrient solutions. In aquaponics system

plant will consume most of their required nutrients at no costs or very less cost from the system itself.

iv. **Aquaponics system is a clearer, modified, purified and advanced form of gardening:** Many people in the world are interested in gardening but sometimes they losses their interests in this practice because of lack of facilities. Sometimes they don't get genuine quality soil in their surroundings. In some cases, they are afraid of getting dirty soil, so they do not cherish their habit of gardening. But in the aquaponics system, we don't need soil. It does involve any digging, dirty hands or clothes and suitable for everyone. So, we can conclude that there is no other better option than growing fish and vegetables together without facing the hazard of soil quality.

v. **Aquaponics system is very much flexible process and very easy to set up:** Aquaponics system is very much flexible and environmentally friendly. It is a very easy process to set up an aquaponics system.

CONCLUSION

One of the major challenges of the 21 st century is to achieve food security and availability. Population explosion is one of the major concern that creates obstructions in the path of civilization. In order to stabilize this present condition, we need to secure food availability for all the people which is one of the most basic needs of all common people. The whole world is looking for a better and alternative method of food production. But if society continues in this situation by overlooking the current detrimental issues, the world will finish very soon. We should be totally free from using those insufficient and unsustainable means of food production. This aquaponics system can be the most environmentally friendly way of farming which could easily fulfill the needs of all common people and also suit in all climatic condition.

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Effects of Climate Change on Domestic Animals

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ABSTRACT

Several anthropogenic activities throughout centuries have resulted in a high level of environmental pollution. Especially the release of greenhouse gases from different sources has caused global warming and other changes in climate conditions. This is affecting all the living organisms on the earth including the domestic animals. The productivity, reproductive ability and the health of the animals are greatly affected by these altered climatic conditions. Indirectly this is affecting the economy of the farmers or producers and also affecting all the human being as they are largely dependent on the animals for several reasons. Necessary steps should be taken to keep the animals safe from environmental stress. Lastly, trees should also be planted and pollution should be reduced to prevent the climatic change and offer a better future to the next generations.

Keywords: Animal, climate change, global warming, heat stress

1. INTRODUCTION

Recently the global climate change has become a burning problem for all the living organisms. The animals are also being greatly affected by the altered climatic conditions especially global warming. The major reasons behind this climate change are both natural and anthropogenic activities. But the major changes occurring in the earth especially in the climatic conditions are due to the later one. For the last few centuries, humans have exploited nature brutally. There are

already several pieces of evidence that animals, birds and plants are being severely affected by global warming, the latest contribution of the human being to nature. Unless and until the reduction of greenhouse gas emission will be done, the temperature of the earth will continue rising. These altered climatic conditions are affecting all the living organisms including the domestic animals. The health, productivity and reproductive capability of the animals are being greatly affected. This has a clear negative impact on the economic condition of farmers and producers. In this section, we will discuss how the climatic changes are affecting animals and what steps should be taken for its prevention.

2. EFFECT ON ANIMAL HEALTH

Several studies have been carried out to assess the effect of climate change on animals especially domestic animals. Climate change particular global warming has affected the health of all the domestic animals and also the human being. The rise in the temperature causes several temperature-related illnesses and also death. In one hand it causes a decrease in production, on the other hand, it causes deterioration of animal health. With the increase in temperature several vector-borne diseases, infectious diseases and foodborne diseases increase rapidly. The high rise in temperature also causes a shortage of animal food in different seasons. The scarcity of food for the animals results in malnutrition. This eventually makes the animals more prone to diseases.

When the animals are exposed to high temperature for a prolonged time period it tries to acclimatize itself with the environment. This causes several physiological and behavioral changes in the animal. It also results in impaired health and decreased productive and reproductive efficacy. The animal always tries to reduce the heat load. In response to reduce heat load, it reduces the feed intake, increases respiration rate and water intake and the hormonal signaling systems are also affected. All these events result in a negative energy balance for the animal that eventually results in decreased body weight and makes the animal more susceptible to the diseases.

Several researchers have shown that heat-stressed animal has a low level of glucose and non-esterified fatty acids. The animal actually tries to reduce metabolism in its body to reduce the heat production and this reduction of metabolism results in negative energy balance and decreased milk yield under hot conditions. The function of the liver and other endocrine glands are also impaired. The level of cholesterol and albumin are disturbed. The metabolic activities in the body are affected greatly by heat stress. The secretion of the saliva is also reduced in the heat-stressed animal due to a reduction in feed intake. So there is always a chance of increased acute ruminal acidosis.

Heat stress also affects the mortality of the newborn calves. It has been reported by several researchers that higher mortality rate has been observed in summer calves. A possible explanation of this may be reduced colostral immunoglobulin coming from the mother to the calf.

In hot weather, the incidence of mastitis is also increased though the mechanism behind it has not been explained well. A possible explanation may be that high temperature facilitates the survival and multiplication of several pathogens or they are vectors.

Several types of research have been carried out to find the relationship between heat stress and immunity. Some have reported an immune impairment during heat stress whereas some have reported no effect. It has been found that cell-mediated immunity decreases during the stress full conditions.

Another mechanism that causes impairment of animal health is mycotoxicosis. The warm temperature and high moisture content result in high production of fungus. These fungi produce mycotoxins that can cause different diseases in the animal. The toxins can affect different tissues of the animal like liver kidney gastric mucosa brain reproductive tract etc. The growth rate of the animals is also decreased and the animals become more susceptible to other infections.

3. EFFECT ON ANIMAL REPRODUCTION

Environmental temperature also affects the reproduction of the farm animal in both sexes. As a result, it also affects the productive traits of the animals. A major portion of the animals are found in the tropical areas and economic losses are also great here due to the high increase of temperature. In the case of females, the level of reproductive hormones is disturbed. The growth of the follicles during the estrous cycle is also disrupted. Development of the embryo is hampered and motility of the embryo is also increased. The animals show poor estrus cycle and poor follicular dynamics.

At the time of the summer, there is also a decrease in conception rate in domestic animals. The growth of the fetus during pregnancy is also hampered. Environmental conditions especially warm climatic condition have a negative impact on pregnancy rate and conception rate. The label of the reproductive hormones is changed due to stress conditions and affect the reproductive ability of the animals.

In the case of male animals also different semen parameters are decreased like motility live and dead percentage concentration abnormal sperm count etc.

4. EFFECT ON ANIMAL PRODUCTION

Climate change particular global warming has a major impact on the productive performances on the farm animals and affect livestock production globally. At the time of the heat stress, the animals try to reduce heat production from their own metabolism. For this reason, they reduce feed intake to reduce heat stress. This results into a decreased weight gain of the growing animals. The body weight becomes lower than average. As the body weight is decreased, animals take more time for coming into puberty and delays sexual maturity. This causes a great economic loss for the farmers.

The major loss occurs at the time of heat stress is the loss of milk production in the dairy cow. As already discussed above, there is reduced feed intake in dairy animals at the time of the summer which results in a sharp decrease in milk yield. There is a threshold temperature depending upon breed and area above which the milk production of the animal starts decreasing. It has also been observed that high producing animals are more affected than the low producing animals. Besides the quantity of milk, the quality is also affected. This temperature-dependent decrease in milk production is observed in all the domestic animals including cattle buffalo sheep and goat.

Besides milk production, the production of the egg and meat are also affected. As already discussed previously that the heat stress results in decreased growth rate and a decreased body weight finally. A reduction in the body size in cattle, buffalo, sheep and goat have been reported by several researchers. The heat stress also affects the growth of the embryo in pregnant animals. The warm climates or hot season also affects the quality characteristics of meat compared to cold seasons. As the animals do not take sufficient feed, the growth is reduced and the animals are often susceptible to different diseases that result in higher mortality. In the case of poultry also higher temperature results in decreased body weight gain and high mortality. Heat stress also reduces the reproductive performance of the laying hens and results in decreased egg production. Different egg quality parameters like egg weight and shell thickness are also compromised.

5. STEPS FOR BETTER PRODUCTION

The first thing that could be done to stabilize the production in the heat-stressed animal is to provide shelter to the domestic animals and protecting them from the heat. Several types of research have been done on animals shelters to provide a comfortable environment to the animal for enhancing the production. Nowadays there is a trend to use the locally available cheap natural materials for making animal shelters. It is economical for farmers and easily found. On the other hand, it provides good insulation from the heat. Many times in Indian conditions animal shelters are made using bamboo, paddy straws, tree leaves and other locally available materials. In the case of big commercial farms, the design of the housing system should be taken care of. There should be proper ventilation but minimum heat exposure to the animal. Water sprinklers or other cooling systems can be installed on the farm to keep the animal in a comfortable environment during the summer days.

Another thing that should be considered is the diet of the animal. As the animal is trying to reduce its metabolic heat the animal should be provided feed which produces less heat. The amount of concentrate should be higher and the amount of roughages should be lowered; as we know that roughages produce more heat during its digestion and metabolism. Vitamins and minerals should also be supplied in optimum quantities. Several vitamins and minerals like vitamin –A, E, C and Selenium act as antioxidant and can help the animal in stressful conditions.

Water should also be supplied in adequate quantity. Cold water can also be provided to the animal but it should not be chilled. Earthern pots can be used for storage of water and it makes the water cold by natural processes.
The third step we can take is to select the animal which is more resistant to heat stress. It has been noticed that indigenous cattle breeds have more capacity to tolerate the heat. Their body is easily adapted to this type of conditions and the effect of heat stress on the production is also very low. On the other hand, exotic animals are easily affected by the stress and their production is greatly hampered. So, the use of indigenous breeds or crossbred animals should be encouraged.

6. PREVENTION OF CLIMATE CHANGE

The most important thing we can do to solve the problem is to prevent climate change. It is well known and established fact that the major reason behind the change in the climatic conditions globally is nothing but the anthropogenic activities. In the way towards modernization and civilization the human have contributed largely towards environmental pollution. So we should reduce the exposure of the pollutants to the environment in the best possible ways. Especially we should focus on reducing the emission of greenhouse gases from vehicles, industries and other places. The substances released into nature should be checked and it should be assured that it does not cause any pollution or change to the ecosystem and environment. On the other hand, we should plant trees at a large-scale scale if we want to fight the battle against climate change. Several reports published by several organizations shows that the number of trees per head is very less in India compared to other countries and it is also decreasing at a very rapid rate. We should take steps as soon as possible to increase the number of trees and decrease the environmental pollution.

CONCLUSION

It is very much clear that climate change is going to be the major problem in the future unless and until we take some steps. Already it has started affecting the productivity of the domestic animals and has hampered lives of other animals species. As the human being is largely dependent upon the animals for several reasons they are also being affected due to these conditions. The demand for animal products is increasing day by day where the productivity is diminishing due to the altered climatic condition. It is affecting the production, reproduction and the health of the domestic animals and results in a great economic loss to the farmers or producers. We should take steps to save the animals from the detrimental effect of heat stress. Feeding management, housing management and selection of proper breed are the way to fight these conditions. And last but not least we should plant trees and reduce environmental pollution to save not only animals but also human beings from the harmful effects of climate change in the future.

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Significance of biofertilizers in flower crops

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ABSTRACT

Nutrition plays a critical role in deciding the growth, yield and quality of flowers. Although, chemical fertilizers played a major role by contributing 50-60 % increase in productivity. Their large scale, non-judicious use created problems of soil deterioration, ground water contamination and air pollution. So, there is a need to supplement chemical fertilizers with alternate source of nutrients, more particularly biofertilizers. Bio-fertilizers contain microorganisms which promote the adequate supply of nutrients to the host plants and ensure their proper growth and development which is ultimately reflected in form of quality produce with higher yields.

The scope of utility and importance of flowers have been realized throughout the World and in this modern age, floriculture has developed into a profitable business in the recent years for domestic and foreign market (Vithu *et. al*., 2018). The steady demand for traditional flowers comes from the use for religious purposes, decoration of homes and for making garlands and wreaths. Hotels and guest houses are also emerging as a major market for flower industry. Seasonal demand is driven mostly by festivals and marriages for specific flowers. Due to continuous rise in demand for flowers, the total area under floriculture has increased to 249 thousand hectares with a production of around 1659 thousand tonnes loose flowers and 484 thousand tonnes cut flowers. The total export of floriculture was around Rs. 507.31 crores in 2017-18. The major importing countries are United States, Netherlands, United Kingdom, Germany and United Arab Emirates. There are more than 300 export-oriented units in India.

The traditional cultivation practices being in use from many centuries sustained Indian agriculture till today. But in today's modern agriculture, imbalanced use of chemical fertilizers is degrading environment quality. No doubt, chemical fertilizers ensures higher crop yield but their indiscriminate use is resulting in degradation of soil physio-chemical and biological properties. People all over the world are becoming aware about the harmful effects of excessive use of chemical fertilizers on environment and health. It has been estimated that about 50% of the fertilizer leaches down into the soil and has started showing its effects on human health in the form of diseases such as methemoglobinemia in children (Kumar and Kumar, 2019). Apart from this, chemical fertilizers are in short supply, derived from non-renewable sources and are costly. Consequently, it is necessary to restrict their use to certain level, by supplementing chemical fertilizers with organic sources of nutrients, more particularly biofertilizers (Gupta *et al.*, 1999).

The biofertilizers offer an economically and ecologically sound mean of reducing external inputs and improving quality and quantity of internal sources. These are less costly, environment-friendly, sustainable and long lasting, thus their repeated application is not necessary. These bio-fertilizers can play a very significant role in improving soil fertility by fixing atmospheric nitrogen, dissolving insoluble form of phosphorus in the soil. These also improve crop growth and quality of products by releasing certain growth substances, enhancing the uptake of plant nutrients by plant roots and thus help in sustainable horticultural production through maintenance of soil productivity (Choudhary and Trivedi, 2008). Although these bio-fertilizers are not alternate to inorganic fertilizers, they may be useful in increasing yield and quality of floricultural crops, when combined with organic manures and inorganic fertilizers in balanced proportion. Some of the benefits of bio-fertilizers are:

- less expensive
- eco-friendly and sustainable
- do not require non-renewable source of energy during their production
- improve growth and quality of crops by producing plant hormones
- increase the sustainability of soil and make it more productive
- also useful as bio-control agents
- improve root proliferation due to the release of growth promoting hormones
- converts complex nutrients into simple nutrients for their easy availability to plants

The biofertilizers are generally classified into three groups, which are mainly biological nitrogen fixers, phosphate solubilizing microorganisms and phosphate mobilizing microorganisms.

BIOLOGICAL NITROGEN FIXERS

Biological nitrogen fixing micro-organisms converts atmospheric nitrogen to ammonia in soil. This process involves highly specialized and intricately evolved interactions between soil micro-organisms and higher plants for harnessing the atmospheric nitrogen. This reaction is performed exclusively by using an enzyme complex termed nitrogenase. The enhanced fixation of nitrogen and release of growth substances like auxins and gibberellins resulted in more photosynthesis, production and accumulation of photosynthates, their diversion to developing vegetative and floral buds, thus attaining better size and quality of flowers. Bhatia and Gupta (2007) noted that the application of biofertilizers resulted in the greatest flower diameter (7.09 cm) and number of flowers/m^2 (180.0) and in the lowest number of days to initial flowering (112.80) in carnation (*Dianthus caryophyllus* Linn.). The nitrogen fixing organisms are given below:

Examples of nitrogen-fixing bacteria			
Free living		**Symbiotic with plants**	
Aerobic	**Anaerobic**	*Rhizobium*	*Frankia*
Azotobacter *Beijerinckia* *Klebsiella*(some) Cyanobacteria	*Clostridium* (some) *Desulfovibrio* Purple sulphur bacteria Purple non-sulphur bacteria Green sulphur bacteria		*Azospirillum*

Phosphate-Solubilizing Microorganisms (PSM)

The Phosphate Solublizing Microorganisms (PSM) includes a range of soil bacteria and fungi. The bacterial species are mainly *Pseudomonas, Micrococcus, Bacillus* while fungal species *are Flavobacterium, Penicillum, Fusarium, Aspergillus*. (Gaur *et al.,*1980). The conversion of insoluble to soluble P requires series of biochemical reactions. Phosphate solubilizing microorganisms (PSM) solubilize P either by production of organic acid or by action of Phosphatase enzyme. These PSM are also known to produce amino acids, vitamins and growth promoting substances like IAA and GA which help in better growth of plants. The response of PSM on growth attributes might be due to more and ready availability of P to plants (Venkateswarlu *et al.*, 1984). Verma *et al.* (2011) concluded that the treatment receiving Azospirillum, Phosphate Solubilising Bacteria (PSB), vermicompost and 50 % recommended NPK recorded significantly highest plant height (63.39 cm), number of branches (primary 20.08 and secondary 23.13), plant spread (33.20 cm) and dry matter accumulation (42.55 g/plant) in chrysanthemum.

Phosphate –Mobilizing Microorganisms

The arbuscular mycorrhizal (AM) fungi are the most ancient type of mycorrhizal symbiosis. It is a mutualistic symbiosis of co-existing partners, with the fungal partner being obligate survival on plant partner. Mycorrhizal fungi send out finely branched, thread like hyphae from plant roots, which act as miniature pipelines for the nutrients. These hyphae can practically, penetrate soil spaces where even the finest plant roots cannot grow. The important genera of AM fungi are *Glomus, Gigaspora, Sclerocystis, Acaulospora and endogene*. The application of phosphatic fertilizers can be reduced by 25-50 % of recommended dose. AM fungi play a very important role in soil by nutrient and water uptake (Clarkson, 1985 and Allen, 1982), root pathogen control and production of growth hormones. The pathogen control may be due to competition for actual site of interaction in and on the root, selection of favourable micro flora by changes in root exudates products, changes in physiology of host root. It provides organic link between root and the bulk of soil (Rao, 1988). Karthiresan and Venkatesha (2002) reported in gladiolus that combined application of Azospirillum and VAM along with recommended dose and 25% reduced dose of NPK recorded maximum plant height (115.91 cm), increased spike length (103.71 cm) and gave early flowering (48.67 days). Godse *et al.* (2006) found that plants receiving vermicompost 8 t/ha + Azotobacter and PSB @ 25 kg/ha each + 80 % RDF significantly increased plant height, spike length, number of corms per plant, weight of corms per plant when compared with RDF and other treatments.

Plant Growth Promoting Rhizobacteria (PGPR): The group of bacteria that colonize roots or rhizosphere soil and beneficial to crops are referred to as plant growth promoting rhizobacteria (PGPR). The PGPR inoculants promote growth through suppression of plant disease (termed Bioprotectants), improved nutrient acquisition (termed Biofertilizers), or phytohormone production (termed Biostimulants). Species of Pseudomonas and Bacillus can produce as yet not well characterized phytohormones or growth regulators that cause crops to have greater amounts of fine roots which have the effect of increasing the absorptive surface of plant roots for uptake of water and nutrients. These PGPR are referred to as Biostimulants and the phytohormones they produce include indole-acetic acid, cytokinins, gibberellins and inhibitors of ethylene production.

METHOD OF APPLICATION

The mode of application of biofertilizers in the soil and seed treatment is also important for better effects on the crop. The biofertilizers may be applied by the following methods:

a. **Seed/bulb treatment**: The biofertilizers inoculum is mixed in certain carrier base like charcoal powder. After coating the seeds/bulbs, they are dried under shade and sown directly.

b. **Drilling**: The inoculum may be mixed into granular forms by adding to farmyard manure. These granules may be mixed with seeds and drilled along with seeds during sowing.
c. **Broadcasting**: The granular form of the inoculum can be broadcasted in crops which have narrow inter-plant/row spaces or where interculture is not possible due to excessive moisture.
d. **Top dressing**: Top dressing of granular biofertilizers is also carried out in some parts of the country. The chemical fertilizers could be applied at half the recommended doses. Chemical fertilizers and biofertilizers should not be applied together as the organisms in biofertilizers are killed due to plasmolysis. Rhizobial culture could be applied near the zone where root develop and chemical fertilizers can be applied 15-20 days later at 10-15 cm depth.

Precautions to be taken at the time of application

- No other fertilizers or insecticides/ fungicides should be mixed with seeds that are treated with biofertilizer.
- Seed treatment, if required, should be done at least 24 hours before mixing the seeds with bio-fertilizer.
- Bio-fertilizer should not be used with any other fertilizers or insecticides.
- Use of organic manures is essential to get the good results of bio-fertilizer.
- Packet of bio-fertilizers should not be kept in damp place and in bright sun.
- Bio-fertilizer should be used before expiry date (Das, 2009).

LIMITATIONS

No doubt, effect of biofertilizers are beneficial and significant, these have not become popular due to few limitations like non-availability of suitable carrier, lack of quality standards, lack of awareness in farmers about benefit of biofertilizers, seasonal and fluctuating demands, soil problems like acidity or alkalinity and presence of toxic elements. So for the best desired response of biofertilizers one should select the biofertilizers strain suitable to particular climate, soil and crop, in proper combination, at proper time by recommended method in optimum dose, and following other crop management practices.

FUTURE STRATEGIES

In order to popularize the use of biofertilizer, there is need to develop strains suited to different agro-climatic conditions, easy availability of good carrier, identification of areas which require inoculation on priority basis, development of suitable production technologies, strengthening marketing, distribution channels, extension and training activities. Proper storage facilities should be provided at production unit, sale points and during transportation to maintain required level of viable cells. There is need to create awareness among the extension workers, dealers and farmers about the importance and use of biofertilizers through conducting training programmes, field demonstrations and audio-visual aids.

CONCLUSION

The application of bio-fertilizers will play an important role in improving the supply of nutrients, organic carbon, accumulation of soil enzymes, future productivity, directly reflects on soil fertility index, economy of farmers; maintain sustainability in natural soil ecosystem and availability of flowers in the coming years. Research exertions are required for exploring new and better horticultural effectiveness of bio-fertilizers in flowers crops.

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New flowers for protected cultivation

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Today floriculture is one of the important sectors all over the globe including India. The Indian Floriculture is a modem floriculture developed from its nascent stages and it has been associated with culture, tradition and also heritage since ancient time. The recent trend in exports have shown tremendous potential and also paved way for starting new arena in Horticulture industry. There is lot of demand for different floricultural products in the export market. Floriculture is a discipline of horticulture concerned with the cultivation of flowering and ornamental plants for gardens and for floristry, comprising the floral industry. It also includes bedding plants, flowering plants, foliage plants or houseplants, cut cultivated greens and cut flowers. In the world the flower export is growing at around 8-10 % per annum.

In the increasingly competitive international cut flower as well as pot plant market, the novel ornamental plants plays an important role in stabilization and expanding market share. Always novelty has been considered as an important attribute in ornamental industry. The consumer choice is also changing for product quality level depending upon purpose of purchase, as well as for higher levels of services and a wider and deeper assessment. Although traditional ornamental crops will continue to play key role in the floriculture trade, a distinct trend towards increasing the share of new crops is clearly evident in recent years. These new products normally fetch high prices than the traditional crops for a certain period, but quite often the prices drop when market is saturated. By that time again the new products should be ready to enter the market. In this context introduction of new ornamental crops is therefore continuous effort in the floriculture industry.

- ✓ There are certain factors which determines the importance of new ornamental crops viz.,
- ✓ Local markets are saturated with all traditional flowers therefore expansion is possible for many new crops.

- ✓ The limiting factor in agricultural production is water and floriculture has high return per cubic water.
- ✓ India has a suitable climate for various flower production all over the country round the year and also
- ✓ The consumers choice The introduction and adaptation of new exportable flower crops normally includes the following stages
- ✓ Searching for optimal crops.
- ✓ Selection and improvement.
- ✓ Developing propagation methods.
- ✓ Studying the growth and flowering, physiology and developing practical means for their control.
- ✓ Evaluation of horticultural practices.
- ✓ Studying post harvest physiology and developing practical methods for post harvest handling, transport and storage.
- ✓ Semi - Commercial export shipments to markets abroad.

In recent past, several growers have introduced new flowers like Heliconia, Alpinia, Protea, Anemone, Zantedeschia, Gypsophyla, Wax flower, Statice, Golden rod, etc. There is still great potential to introduce and also exploit new indigenous as well as exotic ornamental plants. Since diversification is viewed as an important factor to survive in the world floriculture trade in the new millennium. These were introduced into Israel from Australia and South Africa and all these crops are being grown successfully on commercial scale and exported to European countries. This success story of Israel inspired to our growers. Some of these potential exotic ornamental plants are discussed below

HELICONIA: (*Heliconia psittacorum;* CN: Parrot's Beak; Family: Heliconiaceae)

Natives of tropical America and distributed from Mexico to Brazil, Peru and the West Indies. Heliconias are sometimes placed under the family Musaceae or Strelitziaceae. Long stalked stems produced from the ground reach a height of 3 to 10 feet. The flower stalks are 6 to 12 inches long with 3 to 6 bracts. The bracts are green, yellow, or red, or are frequently variegated with these colors. The flowers are orange, yellow, or white with green tip, about ¾ inches long.

The flower, which is a derivative of banana plant offer something new for the floriculture industry due to its striking colour and inflorescence. Major Heliconia producing nations include Barbados, Hawaii, Brazil and Venezuela also they are also cultivated in Netherlands and Germany. This crop can be cultivated by using either seeds or rhizomes. Seeds require 1 to 12 months for sprouting while rhizomes 4 to 8 weeks.

India has an annual production of about 1 lakhs stems which accounts for less than 1% of the total floral production capacity in the country. About 50% of the production comes from coconut farm located in the west Godavari district in Andhra Pradesh. The flower is well adapted to all major agro - climatic zones in

the country and can be cultivated even at a height of 3,000 to 4,000 feet. This is also considered ideal for cultivation in tropics and suitable for botanical conservatory. ALPINIA (Alpinia speciosa) commonly called as light galangal, pink porcelain-lily, shell flower, red ginger

Herb robust, rhizomatous, clump-forming perennial grow up to 4 m high; leaves broad, lanceolate, sheathing the stems; inflorescence drooping, showy, fragrant. Leaves: Bright green, glabrous and shining, up to 600 mm long and 200 mm wide. Flowers: In racemes up to 400 mm long, main axis very hairy; white, waxy, pink-tinged bracteoles enfold the buds; flowers orchid-like; corolla white, lip to 40 mm, crinkled, yellow, with red and brown variegations.

Fruits: Red capsules".

Habitat: It grows in watercourses, forest margins, roadsides, urban open space in moist, warm, coastal and inland regions.

Propagation: Vegetatively propagating or possibly bird dispersed seed. Aquatic dispersal is also apparently occurring along streams.

PROTEA

Proteas are a variable group. Indeed, the family was named after Proteus, a Greek god capable of changing his shape at will. It includes 60 genera and 1400 species of Southern Hemisphere plants, the bulk of which are native to southern Africa and Australia with the remainder coming from South America and many of the Pacific islands, including two species from New Zealand.

There is an enormous variety of foliage among the Proteas. It is almost always evergreen, but may be needle-like, as with many grevilleas; long, narrow and serrated like that of Dryandra formosa; or rounded and leathery like the leaves of Protea cynaroides. Some genera, particularly Leucadendron, include species with brightly coloured foliage, the intensity of which varies with the season. Leucadendron stems retain their colour for weeks when cut and are an important part of the cut flower industry. Protea flowers are composed of clusters of narrow tubes that are often curved. These 'spider' flowers are seen at their simplest in the two native species and some of the grevilleas. The flowering season also varies; many proteas and grevilleas flower in winter, while leucospermums tend to flower in summer.

Cut flower use

- ✓ Many proteaceous plants make excellent long-lasting cut flowers.
- ✓ Leucadendrons in particular are widely used as material for floral decorations.
- ✓ Protea, Leucospermum, Banksia and Serruria flowers can all be used to make impressive large arrangements
- ✓ Some flowers, particularly goblet-shaped Protea flowers dry well although they do tend to disintegrate rather suddenly after a few months.

- ✓ Other genera such as Banksia and Leucadendron produce seed heads or cones that can be used in dried arrangements.

Propagation: Proteas can be frustratingly difficult plants to propagate. Fresh seed often germinates well only for the seedlings to collapse after a few weeks. Cultivars and selected forms must be propagated vegetatively.

Cultivation: Good drainage is absolutely essential. Rich loams and heavy clays do not make good protea soils. Natural leaf mould and rotted pine needles work well. To avoid these materials compacting down into a poor draining thatch, incorporate about 50% fine shingle grit by volume and combine the mix with the existing soil.

Planting: Autumn or winter is best in mild areas as this is when moisture requirements are at their lowest, while spring is the preferred time if regular frosts are expected as this allows the young plants to get well established before having to endure winter conditions. Additional drainage material can be added to the hole if necessary, otherwise planting is just a matter of removing the plant from its container, loosening any spiralling roots before placing in the hole, then refilling the hole and firming the plant into position. Large specimens will require staking to prevent wind damage.

Pruning: Most proteaceous plants need occasional trimming and tidying. This may be to improve their growth habit or to remove old flowers or seed heads that have become dry and unsightly.

Pests and Diseases: Grown under the right conditions proteaceous plants are relatively free of pests and diseases, or rather they're not attacked by anything out of the ordinary. The most widespread problems are leaf roller caterpillars and scale insects, which can eventually lead to sooty mould.

GYPSOPHILA (Gypsophila elegance)

It is also called as Showy Baby's-breath, is a short lived annual native to Southern Ukraine, Eastern Turkey and Northern Iran. The plant has blue-green linear-lanceolate leaves up to 3 inches (7.6 cm) long. Plants will reach up to 18 inches (45 cm) tall. We use this plant in our "Plant Care and Cultivation" class at OU to show how short lived some plants are. The plant has a life span of 5-6 weeks. Florists use the flowers as filler in bouquets and it is used in the landscape as a rock garden plant. For a long blooming season, one must plant seeds every 3-4 weeks for continuous bloom.

Blooming: In the greenhouse, the plants bloom in about 4 weeks from seed, making this an ideal plant for children to grow and watch in classroom or garden. The profuse single white flowers are up to 1/2 inch (~10 mm) across. They are very showy.

Propagation: Gypsophila elegans is best propagated from seed.

Culture: Gypsophila elegans need full sun to light shade, preferring a slightly acid soil mix. In the greenhouse, we use a soil mix consisting of 2 parts peat moss to 1 part loam to 1 part sand or perlite. To this mix, we add 1 cup of hydrated lime to

adjust pH. We also add 1 cup 14-1414 Osmocote slow release fertilizer to every 0.01 cu yards of soil mix. The plants are well watered and allowed to dry slightly before watering again. While the plants are actively growing, we supplement the fertilizer with a balanced fertilizer diluted to 1/2 the strength recommended on the label on a weekly basis. Once plants set bloom, we do not fertilize again. Since the plants only last 5-6 weeks, after seed set we allow the plants to die off. By this time the next planting should be coming into bloom.

STATICE (Limonium)

Limonium is also known as Sea Lavender, Statice, or Marsh-rosemary. Limonium is in Plumbaginaceae, the plumbago or leadwort family. Despite their common names, species are not related to the lavenders or to rosemary. The genus has a distribution in Europe, Asia, Africa, Australia and North America. Sea-lavenders normally grow as herbaceous perennial plants, growing 10-70 cm tall from a rhizome; a few are woody shrubs up to 2 m tall. Many species flourish in saline soils, and are therefore common near coasts and in salt marshes, and also on saline, gypsum and alkaline soils in continental interiors.

Several species are popular garden flowers; they are generally known to gardeners as statices. They are grown both for their flowers, and for the appearance of the calyx, which remains on the plant after the true flowers have fallen, and are known as "everlasting flowers"

Cultivation: Even though these plants are natives of salt marshes, they will flourish in any good garden soil. Those grown in the greenhouse, they may be planted in 5-inch pots filled with two parts of loam and one part of leaf mold, with a bit of sand and well decomposed organic manure added. The best way to water is by waiting until the soil is fairly dry before wetting. Good drainage is a must. They need shading only from the harshest rays of the sun. They should be given a cool spot with good ventilation and when beginning to bloom, occasional doses of weak liquid fertilizer. In mild climates, tender shrubby kinds can be grown outside in light, well drained soil in a sunny position.

SOLIDAGO The goldenrod is a yellow flowering plant in the Family Asteraceae. About 100 perennial species make up the genus Solidago, most being found in the meadows and pastures, along roads, ditches and waste areas in North America. There are a handful of species from each of Mexico, South America, and Eurasia. Some American species have also been introduced into Europe some 250 years ago. Solidago canadensis was introduced as a garden plant in Central Europe, and is now common in the wild. In Germany, it is considered an invasive species that displaces native vegetation from its natural habitat. Goldenrod is a companion plant, playing host to some beneficial insects, and repelling some pests.

Many species are difficult to distinguish. Probably due to their bright, golden yellow flower heads blooming in late summer, the goldenrod is often unfairly blamed for causing hay fever in humans. The pollen causing these allergy

problems is mainly produced by Ragweed (Ambrosia sp.), blooming at the same time as the goldenrod, but is wind-pollinated. Goldenrod pollen is too heavy and sticky to be blown far from the flowers, and is thus mainly pollinated by insects. Frequent handling of goldenrod and other flowers, however, can cause allergic reactions, leading some florists to change occupation.

Goldenrods are easily recognized by their golden inflorescence with hundreds of small capitula, but some are spike-like and other has auxiliary racemes. They have slender stems, usually hairless but S. canadensis shows hairs on the upper stem. They can grow to a length between 60 cm and 1.5 m. Their alternate leaves are linear to lanceolate. Their margins are usually finely to sharply serrate.

Propagation: By wind-disseminated seed or by underground rhizomes. They form patches that are actually vegetative clones of a single plant. Goldenrods are mostly short-day plants and bloom in late summer and early fall and some species produce abundant nectar when moisture is plentiful before bloom, and the bloom period is relatively warm and sunny.

ZANTEDESCHIA (*Zantedeschia aethiopica*)

It is a rhizomatous herbaceous perennial plant, evergreen where rainfall and temperatures are adequate, deciduous where there is a dry season. It grows to 0.6-1 m (2-3 ft) tall, with large clumps of broad, arrow shaped dark green leaves up to 45 cm (18 in) long. The Inflorescences are large, produced in spring, summer and autumn, with a pure white spathe up to 25 cm (10 in) and a yellow spadix up to 90 mm (3½ in) long. Zantedeschia is highly toxic and may be fatal if eaten. Ingestion may cause a severe burning sensation and swelling of lips, tongue, and throat; stomach pain and diarrhea is possible.

Soil preparation: It likes a dry soil with a high content of oxygen. If the soil is too closed or too wet, we will absolutely find problems later on.

Flower period: Day length and temperature induct Zantedeschia aethiopica's flower production. It is not inducted by light intensity.

pH: Zantedeschia aethiopica is very tolerant and grows well in soils with a pH range between 5 and 8.

Fertilization: Before planting enrich the soil with old manure. Zantedeschia aethiopica is a plant that grows fast. Therefore it needs sufficient fertilization. It is impossible to give an advice that counts worldwide, so always look at the local circumstances. Use this advise as a guide that gives you some information about the basic needs.

Irrigation: Zantedeschia eathiopica needs a lot of water. The normal plant height of Red Desire is between 80 to 100 cm while Green Desire is around 100 to 120 cm. If the plants are lower and they are shaded well, then the cause of the lack of length is water. Of course the need of water depends from various factors like evaporation, heavy soil or light soil, temperature and capillary of the soil, etc. etc., so again a worldwide advice is difficult to give.

ANEMONE

Anemone is a Greek word 'anemos', which means wind flower. The genus Anemone consists of 120 species of perennial flowering plants, which grow from tubers. Anemones grow wild in many European countries, in North America and Japan. Anemones are closely related to Pasque flower (Pulsatilla) and Hepatica (Hepatica); some botanists include both of these genera within the genus Anemone. The name Anemone comes from Greek and roughly means a wind flower which signifies that the wind that blows the petal open will also, eventually, blow the dead petals away. The Anemone plants are perennial herbs with an underground rootstock and radical, more or less deeply cut leaves.

- ✓ The elongated flower stem bears one or several, white, red, blue or rarely yellow flowers. There are involucres of three leaflets below each flower.
- ✓ The fruits often bear long hairy styles, which aid their distribution by the wind. They produce cup-shaped yellowish, white, purple, violet, or red Anemone flowers.
- ✓ Among the most popular is the autumn-flowering Japanese Anemone (Anemone hupehensis).
- ✓ Yellow wood anemone (Anemone ranunculoides), also known as the Buttercup Anemone, is a similar plant with slightly smaller flowers of rich yellow coloring.
- ✓ In medicine, Anemone is used as a treatment for cramps, menstrual problems and emotional distress.
- ✓ The plant Anemone nemorosa is poisonous to humans, but has been used as a medicine.

Cultivars: Broadly, there are three types of Anemone flowers-

- ✓ Spring flowering type, which has either rhizomes or tubers.
- ✓ Tuberous Mediterranean, which flowers in spring and summer.
- ✓ Larger Fall flowering type, which blooms in late summer to fall and tends to have fibrous roots.

Growing:

Different Anemones have different growing requirements. Most Anemones should be planted in the fall. If the planted Anemone is tuberous, separate the tubers in summer, when the plant is dormant. If rhizomatous, separate the rhizomes in spring. If the Anemone has fibrous roots, divide the plant in early spring or autumn but keep the plant in the pot for a year until established.

- ✓ Windflowers should be grown in very well-drained, moderately fertile soil in a lightly shaded or sunny location.
- ✓ Plant the tubers in the fall or spring, unless you live north of their adapted zones; in this case, plant in the spring.
- ✓ Before planting, soak the tubers for a few hours or overnight; if you soak them overnight, you will be able to see the slightly swollen areas

from which shoots will grow. Plant the tubers 3 to 4 inches deep and 4 to 6 inches apart.

- ✓ If not sure which end is up, lay them on their sides.

Plant Care

- ✓ Follow a regular watering schedule during the first growing season to establish a deep, extensive root system.
- ✓ For a neat appearance, remove old foliage before new leaves emerge.
- ✓ Divide clumps every 2 to 3 years in early spring.
- ✓ Cut right back to the ground in late autumn. They will shoot away again in spring.

WAX FLOWER (*Geraldton wax*)

Geraldton wax flower (*Ciunnaelaucium uncinatum* Schauer, Myrtaceae) is a native shrub in Western Australia. It was introduced to Southern California and grown outdoors as a minor cut flower. Most of the initial physiological and horticultural research was carried out in Israel, a fact that facilitated the rapid development of the plant as an important commercial crop. More recently important research is also conducted in its native country, Australia. In Israel this plant is currently a major commercial ornamental crop, grown in 300 ha. It is used mainly for cut flower production, but also for cut shoots with flowers buds, cut foliage and flowering pot plants. Israel became the main exporter of wax flowers to Europe in the winter. The Wax flower is a perennial shrub reaching 2-3 meters in height. It has small narrow needle - shaped leaves 10-40 mm long, colours ranging from light to dark green. It has small 5 petalled flowers, which range in size from 10 - 25 mm in diameter, on flower branches reaching from 40 to 100 cm. Flower branches can produce 50 - 500 flowers buds and flower colours range from white, pink, purple to variegated. The Wax flower from autumn through winter to spring.

The crop can grow in most soils but prefers acid and well-drained soils with the optimum pH being 6 - 6.5. It prefers dry conditions and has low water and fertilizer requirements. It can grow in the optimum temperature range of 15 - 35°C but can tolerate lower temperatures. They can't withstand heavy frost. Flower induction requires short days; therefore buds start appearing in autumn. Low night temperature also influence induction and bud formation. Flowers start opening in late autumn and have a good shelf life, branches with unopened flower buds can also be marketed. Wax flower can be planted most of the year except in winter. The best planting seasons are spring and autumn. Recommended planting density is 300 - 700 plants per 1000 m2.

The above said flowers can be very well grown in the protected structures to meet the export market.

Integrated Nutrient Management (INM): Concept and Goals

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INTRODUCTION

The challenge for agriculture over the coming decades will be to meet the world's increasing demand for food in a sustainable way. Declining soil fertility and mismanagement of plant nutrients have made this task more difficult. The call for an Integrated Nutrient Management approaches to plant nutrients for maintaining and enhancing soil, where both natural and manmade sources of plant nutrients are used is the need of the present days.

Because agriculture is a soil-based industry that extracts nutrients from the soil, effective and efficient approaches to slowing that removal and returning nutrients to the soil will be required in order to maintain and increase crop productivity and sustain agriculture for the long term. The overall strategy for increasing crop yields and sustaining them at a high level must include an integrated approach to the management of soil Nutrients, along with other complementary measures. An integrated approach recognizes that soils are the storehouse of most of the plant nutrients essential for plant growth and that the way in which nutrients are managed will have a major impact on plant growth, soil fertility, and agricultural sustainability. Farmers, researchers, institutions, and government all have an important role to play in sustaining agricultural productivity.

What is INM…? (Integrated nutrient management)

Integrated Nutrient Management refers to the maintenance of soil fertility and plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner.

The basic concept of integrated nutrient management (INM) or integrated plant nutrition management (IPNM) is the adjustment of plant nutrient supply to an optimum level for sustaining the desired crop productivity. It involves proper combination of chemical fertilizers, organic manure, crop residues, N_2-fixing crops (like pulses such as rice bean, Black gram, other pulses and oilseeds such as

soybean) and bio fertilizers suitable to the system of land use and ecological, social and economic conditions. The cropping system rather than an individual crop, and farming system rather than an individual field, is the focus of attention in this approach for development INM practices for various categories.

To understand about INM there is a need to understand about plant nutrients and soil fertility, as INM aims at maintaining the nutrient balance through the integration of both organic and inorganic sources of nutrients.

GOALS OF INM

- To ensure productive and sustainable agriculture.
- To reduce expenditure on costs of purchased inputs by using farm manure and crop residue etc.
- To utilize the potential benefits of green manures, leguminous crops and biofertilizers. To prevent degradation of the environment.
- To meet the social and economic aspirations of the farmers without harming the natural resource base of the agricultural production.

CONCEPTS OF INM

INM use five major sub-concepts, viz:

- Plant nutrients stored in the soil.
- Plant nutrients, those present in the crop residues, organic manure and domestic wastes.
- Plant nutrients purchased or obtained from outside the farm.
- Plant nutrient looses e.g. those removed from the field in crop harvest and lost from the soil through volatilization (ammonia and nitrogen oxide gases and leaching (nitrate, sulphate etc.).
- Plant nutrient outputs e.g. nutrient uptake by the crops at harvest time.

NEED OF INM

- Soils which receive plant nutrients only through chemical fertilizers are showing declining productivity despite being supplied with sufficient nutrients.
- The decline in productivity can be attributed to the appearance of deficiency in Secondary and micronutrients.
- The physical condition of the soil is deteriorated as a result of long-term use of chemical fertilizers, especially the nitrogenous ones.
- The recent energy crisis, high fertilizer cost and low purchasing power of the farming community have made it necessary to rethink alternatives.
- The available quantity of animal excreta and crop residues cannot meet the country's requirements for crop production. Therefore, maximizing the usage of organic waste and combining it with chemical fertilizers and bio-fertilizers in the form of integrated manure appears to be the best alternative.

CONCLUSIONS

By following INM soil physical, chemical and biological properties improved. INM provides balanced nutrition to crops and minimizes the antagonistic effects resulting from hidden deficiencies and nutrient imbalance.

Hydroponic: A Soil Less Culture used in Vegetable Crops

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INTRODUCTION

Hydroponics is a subset of hydroculture, which is the growing of plants in a soil less medium, or an aquatic based environment. Hydroponic growing uses mineral nutrient solutions to feed the plants in water, without soil. For those of us who love growing plants these are exciting times indeed. We are no longer limited by climate or by season in the pursuit of our harmless pleasures. We can now grow virtually any plant at virtually any time of the year – the only limitation is our imagination. The simple, effective hydroponic systems now available, coupled with modern horticultural lighting, have transformed our hobby and freed us to grow our favorite plants where and when we choose.

Different Types of Hydroponic systems

When you think of hydroponics, you instantly imagine plants grown with their roots suspended directly into water with no growing medium. However this is just one type of hydroponic gardening known as N.F.T. (nutrient film technique). There are several variations of N.F.T. used around the world and it is a very popular method of growing hydroponically. What most people don't realise is that there are countless methods and variations of hydroponic gardening.

Wicks System

Seen as the most simplistic hydroponic system. The Wick system is described as a passive system, by which we mean there are no moving parts. From the bottom reservoir, your specific Growth Technology nutrient solution is drawn up through a number of wicks into the growing medium. This system can use a variety of mediums, perlite, soil or coco.

Water Culture

This system is an active system with moving parts. As active hydroponic systems go, water culture is the simplest. The roots of the plant are totally immersed in the water which contains the specific Growth Technology nutrient solutions. An air pump with help oxygenate the water and allow the roots to breathe.

Ebb and Flow System (Flood and Drain)

This hydroponic system works by temporarily flooding the grow tray. The nutrient solution from a reservoir surrounds the roots before draining back. This action is usually automated with a water pump on a timer.

Drip System (recovery or non-recovery)

Dip systems are a widely used hydroponic method. A timer will control a water pump, which pumps water and the Growth Technology nutrient solutions through a network of elevated water jets. A recovery system will collect excess nutrient solution back into the reservoir. A non-recovery drip system will avoid this allowing the pH of the reservoir not to vary. If using a recovery system, be sure to check the pH level of the reservoir regularly and adjust using either pH up or pH down solutions on a more frequent basis.

N.F.T System

The N.F.T system is at the forefront of people's minds when hydroponics is mentioned. Nutrient Film Technique uses a constant flow of your Growth Technology nutrient solution (therefore no timer is required). The solution is pumped from a reservoir into the growing tray. The growing tray requires no growing medium. The roots draw up the nutrients from the flowing solution. The downward flow pours back into the reservoir to be recycled again. Pump and electric maintenance is essential to avoid system failures, where roots can dry out rapidly when the flow stops.

Aeroponic System

Aeroponic systems are seen to be a high tech method of hydroponic growing. Like the N.F.T system the growing medium is primarily air. The roots hang in the air and are misted with nutrient solution. The misting of roots is usually done every few minutes. 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 aeroponic system needs a short cycle timer that runs the pump for a few seconds every couple of minutes.

RECENTLY INTRODUCED TECHNIQUES IN HYDROPONIC

Lighting

At the heart of any indoor garden is the lighting system. Over the last 10 years, advancements in horticultural lighting have been astounding:

- High intensity discharge (HID) lighting systems have seen some tremendous advancements and will continue to improve in terms of efficiency.
- Double-ended lighting systems will continue to grow in popularity over the next few years, as they offer multiple advantages over standard HID lighting systems, including increased efficiency and longevity.
- With its unique spectral output, sulfur plasma lighting is poised to become more common as a primary lighting source for indoor gardens in the years to come, as improvements to manufacturing techniques help lower the price of these systems.

Nutrients

Hydroponic nutrients are continually undergoing advancements. We are already starting to see specialty nutrients that "self-buffer" to the desired pH range. I believe we will continue to see an increase in these self-buffering nutrients, along with other time-release, fully soluble nutrients capable of maintaining more consistent ppm and pH levels. Nutrient manufacturers are getting better at combining various elements into stable, one-part formulas. I predict the number of complete, one-part nutrient formulas will increase, particularly as we see more novice gardeners trying hydroponics.

Micro Growing

Similar to the hydroponic appliances for kitchens, automated hydroponic systems aimed at growing microgreens, such as sprouts, will become more popular. The systems designed for producing microgreens and grasses won't stop in our kitchens, though—an increasing number of farmers are using hydroponic systems to grow fodder for their livestock. Hydroponic systems used for growing fodder are not only cost effective, but they also provide a superior food source for livestock.

Sustainable Systems

Aquaponics—the combination of aquaculture (fish farming) and hydroponic gardening—is a sustainable approach to food production because these systems use fish waste to feed plants and plants to filter the water for the fish in a perfect, natural circle. As we continue to deplete our resources, growing crops sustainably is going to become even more important and aquaponic systems are a great way to efficiently produce food on both a small and large scale. Chickens, rabbits, worms, crickets and other animals are also being integrated into sustainable hydroponic gardens. As more people experiment with different strategies, more of these unique biological hydroponic systems will be developed.

APPLICATIONS

Some of the latest trends in hydroponic growing are not directly related to advancements to the systems themselves, but to the application of these systems. Restaurants and grocery stores are starting to incorporate hydroponic systems into their business models as a way to provide the freshest produce possible. Living salad bars allow businesses to provide fresh produce and set themselves apart from

their competitors. The farm-to-table movement has many restaurants interested in setting up their own hydroponic farms to provide customers with fresh food on-site. Not only is this a great novelty to sell to customers, but it also makes good financial sense. Another growing trend in hydroponics is the rooftop gardening movement. I believe we will see more rooftop or vertical, wall-mounted hydroponic systems being incorporated into the specs of new buildings to increase urban food production.

CONCLUSION

People are starting to realize our health is directly related to our diet. This, in turn, creates the demand for more fresh produce from our markets and restaurants. Hydroponic gardening is a practical solution for providing fresh food in dense urban areas. Whether it be on the rooftop or the outside wall of a building, we are sure to see lots of hydro gardens popping up in cities over the next few years. An increasing number of commercial farmers are unlocking the potential hydroponics offers as well. Over the next 10 years, we will see more commercial hydroponic farms established to meet the increasing demand for local, fresh produce.

More people are taking their health and food production into their own hands by setting up some sort of home garden. For many, the only option is a hydroponic system that can produce food in a small space. Home hydroponic systems, especially those that fit on a countertop or in a kitchen window, will eventually become commonplace. With all the benefits hydroponics offers, especially in urban areas, there is no doubt hydroponic gardening will be a major part of our society's food production in the future.

Dairy farmer issues in India

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INTRODUCTION

Indian Livestock sector is one of the largest in the world, comprising of 11.6 per cent of total livestock population of the world. India has highest buffalo population and second highest cattle population in whole world. It provides employment to nearly 8.8 per cent of Indian population (GoI, 2009).. Total milk production in the country was recorded as 165.4 million tonnes and the per capita availability of milk was around 355 grams per day during 2016-17 (Anonymous , 2017). In India, the co-operatives and private dairies have access to only 20% of the milk produced. Approximately, 34% of the milk is sold in the unorganized market while 46% is consumed locally. There are significant regional variations in the structure of dairying in the country. There are different issues faced by dairy industry in India, some are area specific while some are common. There are some of the important issues concerning the productivity and marketing of dairy products which greatly affects Indian farmers are discussed in details as follow:

1. Shortage of feed/fodder:

For any kind of livestock rearing the most essential requirement is high quality feed. A dedicated amount of feed and fodder is needed for cattle to survive and to produce milk. Thus, providing the right quantity of feed is a matter of concern for every cattle owner. Unfortunately India is facing an acute shortage of feed and fodder and its negative influence on the dairy economy is clearly visible. In India, Shortage of green fodder (35.6%), dry fodder (10.95%) and feed concentrate (49%) is the root cause of poor performance of dairy sector in general as the genetic milk production potential of cow cannot be exploited fully in absence of proper nutrition (IGFRI, 2017).

The major challenges are the fixed area under fodder production and decline in pasturelands. The landless farmers graze their animals as well as collect fodder from the common pastureland. According to an estimate, nearly 12.15 million ha of land in country is classified as permanent pasture/grazing land. Land

allocation to cultivation of green fodder crops is limited and has hardly ever exceeded 5 per cent of the gross cropped area (GoI, 2009). Hence, the supply of feed has always remained short of requirement (Ramachandra *et al.,* 2007). In order that the dairy cattle and buffaloes are kept out of competition with human beings and other monogastric livestock for foodgrains, we are to depend on forages and crop by-products for protein and energy requirements of these livestock. Forage crops at present do not find any important place in the crop rotations of the farmers, due to their small holdings and low economic importance attached to these crops. Another factor is the replacement of coarse cereal crops, one of the main sources of crop residues, by commercial crops. Moreover, the total area for fodder production is also being marginally reduced each year due to increased industrialization.

In India very few pasture lands are prepared for grazing separately. More than 84 percent of poor households gather food, fuel, fodder and fibre items from the common village pastures or grazing grounds, Gochar land, revenue common lands, common wastelands, community forests, etc. (IGFRI, 2017). In addition, Estimates also reveal that the number of livestock is far many much relative to the carrying capacity of grasslands in India. India has the huge livestock population a sizeable amount is contributed by unproductive animals. These animals compete with productive animals for feeds and fodder.. These unproductive animals consume over 90 percent of the limited feed resources as well as they are limiting the pasture land availability for high yielding animals (Mathur, 2000). Also if we consider around 50 Million milch animals in India then we need at least 50 Million MT of compound cattle feed per annum, however, we are producing only around 8-10 MMT compound cattle feed per annum.

Lack of Marketing Facilities:

Though governments have put various dairy development programmes in the country, it is a fact that all the marginal farmers are not able to get marketing facilities for milk. Dairy farmers are not getting attractive remunerative for milk from the Milk producer's Co-operative societies. Additionally the milk producing farmers are spread across geographically while the milk production centres are not linked in a circle route for procurement and transport of milk to the nearest chilling/processing centres, the cost of procurement goes resulting increased marketing price of milk and milk products. The dairy sector is largely unregulated sector, which handles the majority of the milk production, providing ample opportunity for malpractice. Some of the common forms of malpractice include false measurements in the selling of milk and adulteration of milk. (Rajendran and Samarendu Mohanty, 2004).

Middleman:

Milk production in India tends to come from millions of individual farmers who have one or two cows and produce five to 10 litres of milk each day. This.

fragmented market for milk and milk products involving a chain of middleman who reaps the actual benefit depriving the producers from their due share. By unorganized it means that the milk is collected by the milkman or vendors from the local producers and sold to house hold and mithai shops.. Increased number of middleman, lack of bargaining power by producer and lack of infrastructure for storage of milk at producer level and contribute to less amount of money received by producer per unit of milk sale

- L**ow productivity of indigenous breeds** India has some of the best dairy breeds in the world such as Sahiwal, Red Sindhi, Gir, Kankrej, Ongole, Murrah, Mehsani, Banni etc Though India has been the highest milk producing country in world since quite a time but the per animal productivity is considerably low as compared to dairy animals. Indian ivestock are half as efficient as average world mich breed and nearly one fourth as milch animals of advanced countries Over 65-70% female cattle are low productive, due to indiscriminate breeding and neglect, thereby turning dairy husbandry uneconomical. Nearly 80 percent of the cattle and 60 percent of the buffaloes are nondescript and have a very low milk yield and work output

Due to Lack of proper veterinary extension system: The prevalence of various diseases ,internal and external parasites, tick borne diseases , metabolic diseases and infectious diseases affect the production potential of the animal. Veterinary health care centres are located in far off places. Today in most of states in country the farmer has to bring his sick animal almost 8- 10 km for health or veterinary services. This takes services of at least two – three persons including the transportation costs sometimes even the veterinary doctor is not available at the entre this often discourages the livestock owner and he is reluctant to avail this service.

a shortage in the number of veterinarians in addition to poor collaborative research–academic– extension linkages, neglect in regular vaccination and deworming programmes and absence of the effective breeding strategy communication to dairy farmer are major hindrances to dairy development The livestock owners have no control over the selection of breeding sires and poor quality bulls used for semen collection and poor semen freezing facilities further affect the productivity of cattle and buffaloes. Lack of good quality semen and coverage of artificial insemination has seriously impaired attempts for genetic improvement of the national milch herd. .Socioreligious compulsions have prevented culling of unproductive animals.Over 30 percent of the adult females among cattle are not suitable for further propagation.

Labour problems, lack of manpower at specific period of time in some regions , lack of awareness among small farmers about various opportunities for enhancing the production and increasing communication gap between male extension workers and female livestock owners, ans also lack of initial means and money to associate with the technology is causing delay in adopting modern technologies. The White revolution has increased milk productivity and the processing

infrastructure but not transformed the farming system the Indian dairy industry still runs on age old infrastructure operating on obsolete technology. Lack of reliable electricity and refrigeration still exists in some rural areas

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Key role of cut foliage's in floriculture industry

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The Present day ornamental Horticulture is not merely confined for growing of few ornamental plants for pleasure or as recreation of the rich but it has become a viable commercial enterprise. Indian floriculture co the domestic can be broadly classified into two groups while the traditional floriculture caters to the domestic market with the emphasis on the production and marketing of traditional loose flowers and the contemporary floriculture deals with cut flowers, cut foliage and potted greens.

Cut-foliage industry has made a major breakthrough in floriculture business. Most foliage plants are indigenous to tropical and subtropical regions. In general, foliage plants are grown as understory plants in the canopy of giant trees. As a result, foliage plants are native to this type of environment, are tolerant to low light, sensitive to chilling temperature and are day-neutral to photoperiod. In subtropical climes, temperature as well as humidity may vary with season. Among various parameters, leaf characters assume significance for their use as cut-foliage.

Of the total turnover and supply of floricultural products during 2010 (€ 4130 million), indoor foliage plants alone contributed € 1445 million (Rs. 99.23 billion) in global floricultural trade.The most recent statistics from ISPF 2014 and 2017 revealed that china(7,497 ha) is the dominant producer of cut foliage, followed by Italy (3,082 ha) and Netherlands (2,248 ha). The UK imports treated cut foliage largely from Netherlands worth euro 8.7 m in 2016. The trend shows that India has been slowly accelerating its pace in the international trade. As for the foliage plant industry, during 2008-2009 more than 39% of the total export from India was contributed by foliage products, fresh or dry. India exports treated cut foliage to UK worth Euro 1.0 m annually.

Cut foliage or decorative green leaves refer to vegetation used mainly in bouquets, although it is also sold as separate decorative elements. The most frequently used cut foliages are

Asparagus species:

Aspargus densiflorus var.Springer is a herbaceous tender evergreen perennial which is used for its attractive, fine textured foliage. It grows up to a length of 4 feet and has true leaves that are actually leaf-like branchlets called

cladophylls. *Aspargus densiflorus var.Springer* are recommended for foliage arrangement

Asparagus setaceous is slow in growth and it could be recommended for filler and hanging arrangements. *Asparagus densiflorus*.var. Mayers is recommended as cut foliage in flower arrangement

Monstera deliciosa

It grows best between the temperatures of 20–30 °C (68–86 °F) and requires high humidity and shade. The plant can be propagated by taking cuttings of a mature plant or by air layering. Monstera are known for their large glossy striking green leaves which are broad are regularly used in arrangements by florists and exported as cut foliage

Philodendron

Philodendron is sometimes called has Saddle-Leaved philodendron. It grows a rosette thick, waxy green, broad leaves with a thickened midrib and a short bulb like petiole. It requires the light from medium to high and propagation is by air-layering.

Ferns

Ferns are found in their wild state all over the world. A few are native to the arctic regions ranging southward to the equator. The species that are most widely cultivated belong to the family Polypodiaceae. These include, among others, Boston ferns, Maidenhair fern and holly fern.

A group of importance to the commercial florist industry is of genus *Woodwardia* and the leather leaf fern *Polstichum adiantiforme.* These are marketed as cut greens throughout the world for use in wedding work and other floral decoration.

Box wood

Box woods have long enjoyed a well- deserved reputation as excellent outdoor evergreens. They have shiny deep green of their 1-inch oval leaves and for their dense branches, which respond well to pruning or shearing. Box wood grows slowly perhaps 2-4 inches a year. Box wood is propagated by stem cutting

Cordyline and Dracaenas:

Cordyline and Dracaenas are propagated by division of suckers in species producing suckers more frequently by air layering and from node or terminal cuttings of the stem. The old stems are cut into bits, each containing one node or joint and then placed horizontally in moist sand in seed pans with the bud pointing upwards. The sand is kept just moist and the cuttings soon develop roots and start growing. Terminal cuttings also roots, but the plants are not as good as those from node cuttings.

Some of the important species of cordyline and dracaena are listed below *Cordyline australis, Cordyline australis aureo-striata , Cordyline terminalis,Dracaena deremensis, Dracaena fragrans*

Rhapis palm

A clustered stem palm from southern china, family *Palmae. I*t is much desired as a tub specimen for outdoor patios in warm countries and interior plantings everywhere. It is a very durable palm,is slow –growing and produces a dense clump. It will tolerate lower temperatures than many other palms.

Rhapis excelsa which has leaf segments $1^{1/8}$ inches and grows to 12 to 15 feet high and trunks of two inches in diameter. Propagated by division of clumps

Conclusion

Cut foliages continue to play an important role in the floriculture industry. Among various cut foliages *Draceana reflexa*, *Phyllodendron xanadu, Nephrolepis exalta, Aspargus densiflorus var.Springer*, *Asparagus setaceous*, *Asparagus densiflorus*.var. Mayers, Box wood and Ferns are commercially recommended as cut foliage.

Rapid multiplication of tuber crops

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ELEPHANT FOOT YAM

Elephant foot yam (*Amorphophalluspaeonaiifoius*), an underground stem tuber, is one of the most popular tuber crops, extensively used as a favourite vegetable by millions of people in India, Gulf and South East Asian countries.

Propagation:

Amorphophallus is usually propagated by offsets of corms. The offsets are miniature tubers which grow out of the parent corm and are called daughter corms. In some types the daughter corms are not produced in which the mother corm is cut vertically into pieces of 750 – 1000 g weight in such a way that each piece has a portion of central bud from where the future bud initiates after planting. Whole corms of 500 g size can also be used as a planting material.

Use of cormels and minisett transplants of 100 g size as planting material at a closer spacing of 45 x 30 cm is also suggested. There are also projections with tender buds called “Arumbu”. These are removed before planting as they do not give vigorous growth.

Minisett production:



Multiplication ratio is extremely poor in this crop and hence in order to enhance the multiplication ratio, minisetts of 100 g size was found to be the optimum. By this technique the multiplication ratio was enhanced to 1:15 from the traditional 1:3.While making minisetts enough care should be taken to see that a portion comprising of buds from the central ring of Amorphophallus is retained in

each minisetts. On and average, about 15 minisetts could be made from a corm weighing 1.5 kg, which may be treated with Trichoderma mixed in cowdung slurry. They are then spread under shade cover for one day, prior to planting in the main field. This treatment would protect the crop against attack from *Schlerotiumrolsfi*, a soil borne fungus which causes collar rot. Such minisetts could be planted in a closer spacing of 60 x 45 cm. Minisetts may be planted straight in to the main field, after ensuring sufficient moisture presence in the soil. A small layer of soil is packed over the minisetts which are further covered with sufficient quantity of dry or green mulch.

A total of 37,000 minisetts could be planted in a hectare of land while by the traditional method only 12, 345 setts would be accommodated in a hectae.

Field preparation and Planting

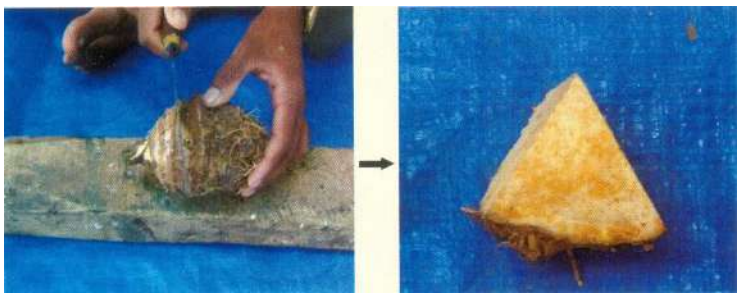
The land is prepared by ploughing two to three times. Pits of size 50 cm x 50 cm x 30 cm are dug at a spacing of 75 cm x 75 cm or 90 x 90 cm. An ordinary sized yam gives about 6 to 8 bits for planting. The cut pieces of corms are dipped in cow dung slurry, dried in shade and then planted in these pits at a depth of 20 cm. to prevent evaporation of moisture from cut surface. In some places, the small round daughter corms are also planted. The pit should be filled with top soil and farm yard manure (2kg/pit) prior to planting. The pieces are planted in such a way that the sprouting region (the ring) is kept above the soil. About 3500 kg of corms will be required to plant one hectare. Sprouting takes place in about a month.

COLOCASIA/TARO (*Colocasiaesculenta*)

Colocasia(*Colocasiaesculenta*) is a crop of tropical and sub-tropical regions and requires a warm humid climate.

Propagation:

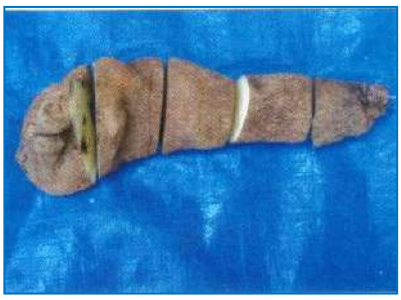
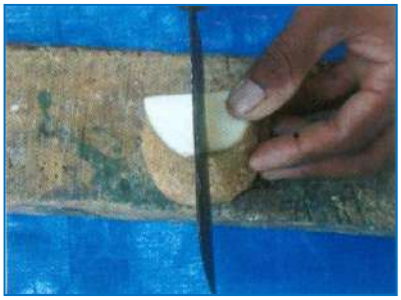
Use side tubers each of 25-35 g for planting. About 37,000 side tubers weighing about 1200 kg are required to plant one hectare. Plough or dig the land to a depth of 20-25 cm and bring to a fine tilth. Make ridges 60 cm apart. Plant the side corms at a spacing of 45 cm on the ridges.



In minisett technique, mother corms are selected from healthy plants at harvest. Such selected mother corms are first cut into cylindrical pieces and then cut horizontally into minisetts of about 10 g weight. The minisetts are then directly planted in the main field at a spacing of 45 x 30 cm. by adopting minisett technique the multiplication ratio can be enhanced to 1:120 from 1:20.

Dioscorea: *Dioscoreaesculenta*L. *Dioscoreaalata* L.;
Season and planting: March - June.
Use mature tubers or pieces of 250-300 g tubers taken from the previous crop as seed material at the rate of 1875 – 2500 kg/ha. For planting lesser yam, medium sized tuber of 100-150 g is sufficient. Planting is done in beds or in ridges or in mounds or in rows 75 cm apart either way. Mini setts of 25-30 g is recommended for planting directly in the field or raising a nursery and planting plants after 60 days. By reducing the size of planting material to 30 g, a multiplication ratio of 1: 24 could be obtained (conventional 1:6).

Buds are spread all over the periderm (body surface) of yam tuber. Hence any portion of yam tuber is capable of sprouting and producing a new plant. For preparing minisetts, the tuber is first cut into small cylindrical pieces of about 5 cm length. From these pieces, minisetts of about 30 g weight are prepared. Adequate care should be taken to see that each minisett has a surface layer of periderm.


Minisetts are planted in the nursery with cut surface facing up, so as to prevent drying up of periderm. Spacing between two rows is 5 cm. after planting, they are covered with a thin layer of soil-sand mixture.
Preparation of field: Plough the field to a fine tilth and form ridges and furrows at 75 cm spacing for raising lesser yam. Ridges and furrows at 75 cm spacing or pits of 45 x 45 x 45 cm for planting greater yam at 90 x 90 cm. Fill the pits with top soil and FYM.
Method of planting: To plant greater yam 3000-3700 kg and for lesser yam 1800-2700 kg of seed material is required.

Precision Farming: Future of Agriculture

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The growth of human population has become a global problem today. The world`s population is about 7 billion now which is expected to rise up to 10 billion in 2050. So, the major challenge that comes to us is that how to feed this growing population with limited natural resources like land, water and other natural resources. Different alternatives can be viewed as the solutions but all these look like impossible for current scenario of the world. Some of them are like increasing agricultural land which is not possible due to restricted cultivated area and increasing human population. Increased use of chemical fertilizers and pesticides which will be a short term solution to the problem. Because these harmful chemicals will affect the soil health in long term. Next one is increased use of safe and efficient herbicides and pesticides which is not an eco-friendly approach. Increasing farm mechanization which will be expensive for the man-kind. Transgenic crops can increase the agricultural productivity but their effect on human health is still a mystery to be solved and increased use of transgenic crops is against the ethical values. The problem can be solved if we use the high tech technology developed by the man-kind to revolutionize the world of agriculture.

Precision farming is a concept where technology can be used to solve the problem of increasing demand of food. Precision as the name suggests using in the efficient and effective manner. Precision farming is one the modern farm practices that makes agricultural production more efficient. With the help of precision agriculture farmers and soils will work better and not harder. Precision agriculture (PA) is an approach to farm management that uses information technology (IT) to ensure that the crops and soil receive exactly what they need for optimum health and productivity. The goal of PA is to ensure profitability, sustainability and protection of the environment. **Precision agriculture (PA), satellite farming or site specific crop management (SSCM) can be defined as farming management concept based on observing, measuring and responding to inter and intra-field variability in crops. PA is also known as satellite agriculture, as-needed farming and site-specific crop management (SSCM).In other words, we can define precision agriculture as a concept of modern world where technology and resources can be used altogether in efficient way to increase the agriculture**

productivity by observing, analyzing and supplying nutrients according to the need of crops in the field. The end goal of precision agriculture is to maximize economic return by optimizing crop yield, and minimizing environmental impact. This requires use of technologies like: Global Positioning Systems (GPS), crop sensors, aerial and/or satellite imagery, Geographic Information System (GIS) computer software, electromagnetic soil mapping, soil sample collection, crop yield data collection, crop or soil color index maps, soil types, soil characteristics, drainage level, potential yields. This technology will provide a wealth of information to the farmers which will help to make modern agriculture more efficient. These data will help to subdivide a large field area into smaller management zones. Using small management zones reduces waste while increasing production potential. These data will help to make field management by farmers more efficient at different levels like crop, environment and economic level. Precision farming helps management practices to be more effective by providing inputs to different crops according to the need of crops. It also reduces environmental risks and tolerates wasteful practices of resources. It also increases the benefits from different farming practices by encouraging competitiveness by more efficient utilization of resources. Farmers are able to gather a lot of information about their farms which in turn improves their decision making process with the help of precision farming. It also improves the quality of farm products and enhances their marketing.

I. Information or data base

Soil: Soil Texture, Structure, Physical Condition, Soil Moisture; Soil Nutrients, etc.
Crop: Plant Population; Crop Tissue Nutrient Status, Crop Stress, Weed patches (weed type and intensity); Insect or fungal infestation (species and intensity), Crop Yield; Harvest Swath Width *etc.*
Climate: Temperature, humidity, rainfall, solar radiation, wind velocity *etc*.

In-fields variability, spatially or temporally, in soil-related properties, crop characteristics, weed and insect-pest population and harvest data are important databases that need to be developed torealize the potential of precision farming

II. <u>Technologies Involved in PA</u>

There are different types of modern technologies involved in precision farming which makes this farming more effective and efficient than other farming systems. These are:

- **Global Positioning System (GPS):** It is a satellite based system which gives exact location that is provides continuous position information in real time, while in motion. The satellite broadcasts signals which are received by GPS receivers to compute locations.This precise location information allows soil and crop measurements to be mapped at any time.GPS receivers, either carried to the field or mounted on implements allow users to return to specific locations to sample or treat those areas. While purchasing a GPS receiver, its differential

correction type and coverage area relative to use area should be considered. Differential correction which is the position correction provided by the uncorrected GPS signals when compared with land based satellites. Uncorrected GPS signals have an accuracy of about 300 feet. The corrected position accuracy is typically 63-10 feet.

- **Geographic information systems (GIS):** Geographic information systems (GIS) are computer hardware and software that use feature attributes and location data to produce maps. Animportant function of an agricultural GIS is to store layers of information, such as yields, soil survey maps, remotely sensed data, crop scouting reports and soil nutrient levels.
- **Remote sensing:** It is the collection of data from a distance. Data sensors can simply be hand-held devices, mounted on aircraft or satellite-based. Remotely-sensed data provide a toolfor evaluating crop health. Plant stress related to moisture, nutrients, compaction, crop diseases and other plant health concerns are often easily detected in overhead images. Remotesensing can reveal in-season variability that affects crop yield, and can be timely enough to make management decisions that improve profitability for the current crop.
- **Variable Rate Applicator:** The variable rate applicator has three components: Control computer, Locator and Actuator.

  The application map is loaded into a computer mounted on a variable-rate applicator. The computer uses the application map and a GPS receiver to direct a product-delivery controller thatchanges the amount and/or kind of product, according to the application map.
- **Combine harvesters with yield monitors:** Yield monitors continuously measure and record the flow of grain in the clean-grain elevator of a combine. When linked with a GPS receiver, yield monitors can provide data necessary for yield maps.

III. Management

1. Information management: The adoption of precision agriculture requires the joint development of management skills and pertinent information databases. A farmer must have clear idea of objectives of precision farming and crucial information necessary to make decisions effectively. Effective information management requires many more than just keeping analysis tools. It requires an entrepreneurial attitude toward education and experimentation.

2. Decision support system (DSS): Combination of information and technology into a comprehensive and operational system gives farmers a decision to treat the field. For this purpose, DSS can be developed, utilizing GIS, agronomic, economic and environmental software, to help farmers manage their fields.

3. Identifying a precision agriculture service provider: It is also advisable for farmers to consider the availability of custom services when making decisions about adopting precise/site specific crop management. Purchasing the equipments and learning the necessary skills for precision farming is a significant up-front cost

that can not be affordable for many farmers. Therefore, farmers are advised to take services of agricultural service providers or properly trained extension workers for precision agriculture. The most common custom services that precision agriculture serviceproviders offer are intensive soil sampling, mapping and variable rate applications of fertilizer and lime. Equipments required for these operations include a vehicle equipped with a GPS receiver anda field computer for soil sampling, a computer with mapping software and a variable rate applicator for fertilizers and lime. By distributing capital costs for specialized equipment over more land and by using the skills of precision agriculture specialists, custom services can decrease the cost and increase the efficiency of precision agriculture activities.

STEPS IN PRECISION FARMING

I. Identification and assessment of variability

1. Grid soil sampling: Grid soil sampling uses the same principles of soil sampling but increases the intensity of sampling compared to the traditional sampling. Soil samples collected in a systematic grid also have location information that allows the data to be mapped. The goal of grid soil sampling is to generate a map of nutrient/water requirement, called an application map.
2. Crop scouting: In-season observations of crop conditions like weed patches (weed type and intensity); insect or fungal infestation (species and intensity); crop tissue nutrient status; also can be helpful later when explaining variations in yield maps.
3. Use of precision technologies for assessing variability: Faster and in real time assessment of variability is possible only through advanced tools of precision agriculture.

II. Management of variability

1. Variable rate application: Grid soil samples are analyzed in the laboratory, and an interpretation of crop input (nutrient/water) needs is made for each soil sample. Then the input applicationmap is plotted using the entire set of soil samples. The input application map is loaded into a computer mounted on a variable-rate input applicator. The computer uses the input application map anda GPS receiver to direct a product-delivery controller that changes the amount and/or kind of input (fertilizer/water), according to the application map.
2. Yield monitoring and mapping: Yield measurements are essential for making sound management decisions. However, soil, landscape and other environmental factors should also be weighed when interpreting a yield map. Used properly, yield information provides important feedback in determining the effects of managed inputs such as fertilizer amendments, seed, pesticides and cultural practices including tillage and irrigation. Since yield measurements from a single year may be heavily influenced by weather, it is always advisable to examine yield data of

several years including data from extreme weather years that helps in pinpointing whether the observed yields are due to management or climate-induced.

3. Quantifying on farm variability: Every farm presents a unique management puzzle. Not all the tools described above will help determine the causes of variability in a field, and it would be cost-prohibitive to implement all of them immediately. An incremental approach is a wiser strategy, using one or two of the tools at a time and carefully evaluating the results and then proceeding further.

SCOPE OF PRECISION FARMING IN INDIA

The concept of precision farming is not new for India. Farmers try their best to do the things for getting maximum possible yield with information and technologies available to them but unless & until total information about their fields and advanced technologies are available, they cannot do precision farming in perfect sense. In India, major problem is the small field size. More than 58 percent of operational holdings in the country have size less than 1ha. Only in the states of Punjab, Rajasthan, Haryana and Gujarat more than 20 per cent of agricultural lands have operational holding size of more than four hectare. When contiguous fields with the same crop are considered, it is possible to obtain fields of over 15 ha extent in which similar crop management are followed. Such fields can be considered for the purpose of initiating the implementation of precision farming. Similar implementation can also be carried out on the state farms. There is a scope of implementing precision agriculture for crops like, rice and wheat especially in the states of Punjab and Haryana. Commercial as well as horticultural crops also show a wider scope for precision agriculture in the cooperative farms. Nearly two-third arable land in India is rain-fed. The crop yields are very low (≈1t ha-1) and very good potential exists for increasing productivity of rain-fed cropping systems.

Benefits of precision farming

- The concept of "doing the right thing in the right place at the right time" has a strong intuitive appeal which gives farmers the ability to use all operations and crop inputs more effectively.
- More effective use of inputs results in greater crop yield and/or quality, without polluting the environment.
- Precision agriculture can address both economic and environmental issues that surround production agriculture today.

Drawbacks of precision farming

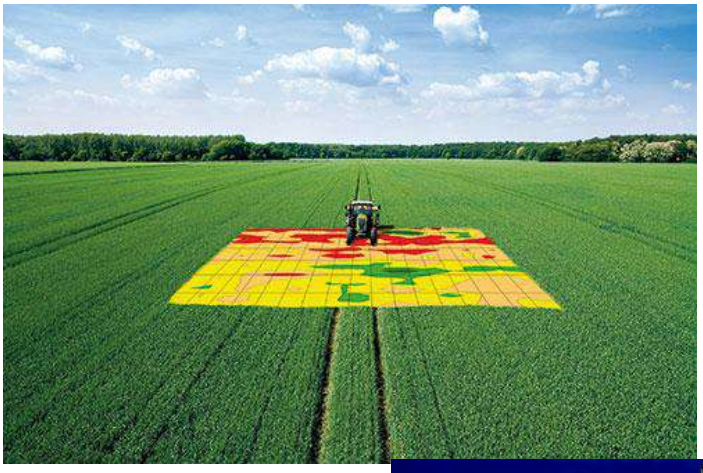
- High cost: It has proven difficult to determine the cost benefits of precision agriculture management. At present, many of the technologies used are in their infancy, and pricing of equipment and services is hard to pin down.
- Lack of technical expertise knowledge and technology: The success of precision agriculture depends largely on how well and how quickly the knowledge needed to guide the new technologies can be found (India

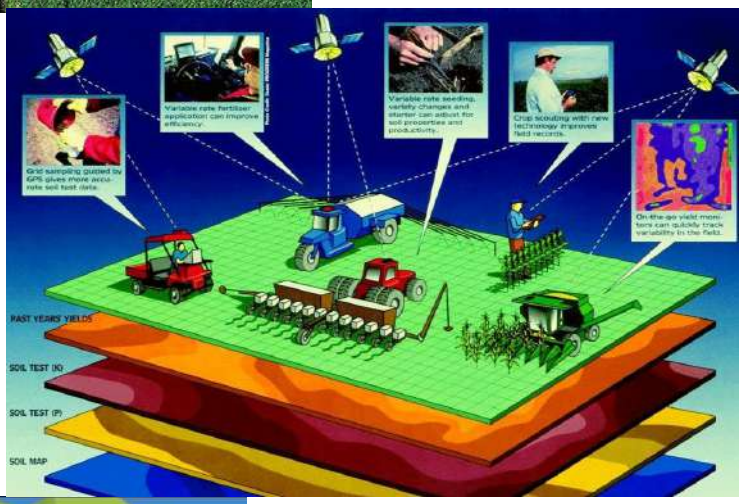
spends only 0.3% of its agricultural Gross Domestic Product in Research and Development)

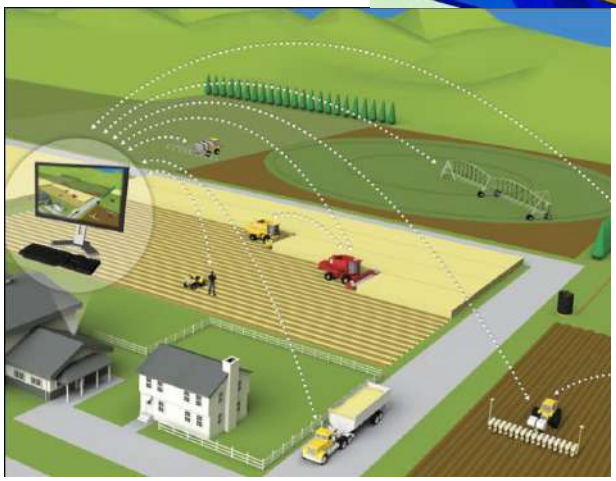
- Not applicable or difficult/costly for small land holdings
- Heterogeneity of cropping systems and market imperfections.

CONCLUSION

Rapid socio-economic changes such as economic growth, urbanization, and energy consumption are creating new opportunities for the application of precision farming in India. Instead of blindly adopting the advanced Precision Agriculture technologies adopted by developed countries, India should adopt technologies based on the need of the socio-economic condition of the country.







Tissue culture mediated propagation of banana for generation of virus free plants

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Banana (*Musa paradisiaca*) is a nutritional rich fruit crops commonly grown in tropical and subtropical part of the world. It is originated in south East Asia and India and spread around 120 tropical and subtropical countries of the world. The annual world production of banana was estimated around 86 million tons of fruits (Source). India is largest producer of the banana fruit having around 14 million tons of annual production (source). Banana is a monocotyledonous giant herb belongs to the genus Musa, order Zingiberales and family Musaceae. Most of the edible banana cultivars are hybrid in nature and were developed from crossing of its wild relatives *Musa acuminata* and *Musa balbisiana*. Banana is a rich source nutrient like carbohydrates,calcium, phosphorus and vitamins which provide a balance diet. The low cost and easy accessibility makes it a popular fruit crops among consumers. Cultivated banana are triploid in but many species of banana found to be diploid as well as tetraploid in nature. Most of the banana species are seedless in nature, while some of the species produces seeds, but they are thick and having hard seed coat leads to poor germination of banana seeds. Hence, traditionally banana plant is propagated through clonal propagation using sward suckers and underground rhizome. Most of the banana growing farmers fallow the native practice to sowing the suckers for next season, but associated with many problems like single mother plant produces only 5-10 suckers in the year, and also many suckers with poor quality, disease infested and poor varietal character.

One of the major problems associated with traditional method of propagation is the infestation of viral diseases like banana bunchy top virus and banana streak virus contamination from mother plant to suckers. There are no management practices available to control virus infestation and eradication of complete is only measure to remove infestation leads to 100% loss of yield. Hence, there is a huge demand across

the country for good quality and disease-free plantlets of superior varieties for large scale production.

Tissue culture mediated banana propagation is the best alternative to produce high quality and disease free plantlets.The selection of mother plant is most critical steps in tissue culture mediated banana propagation. The mother plant used for tissue culture mediated propagation should be high yielding, consumer preferable cultivars and must be selected from disease free cropping areas. Meristem Culture is the best method for virus free propagation because in the meristem a rapid round of cell division is going on and no cell differentiation is occurred. Virus can move cell to cell via plasmodesmata using their movement protein. The cells present in the meristem tissues are lack of plasmodesmata leads to prevention of contamination of systematic microbes like virus and viroides. Hence, meristem tissues are widely used for clonal propagation of banana through tissue culture. Now a day, commercial acceptance rate of tissue cultured banana plants are going high due to their superior quality, disease freeness and mass production in short time duration. The protocols for meristem culture for wild range of Musa species have been standardized. Different source of shoot tips can be used from the pseudo-stem, peepers, suckers, lateral buds and small eyes are widely used as propagation material but among them suckers from flowering plant are best explants to confirm their trueness to type and vigorousness. .

Steps involved in banana micropropagation

Stage 0: Selection of mother plants is an important step for production good quality plantlets. Suckers can be collected from the farmers field or isolated nursery area having disease free, high yielding and good quality plants.

Stage 1: Initiation of shoot cultures

Apical meristem cubes about 1-2cm^3 are excised from the selected suckers. A thoroughly washing with water to the material to remove all dust and trimmed their size of 12x12x15 mm from the basal side. Soak in the clean water for 30 min and transfer in the detergent solution for 30 with intermediate shaking followed by washing with 70% ethanol and $HgCl_2$ is required. The explants are trimmed to a final size of 8x8x*10 mm, in sterile conditions (in LAF – Laminar Air Flow Chamber), inoculated in MS media and keeps in the culture room at 25± 2 ℃ in dark for 3-4 weeks. Polyphenolic compounds are released from wounded banana tissue by oxidation which causes unwarranted blackening to the culture media and make an obstruction around the tissue which hampered nutrient uptake, tissue growth and sometimes browning of the tissue which may cause the tissue mortality. Therefore, unmarked shoot-tips should be transferred to fresh media in every 1–1.5 weeks throughout the first 3-4 weeks.

Stage 2: Multiplication of shoot-tip cultures

For multiplication purpose MS media with different concentration of IAA and BAP were used for inoculation of explants with a control environment of 25°C temperature, relative humidity 50 - 80 % and 2 kilo lux intensity of light. It was found that media with MS+ 0.57 µM IAA +17.74 µM BAP give best results among different combination of IAA and BAP. This multiplication step is very much useful for fast production of multiple copy of the explants as shoots and make a bunch of shoots. Sub-culturing of each shoots and individually culturing them in new multiplication media is required to multiply new bunch of shoots from single shoot. This Subculturing step should be repeated for several times to get maximum number of shoot tissues, usually seven to eight cycles are practiced.

Regeneration of plants:

After getting abundant number of shoot or shoot clumps, single shoot should to transfer to the rooting media for promotion of root development . For rhizogenesis auxin can be used from different sources like IAA, NAA or IBA with combination with MS media at between 0.1 and 2mg/l. In rooting medium, MS medium combination with IBA- 0.5 mg/l + NAA 1.0 mg/l and activated charcoal (AC) 250 mg/l gives most significant results (Saraswathi et al.).

Planting out and Hardening:

Hardening is one of the most transition period for the plantlets and carried out by altering external factors like water, temperature and food sources as nutrient supplied. Plants with roots and shoots are then first grown in mist chamber having controlled condition with 24-26℃ temperature and more than 80 % humidity to become accustomed with climate exterior to the lab. Normally, primary hardening take 2-3 weeks,then the plantlets were transferred in potting media and shifted to green house for 5-6 days. After this primary hardening, Press Mud Cake (PMC) mixed with soil are used for secondary hardening, it is an optimal medium which is supplemented with liquid NPK on weekly basis which produce sturdy uniform sized banana plantlets. After 2-3 months of hardening the plants are ready for field plantation.

Duration of 9 months is required to get a mature hardened plant to the field from the inoculated explants. More than thousand plants are generated from a single explant within 9 month duration.

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