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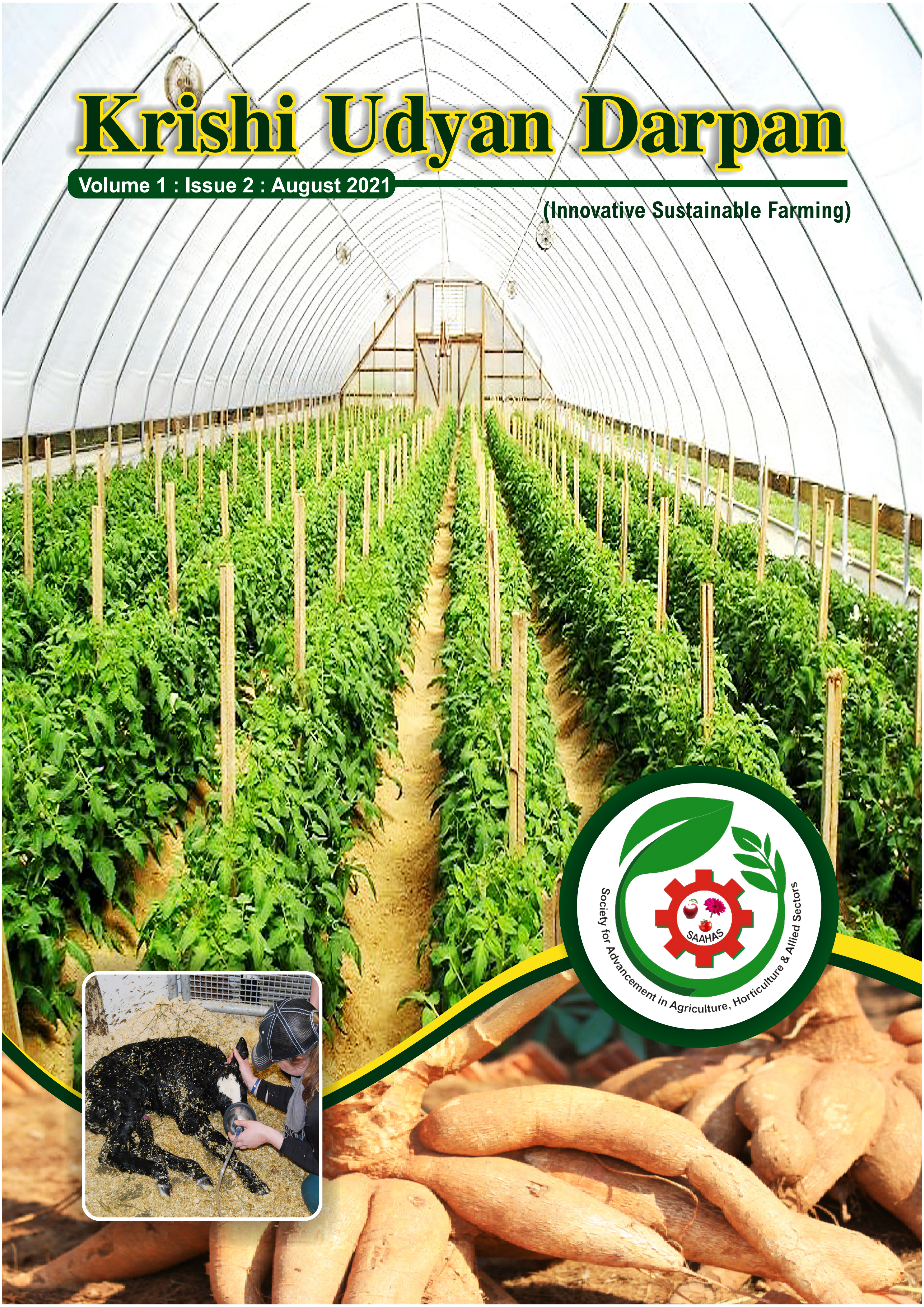

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In This Issue

Bio-fertilizers : Key Inputs for Sustainable Agriculture

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Introduction

Plant nutrients are essential for the production of crops and healthy food. Soil management strategies are mainly dependent on inorganic chemical based fertilizers, which caused a serious threat to human health and environmental pollution. The exploitation of beneficial microbes as a bio-fertilizer has become paramount importance in agriculture sector for their potential role in sustainable farming systems. Microbial inoculants, term as bio-fertilizers, are a promising technology to reduce the use of conventional inorganic fertilizers. Bio-fertilizers play a key role in productivity and sustainability of soil and also in protecting the environment as eco-friendly and cost effective inputs for the farmers. The use of bio-fertilizers leads to improved nutrients and water uptake, plant growth and plant tolerance to abiotic and biotic factors.

Classification of Bio-fertilizers

Biofertilizers can be categorised in different ways based on their nature as following :

Rhizobium: *Rhizobium* is a soil habitat bacteria, which lives symbiotically the root nodules of leguminous plants and supply atmospheric nitrogen to the plants. The beneficiary crops are groundnut, soybean, greengram, Blackgram, cowpea, chickpea.

Azotobacter: *Azotobacte*r is non-symbiotic nitrogen fixing bacteria recommended for non-leguminous crops like paddy, wheat, millets, mustard, cabbage etc.

Azospirillum: They develop associative symbiotic relationship with graminaceous plants. Apart from nitrogen fixation, growth promoting substance production (IAA), disease resistance and drought tolerance are some of the additional benefits of inoculation with *Azospirillum*.

Cyanobacteria: Both free-living as well as symbiotic cyanobacteria (blue green algae) have been harnessed in rice cultivation in India. Once so much publicized as a biofertilizer for rice crop, it has not presently attracted the attention of rice growers all over India.

***Azolla*:** *Azolla* is a free-floating water fern that floats in water and fixes atmospheric nitrogen in association with nitrogen fixing blue green alga *Anabaena azollae*. *Azolla* is used as biofertilizer for wetland rice and it is known to contribute 40-60 kg N/ha per rice crop.

Phosphate solubilizing microorganisms* (PSM)*: Several soil bacteria and fungi posses the ability to bring insoluble phosphate into soluble form by secreting organic acids and lower the pH in their vicinity to bring about dissolution of bound phosphates in soil.

AM fungi: The transfer of nutrients mainly phosphorus and also zinc and sulphur from the soil *milleu* to the cells of the root cortex is mediated by intracellular obligate fungal endosymbionts of the genera *Glomus, Gigaspora, Acaulospora, Sclerocysts* and *Endogone* which possess vesicles for storage of nutrients and arbuscles for funnelling these nutrients into the root system. By far, the commonest genus appears to be *Glomus*, which has several species distributed in soil.

Silicate solubilizing bacteria (SSB): Microorganisms are capable of degrading silicates and aluminium silicates. During the metabolism of microbes several organic acids are produced and these have a dual role in silicate weathering. They supply H+ ions to the medium and promote hydrolysis and the organic acids like citric, oxalic acid, Keto acids and hydroxy carbolic acids which form complexes with cations, promote their removal and retention in the medium in a dissolved state.

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.

Methods of Application of Bio-fertilizers

Seed Treatment: 200 g of bio-fertilizer is suspended in 300- 400 ml of water and mixed gently with 10-12 kg of seeds using an adhesive like jaggery solution, gum acacia, etc. The seeds are then spread on a clean sheet/ cloth under shade to dry and used immediately for sowing.

Seedling Root Dip: This method is used for transplanted crops. For rice crop, a bed is made in the field and filled with water. Recommended bio-fertilizers are mixed in this water and the roots of seedlings are dipped

Types of Biofertilizers

S. No.	Groups	Examples
	N2 Fixing Biofertilizers	
1.	Free-living (non-symbiotic)	*Azotobacter, Beijerinkia, Clostridium, Klebsiella, Anabaena, Nostoc*
2.	Symbiotic	*Rhizobium, Frankia, Anabaena azollae*
3.	Associative Symbiotic	*Azospirillum*
	P Solubilizing Biofertilizers	
4.	Bacteria	*Bacillus megaterium* var. *phosphaticum, Bacillus subtilis, Bacillus circulans, Pseudomonas striata*
5.	Fungi	*Penicillium sp., Aspergillus awamori*
	P Mobilizing Biofertilizers	
6.	Arbuscular mycorrhiza	*Glomussp., Gigaspora sp., Acaulospora sp., Scutellospora sp. & Sclerocystis sp.*
7.	Ecto-mycorrhiza	*Laccaria sp., Pisolithus sp., Boletus sp., Amanita sp.*

for 8-10 h and transplanted.

Soil Treatment: 4 kg each of the recommended bio-fertilizers is mixed in 200 kg of compost and kept overnight. This mixture is incorporated in the soil at the time of sowing or planting.

Advantages of Using Bio-fertilizers

- They are eco- friendly as well as cost effective
- Leads to soil enrichment and improve the quality of the soil
- These fertilizers harness atmospheric nitrogen and make it directly available to the plants.
- Increase the phosphorous content of the soil by solubilising and releasing unavailable phosphorous.
- Improve root proliferation due to the release of growth promoting hormones.
- Microorganism converts complex nutrients into simple nutrients for the availability of the plants.
- They help in increasing the crop yield by 10-25% also protect plants from soil borne diseases to a certain degree

Liquid Bio-fertilizer (LBF)

The liquid Bio-fertilizers (LBF) are suspensions having useful microorganisms, which fix atmospheric nitrogen and solubilise insoluble phosphates and make it available for the plants.

Benefits of Liquid Bio-fertilizers

The advantages of liquid biofertilizer over conventional carrier-based biofertilizers are listed below:

1. Longer shelf-life- 12 to 24 months
2. No contamination
3. No loss of properties due to storage up to 45° C
4. Greater potential to fight with native population
5. Easy identification by typical fermented smell
6. Better survival on seeds and soil
7. Very easy to use by the farmer
8. High commercial revenues
9. High export potential

Conclusion

Bio-fertilizers being essential components of organic farming play a vital role in maintaining long term soil fertility and sustainability by fixing atmospheric di-nitrogen, mobilizing fixed macro and micro nutrients in the soil into forms available to plants. Currently there is a gap of ten million tons of plant nutrients between removal of crops and supply through chemical fertilizers. In context of both the cost and environmental impact of chemical fertilizers, excessive reliance on chemical fertilizers is not practicable in the long run because of the cost, both in domestic resources and foreign exchange involved in setting up of fertilizer plants and sustaining the production. In this context, bio-fertilizers would be the viable option for farmers to increase productivity per unit area.

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Betelvine - A Green Gold

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Introduction

Betel vine or *pan (Piper Linn)* is an important, traditional and ancient crop of India. It is a perennial, dioecious, evergreen creeper grown in India. It is generally known as 'Paan' in Hindi in the subcontinent and by different names in the Asiatic region. The betel leaf occupies a significant place in everyday life of the Indian people. Other than its use in ethosocial rituals, chewing of the leaf or 'pan' as it is called is an ancient habit among all classes of people. The crop is highly labour-intensive and particularly suited to small holdings. Once established, it becomes a perennial source of employment and cash flow for day-to-day income of the farmers.

Betel vine *(Piper betel* Linn.) is a native of central and eastern Malaysia and has spread through tropical Asia and Malaysia. Now a days, it is an important cash crop in Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal. It's leaves are exported to Pakistan, Bangladesh, Indonesia, Malaysia, Burma and Thailand. In Karnataka, Chitradurga, Bellary, Uttara Kannada, Dharwad, Chikkamagalore, Hassan, Mysore, Shivamogga and Bangalore are the important districts.

Active compounds

The compounds present in the leaf and other parts are hydroxy chavicol, hydroxyl chavicol acetate, allypyrocatechol, chavibetol, piperbetol, methyl piperbetol, piperol A and piperol B. Phenol rich leaves of betelvine show high antioxidant activities.

Uses

The betel leaf is fairly rich in vitamin B and C and is supposed to be a tonic to the brain, liver and heart. Betel leaf chewing has beneficial role in oral hygiene. It clears the mouth and throat and helps digestion by encouraging salivation and neutralizing excess of acid by the lime eaten with it. It is the source of anti-cancer, anti-diabetic, cardiovascular, anti-inflammatory, anti-ulcer, anti-tumor, anti-microbial, anti-oxident, carminative, aphrodisiac, laxative, gastroprotective and wound healing. The leaves contain an essential oil which gives the aroma and pungency to the leaves.

Botany

The species *Piper betel* is a perennial dioecious dicotyledonous creeper with semi woody stem which climbs by short adventitious roots. Leaves are 5-20 cm long, broadly ovate to slightly coradate and offer unequal at the base, shortly acuminate, acute, entire with often an undulate margin, glabrous, yellowish to dark green, shining on both the surfaces; petiole is stout, 2.0 to 2.5 cm long.

The plant produces orthotropic (vegetative) and plagiotropic (reproductive) branches. Growth rates in terms of stem elongation, number of leaves and branch production are higher in vegetative branches compared to reproductive branches. Vegetative branches also produce leaves with higher petiole length and intermodal length. The reproductive branches bear male or female flower in a plant. The male spikes arising singly from leaf base are long, cylindrical and wavy, measuring 54-90 mm in length with a stalk length of 23-30 mm. The female spikes also arise singly from the axil and are short, stout, cylindrical and creamy-white to light orange in colour.

The spikes measure 40-55 mm in length with a stalk measuring 19-26 mm. Individual flowers are small, sessile, 5-7 lobed with 3-5 stigmas. During maturation, irregular swelling called node sites are formed on the fleshy fruits and their number varies from 5 to 7. The mature fruits possesses 2-20 spherical to oval, smooth surfaced seeds.

Important betel vine cultivars

1. Andhra Pradesh - Karapaku, Chennor, Tellaku, Bangla and Kalli Patti
2. Assam- Assam Patti, Awani pan, Bangla and Khasi Pan
3. Bihar - Desi Pan, Calcutta, Paton, Maghai and Bangla
4. Karnataka - Kariyale, Mysoreale and Ambadiale
5. Kerala - Nadan, Kalkodi and Puthukodi
6. Madhya Pradesh -Desi Bangla, Calcutta and Deswari.
7. Maharashtra - Kallipatti, Kapoori and Bangla (Ramtek)
8. Orissa-Godi Bangla, Nova Cuttak, Sanchi and Birkoli.
9. Tamil Nadu -Pachai Kodi and Vellaikodi
10. Uttar Pradesh - Deswari, Kapoori, Maghai and Bangla
11. West Bengal - Bangla, Sanchi, Mitha, Kali Bangla and Simurali Bangla.

Varieties

Karpurakodi, Kallarkodi, Revesi, Karpuri, SGM 1, Vellaikodi, Pachaikodi, Sirugamani 1, Anthiyur kodi, Kanyur kodi, Bidan pan, Bangla type, SGM-1, SGM-2, are under cultivation

Climate

Betel vine requires tropical climate for its luxuriant growth. The favourable conditions for it better growth is shady place with high humidity. It grows well where the rainfall is high (2250-4750 mm) and up to an elevation of 1,500 m MSL.

Soil

It is generally grown on different types of soils-heavy clayey loam, literate and sandy loam. However, soil with good organic matter and drainage system is best-suited for its cultivation. It requires pH ranges between 7-7.5. Avoid saline and alkaline soils which is not support the growth of the plants.

Propagation

Betel vine is propagated through cuttings having 3-5 nodes planted in such a manner that, 2-3 nodes are buried in the soil. A single node cutting with a mother leaf is also planted. Cuttings of the apical and middle portions of the vine are also used for planting. Cuttings are generally made from mature stem and it is collected from 2-3 years old plantations. Dipping of cuttings in 50 ppm NAA and IBA solution has been shown to increase the root formation and vigour of the crop.

Beetle vine is cultivated under fast-growing plants which provide support as well as shade. Under artificially-created shed known as *Boroj, Bareje* etc., it is also cultivated. Besides, mixed cropping with areca nut, coconut, jackfruit and mango is followed on a limited scale.

Construction of Bareja/ Boroj

Bareja are normally made on raised slightly slopy land. It is constructed with locally-available materials-bamboo, jute sticks, straw etc. Its shape may be square or rectangular with a height of 2-2.5m. Usually a wide passage (0.5-1.0m) is provided inside along the wall of the bareja. The walls and top of the bareja are covered with thatching material like leaves of coconut, wild date palm, sugarcane, straw, grass and jute stick. It should be constructed near a source of irrigation. The site must be at a higher level than the adjoining area. There must be a slope in all directions for a quick drainage of excess water.

Raising of support plant in open cultivation

Plants of *Sesbania grandiflora, S. sesban, Erythrina variegata* and *Moringa oleifera* are raised to provide support and shade. They are sown in 45-60cm rows at least 45 days before planting the cuttings of betel vine. The proper wind break, quick growing freely branching and non competing crops are to be raised all along the border of the betel vine garden. Coconuts, jack fruit, casurina, silver oak are grown for this purpose.

Land preparation

Land is prepared well by 4-5 ploughings. It should be raised by 5-10 cm from the adjacent areas. It is done by applying soil collected from ponds or tanks. The land is raised with proper gradient on both sides for quick drainage of excess water. Before use, the soil should be pasteurized by solarization technique. Then it is irrigated, pulverized and levelled. Afterwards, beds of suitable size (15cm high and 30cm broad) are prepared.

Planting

The onset of monsoon is ideal time of planting. But where support plants are used, the planting may be done up to October-end. Nearly 40,000-75,000 cuttings are used for hectare where support crop is used, whereas 1,00,000-1,20,000 cuttings/ha are grown in bareja (closed) system of cultivation. Rooted cuttings raised in nursery are also planted. The planting season varies from state-to-state and even place-to-place.

The sets begin to sprout and creep along in a month after planting. Trail the creeper to the supporting tree by tying the vines at an interval of 15-22.5 cm with the help of the banana fibre. When they come in contact with the supporting tree strike advantageous roots which help them to climb further, attend trailing of vines for 15 to 20 days depending upon the rapidity of the growth of the vines.

Row spacing	Vines/hectare	
	Single vine	Double vine
20 cm	50,000	1,00,000
30 cm (1 ft)	30,000	60,000
45 cm (11/2 ft)	22,500	45,000

Intercultural operation

- **Training of the live standards:** Before the establishment of vines, the side branches of Agathi trees up to a height of 2 m are removed for early creeping of the vines.
- **Training of the vines :** Training is done by fixing the vine at intervals of 15 to 20 cm along the standards loosely with the help of banana fibre. Training is done at every 15 - 20 days interval depending upon the growth of vines.
- **Lowering of the Vines :** When the vines reach a height of 3-4 m in one year's time, the vigour of the vine to produce normal size leaves will reduce. At this time, they need rejuvenation. This is achieved by lowering the vines down to the ground level at least once a year.

Betel vine is a crop demanding frequent irrigation. Wherever providing regular irrigation is not possible, burry a large portion of the exposed vine in the soil. Attend to the lowering of the vines either in the commencement of monsoon or at the end of the monsoon.

Summer is the best time for lowering the vines. Before lowering do harvest all the leaves. Untie the vines from bottom upwards, coiled up carefully leaving 1 or 2 feet length of top shoots, then burry in a small trench dug at the base of supporting tree.

Lowering is done during March-April (1 time) in Uttar Pradesh, Madhya Pradesh and Bihar, during May-June in Andhra Pradesh; during January-February or April-May in Tamil Nadu and 3-5 times in West Bengal and Orissa. In West Bengal and Orissa, after every lowering stem is covered with loose soil brought from outside. In open system, soil is dug and stem is coiled and lowered and thereafter covered with soil

Irrigation

Betel vine requires high soil moisture. Frequent light irrigation is necessary depending upon the season. Irrigation should be need-based. The flood irrigation should be avoided. Since over irrigation or excess water causes wilting of plants, proper drainage is essential during rainy season.

Intercrops

To get additional income, often many growers are cultivating intercrops, such as cucurbits, coccinia, chillies, ginger, banana, drumstick, brinjal, bendi *etc*., in North India. But, it is not common in other states.

Weeding

The plots of betel vine should be kept free from weeds. Two to three manual weeding is done.

Plant protection

Pests

1. Scale insects : Select scale-free vines. Spray Spray NSKE 5 % or Chlorpyriphos 20 EC 2 ml/lit when one or two scales are noticed on the basal portion of the stem/leaves. Direct the spray solution to the basal portion of the vines.

2. Mites : Mites can be controlled by spraying Wettable sulphur 50 WP @ 1 g/lit

3. Mealy bugs : Mealy bugs can be controlled by spraying Dimethoate 30 EC 2ml/lit. Concentrate the spray towards the collar region.

4. Nematode

- Application of Neem cake at 1 t/ha or shade dried Calotropis leaves @ 2.5 t/ha can be applied to soil for controlling the nematode populations.
- Soil application of *Bacillus subtilis* (BbV 57) or *Pseudomonas fluorescens* @ 10 g / vine for the control of root knot nematode and quick wilt of betel vine

Diseases

1. Phytophthora Wilt

- Select well matured (more than 1 year old) vines free from pest and diseases.
- Soak the vines for about 30 minutes in *Streptocyline* 500 ppm or Bordeaux mixture 0.5 %.
- Remove the affected vines away from the garden and burn them.
- Drench Bordeaux mixture 0.25% in basins formed around the vine at monthly intervals starting from October – January, three times soil drench and six times spray from June - July.
- During winter season avoid frequent irrigation.
- Application of *Trichoderma viride* @ 5 g/vine.

2. Bacterial leaf spot, blight and bacterial stem rot

Spray Streptocycline @ 400 ppm + Bordeaux mixture @ 0.25% at the time of first disease symptoms appear. Continue spraying at 20 days intervals. Always spray the chemical after plucking the leaves.

3. Anthracnose

Spray 0.5% Bordeaux mixture after plucking the leaves after the first appearance of the symptom. The variety Karpoori is susceptible to the disease.

4. Powdery mildew

Powdery mildew can be controlled by spraying 0.2% Wettable sulphur after plucking the leaves.

Harvesting

Mature leaves are plucked along with a portion of petiole. They are plucked by hand without any aid. However, in certain areas iron nail is used to facilitate plucking. In Karnataka and Tamilnadu, leaves are plucked from side shoots. In south India, comparatively tender leaves are preferred in the market. After plucking, they are washed thoroughly and made into bundles according to the prevailing custom of the area. On an average, about 60-80 lakh leaves are harvested annually from one hectare garden.

Grading and packaging

Harvested leaves are washed, cleaned and graded according to their size and quality. Then leaves are packed after cutting a portion of the petiole and rejecting the damaged leaves. All growers do not grade betel leaves. The picked leaves are sorted into different grades according to size, colour, texture and maturity. After that, they are arranged in numbers (the number varies from place-to-place) for packing. Grading and packing of leaves are very specialized jobs. For packing mostly bamboo baskets are used and in many places straw: fresh or dried banana leaves, wet cloth etc. are used for inner lining to maintain turgidity of leaves. Leaves can be kept fresh by sprinkling water and wrapping wet cloth, up to 5-6 days.

Usually betel leaves are used for chewing as fresh unprocessed. But in certain areas, leaves are subjected to processing known as bleaching or curing. There is a good, demand for such leaves which fetch higher prices in the markets. Bleaching is done by successive heat treatments at 60°-70°C for 6-8 hour.

Conclusion

Betelvine cultivation is profitable to the farmers even now a days it become the most popular mixed crop in arecanut. Demand for betelvine is increasing day by day in village and in the urban area. Bareja system of cultivation is like creating home for betel vine. This has created opportunity to cultivate betelvine in the nontraditional area. Hence there is more scope for the cultivation of the crops. At the same time special efforts should be made on characterization of most of the available landraces to release as new and improved varieties and also pest and disease management in betelvine.

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Cultural Practices : Best way for Prevention of Plant Diseases

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Introduction

The term cultural practice implies the human activities employed at controlling and managing diseases through the cultural manipulation of plants. In some crops cultural methods may be the only viable methodology for disease management. These practices are preventive and indirect in their action against pests and diseases. In some cases diseases can be minimized by planting the crop in areas other than where it is normally grown for e.g., management of viral diseases in crops like potato, cassava and yams. These crops if grown at higher altitudes reduce the chances of getting infection due to the low incidence of pests that transmit the viruses. For preventing disease outbreaks either the initial inoculum of the pathogen is reduced or the rate of spread of pathogens be checked for their management. A number of cultural practices like use of cover crops, crop rotation, intercropping, flooding and mulching have been effective for managing a number of pathogens. Here we discuss different cultural methods for effective management of diseases.

Site Selection

Site selection plays a key role in disease management. Site should be ideal for the crop but unfavourable for the pathogen. A site should have adequate fertility, soil drainage and free from soil problems. Poor drainage can stress crop plants and increase the risk of root rot and damping off diseases. Acidic soil encourages club root pathogen *Plasmodiophorabrassicae* in crucifers.

Similarly alkaline soil promotes common scan in potato caused by *Streptomyces scabies.* A site with good air drainage is also very important where the plants are exposed directly to sunlight. Good air circulation in the fields helps in faster drying of foliage thereby prevents the germination of pathogen spores and multiplication of bacterial cells. Some pathogens such as *Fusarium*, *Sclerotium*, *Plasmodiophora* are true soil inhabitants and persist longer in the soil once the field is infected. Therefore, when selecting a planting site care should be taken to avoid such site.

Adjustment of Sowing or Planting Time

Adjusting the date of sowing in such a way that the susceptible stage of plant growth does not coincide with the congenial environment required by the pathogens to proliferate and cause disease. Farmers can avoid diseases by planting crops at times of the year when certain pathogens are less pervasive. Some pathogens prefer specific weather parameters and in its absence pathogen cannot initiate the infection and attack crop plants. Mustard crop sown during June 9 to August 23 recorded heavy incidence of white rust whereas crop sown during September 7 to 22 recorded considerably reduced infection due to less relative humidity and less rainfall. Early sowing of crop on 21^{st} October recorded significantly less white rust severity whereas increase in disease with delay in sowing. Early sowing of paddy (June 10) showed less incidence of leaf, node and neck blast. The yellow mosaic virus infection was comparatively less in plants sown during February to end of March whereas the incidence was more in plants sown during April to June. The maximum smut severity was recorded in earliest *i.e.,* 15^{th} June sown crop, followed by 25^{th} June sown crop whereas lowest severity was observed in late sown crop.

Field Sanitation

Sanitation is the physical removal or destruction of infected plant parts, crop debris and crop residues. It is an important cultural practice for management of disease. Field sanitation is considered to be very effective method in reducing over wintering pathogens in many crops. In onion, periodic removal of necrotic leaves reduced the spore load and delayed the progress of leaf spot caused by *B. cinerea*. In perennial strawberry removal of foliage and fruit from the field suppressed spore production and reduced Botrytis fruit rot in following season.

Weeding

Weeds may contribute to the survival of pathogens or vectors of disease in the absence of a host crop as propagules of pathogen may not readily survive in soil or plant debris. If weeds are left uncontrolled, pathogens and disease transmitting vectors can move to healthy crop plants. Disease causing pathogens may use these plants as alternate habitat until an appropriate crop occurs in a nearby field. Many disease causing pathogens survive in alternate or collateral hosts. These hosts are generally weed plants which survive along with crop plants or away from host plants. Rice blast pathogen (*Pyriculari-agrisea*) infects weed hosts such as *Panicumrepens, Digitariamarginata* and *Setariaintermedia.* Similarly wheat rusts survive in their alternate or collateral hosts such as *Barberry* (black rust). *Thalictrum* (leaf rust) and *Hordeum, Bromus, Agropyron* (yellow rust).

Crop Rotation

There are many control methods available to reduce the chance of developing a disease on the crop plants. One old, but practical method that most growers can use frequently and very easily without any cost involvement is crop rotation. However, like other pest control methods, it needs to be properly understood and used correctly to make it effective for disease management. It is known that if a particular crop is grown on the same

piece of land the crop becomes susceptible to disease. An effective crop rotation is one in which a crop of one plant family is followed by one from a different family that is not a host crop of the pest to be controlled. Crop rotation interrupts normal life cycle of pests and diseases. Most of the diseases causing pathogens survive in the soil or crop debris as spores or sclerotia or dormant mycelium. So if the same crop is cultivated year after year in the same area the pathogens build up will be so large that it becomes difficult to grow that crop without yield losses. Only measure to eliminate the pathogen from that area is to break the cycle by avoiding the cultivation of same crop or crops belonging to the same family in the same area. Over time, many pathogens will die and then the field becomes suitable to cultivate the original crop. Crop rotation with non-host crops prevents the buildup of large populations of pathogens. This is the idea behind rotating crops to prevent plant diseases.

Flooding

Flooding is a physical method of managing the disease in which the field is subjected to continuous stagnation of water. The soil borne pathogens like *Rhizoctonia, Fasarium, Sclerotium, Sclerotinia*and *Ralstonia*are reported to be managed by flooding.

Flooding in Disease Management

A classical case of disease control on a large scale is the Panama wilt disease of bananas caused by *Fusariumoxysporum*f. sp. *cubense*. Flooding diseased cotton trash for up to six weeks reduced the incidence of bacterial leaf blight (*Xanthomonas campestris* pv. *malvacearum*) and flooding also gave satisfactory result in the control of *Phytophthora parasitica*(black shank of tobacco) and *Sclerotium spp.* attacking vegetable crops. Continuous flooding for 2 months in cotton also significantly reduced the occurrence of Fusarium wilt caused by *Fusariumoxysporum*f. sp. *vasinfectum*on subsequent cotton planting. The three weeks

flooding completely killed the sclerotia of the pathogens. Bacterial wilt caused by *Ralstonia solanacearum* was also effectively managed by flooding. Flooding combined with organic amendments produces fermentation products which inactivate the pathogens also has disease suppressive effect.

Mulching

Mulch is any material applied on the soil surface as a protective cover in order to prevent soil erosion to increase the soil moisture and to suppress the weed growth. Mulching is also reported to be effective in controlling pest and diseases in crop plants. Both organic and inorganic materials can be used for mulching. The organic materials like fallen leaves, tree bark, twigs, wood chips, compost newspaper or card board straw and grass clippings can be used as mulch. In case of inorganic mulch black polythene, stone, gravel and rubber can be used for mulching.

Mulching in Disease Management

The crop residue from the previous crop can be successfully used as mulch. The organic matter formed from the previous year crop residue directly or indirectly influences the antagonistic microorganism. The burial of groundnut crop residue 15 to 20 cm deep with a mould board plough will control several peanut diseases especially southern stem rot caused by *Sclerotiumrolfsii*. The mulch acts as a physical barrier between the crop plants and the infested soil. It prevents the direct contact parts of crop plants with infested soil and the roughness produced by the mulch reduces the rain splash dispersal of spores of pathogenic microorganisms. There are different types of plastics which were used for mulching like black, white and metalized UV reflective polythene. Mulches affect soil temperature and plant growth. Highly UV-reflective aluminum (metalized) mulch is effective in reducing primary infections.Black polythene along with

ammonium sulphate reduced the verticilium wilt in egg plant. Surface-applied straw mulch has been used as a ground cover to suppress splash dispersal of pathogens. Various study observed that straw spread on the soil surface suppressed final cucumber mosaic virus incidence by 25-40%.

Conventional Tillage

Deep ploughing has long been recommended for controlling *Sclerotiumrolfsii*in substropical and tropical climates. Deep ploughing buries sclerotia and moves the energy source for the pathogen away from stems and crown. Tillage (moudlboard plowing to 30-35 cm) was most effective in reducing sorghum downy mildew when ploughing was conducted in a downwind direction and not preceded by deep disking. Incidence and severity of Fusarium head blight

was lower in mould board-ploughed plots than in either chisel plough or no-till plots. The conventional tillage after harvest under furrow irrigation decreased the degree of aggregation of sclerotia of *Sclerotinia.*

Conservation Tillage

Recent changes in agricultural practices towards conservation tillage cause us to

wonder if farming is entering a new era of disease problems. Residue cover provides soil- and residue-borne micro-organisms with a favorable habitat' Conservation practices in combination with the crop residue may physically, biologically and structurally alter the local field environment by affecting soil temperature and moisture, competition among micro-organisms and soil disturbance. Severity of peanut leaf spots in reduced-tillage plots was lower than in conventional-tillage. Incidence of spotted wilt caused by Tomato spotted wilt virus (TSWV), typically in lower in reduced-tillage plots than in conventional tillage.

Conclusion

Chemical strategy for pathogens management is very effective but also delicate to environmental pollution, residual effect in grain and killing the non-target organisms. Development of fungicide resistance in plant pest is a major obstacle of chemical strategy when use continuous. The pathogens are perpetuated with/in seed and also in soil through infected plant debris. The management of pathogens can be done through cultural *i.e.,* crop rotation, changing in sowing date (early or late sowing), destruction of plant debris, soil solarization, use of resistant cultivars. Cultural strategy is the cheap and best but mostly effective at initial stage, specially at sowing time of crops and they can not manage the disease in standing crop and even after appearance of disease. ❖❖

Vital Role of Sheep Farming

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Introduction :

Sheep with its multi-facet utility for wool, meat, milk, skins and manure, form an important component of rural economy particularly in the arid, semi-arid and mountainous areas of the country. It provides a dependable source of income to the shepherds through sale of wool and animals. Its plays an important role in the livelihood of a large percentage of small and marginal farmers and landless labourers engaged in sheep rearing. Sheep and goats are important species of livestock for India. 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 small and marginal farmers and landless labourers.

The advantages of sheep farming are:

- Sheep do not need expensive buildings to house them and on the other hand require less labour than other kinds of livestock.
- The foundation stocks are relatively cheap and the flock can be multiplied rapidly.
- Sheep are an economical converter of grass into meat and wool.
- Sheep will eat varied kinds of plants compared to an other kind of livestock. This makes them excellent weed destroyer.
- Unlike goats, sheep hardly damage any tree
- The production of wool, meat and manure provides three different sources of income to the shepherd.
- The structure of their lips helps them to clean grains lost at harvest time and thus convert waste feed into profitable products.
- Mutton is one kind of meat towards which there is no prejudice by any community in India and further development of superior breeds for mutton production will have a great scope in the developing economy of India.

Scope for Sheep Farming

The country has 71.6 million sheep as per 2012-13 annual report of Animal Husbandry Department and ranks sixth in the world. The contribution of sheep through export of meat is 8 per cent of the total export value of agricultural and processed food products. Sheep skin in the form of leather and leather products is also exported. Sheep make a valuable contribution to the livelihood of the economically weaker sections of the society.

Role as a livestock

- Sheep are mostly reared for wool and meat. Sheep skins and manure constitute important sources of earning, the latter particularly in southern India. Milk from sheep is of limited importance and that too in very limited areas of Jammu and Kashmir, Rajasthan and Gujarat. Indian sheep are not regarded as dairy sheep.

- Basically Sheep are very much compatible for breeding because of their hardiness and adaptability to dry conditions; the north-western and southern peninsular regions of the country have a large concentration of sheep. In the tropics, they are non-seasonal breeders and can be made to lamb throughout the year.
- The productivity of Indian sheep is lower than those of agriculturally more advanced countries. Yet considering their nutritional and physical environment, their productivity cannot be considered as inefficient.
- The major reasons for low productivity are inadequate grazing resources, diseases causing high mortality, morbidity and consequent reduced production, and serious lack of organized effort for bringing genetic improvement.

Conclusion

Sheep were earlier reared for wool as the major produce while with paradigm shift in agriculture meat has replaced wool. More than 70% Indian consumers are non-vegetarian by choice with preference for sheep meat. With rapid urbanization and improvement in economic status, the demand for meat is likely to increase further than the present level of 6 kg/person/year. Moreover the demand and for meat in southern status, Jammu and Kashmir and export market is increasing rapidly requiring development of technology to meet the challenge. Sheep are reared mainly by poor people belonging to lower state of the society and serve either as the main or supplementary source of income for them. They are valued for both mutton and wool production. Indigenous sheep productivity is low compared to exotic sheep. It is most docile and earliest domesticated among farm animal for basic needs of food and clothings. Its converts food and roughage cheaply into good cash products and fertilize land. Sheep are small animals easy to manage. They are kept by poor farmers and landless labourers for meat, wool, skin, manure and to some extent even milk. Sheep with multifaceted utility plays and important role in arid and semi-arid areas with marginal and sub marginal land unfit for crop production, even under dry land farming

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Digitalization in Agriculture: One Steps Towards Advancement

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Introduction

Digitalization, is the socio-technical process of applying digital innovations. So, now the question is 'what is digital agriculture'? The technology which is applied in agriculture for the betterment of farming system like overcoming productivity stagnation, strengthen market linkages and improving farm management that ensures food security and reduce dependency on imports. Digital agriculture means the use of computer and communication technologies for sustainable agriculture (Ozdogan,*et.al.*2017). Digital agriculture brings together new opportunities and widespread use of advanced, data-intensive computer technologies in agriculture. Digital agriculture is also known as e-agriculture.

Indian agricultural scenario is like India has 131 agro-climatic zones, one of the biggest food grain and oilseed producers in the world, largest producer of milk production, 2nd largest producer of fruits and vegetables and tea production in the world. Through agricultural sector, India contributes around 15 per cent of GDP. But now-a-days, Indian agriculture is suffering from over population, soil infertility, crop damage due to improper nutrition management which causes low productivity in agriculture sector, that is another main reason of malnutrition. So, using different technology in agriculture sector will be helpful to mitigate the above-mentioned problems.

Components of digital agriculture

Different components of digital agriculture are,

1) Big data: The scope of big data application is large. The ability to track physical items, collect real time data and forecast scenarios can be a real game changer in farming practices. It also helps to feed a growing population by increasing farm productivity and profitability, to use pesticides without harming the ecosystem, to optimize farm equipment in large field and ensure long-term health of farm equipment and to manage supply chain issues by tracking and optimizing delivery truck route etc. In digital Agriculture period the machines have all kind of sensors which are used to gauge data and resulting analysis of data. Big data helps farmers to monitor all parameters of production of real time. Thus, improving the process of decision making (IDEAGRO2015). Data production process consists three stages.

Process oriented: This is the process driven and data from traditional operating system related to activities of an enterprise, its customers and its operations. (IRMA 2016)

Machine Generated: Data obtained from machines, obtained from objects, many sensors used to record and measure agricultural operations. (Hashem 2015)

Human sourced: Data that are collected from personal experiences are here. Social media data, personal blogs, and comments, pictures and videos are in this category (Devlin 2013).

Cloud computing is used to store large-scale data but with low investment cost and also makes it possible to instant access to this data (Chavali 2014). A wide range of farm implementations can be obtained through cloud computing. Such as-

• Real-time monitoring and guidance in agricultural production: Agricultural activities can be viewed, controlled and intervened immediately if required. (Zhu *et al.* 2013).

• Farm management system: farmers can enter data into the system time and space independently. So, they can take managerial decisions to be up to date all time (Patel & Patel 2013; Ault 2013).

• Data flow from external sources: Information for weather and other climatic conditions can be obtained instantly which are needed in agricultural practices and used directly in decision-making through interrelated devices (Goraya& Kaur 2015).

2) Internet of Things and Drones in Agriculture: IoT revolution will entirely change sectors such as production, energy, agriculture, transportation and other industrial sectors within next 10 years (O'Halloran and Kvochko, 2015). In Agriculture, existing tolls can be more functional by using IoT. IoT can bring information from different sensors and RFID tags, so has unlimited potential application areas. The Internet of Things can reduce the gap between Scientists, farmers and Crop by using the sensor network in Agriculture. This helps producers to take timely appropriate decisions thus all resources can be used efficiently.

Well, in case of sensitive agriculture implementations; satellites and air vehicles are very useful to obtain information about agricultural areas for a long time. Use of Drone technology for agricultural purposes has become widespread. Farmers can access the images the need very easily and quickly by low cost and less time. Some drones are specially developed for agricultural purposes that have special sensors and image systems which can detect pest and diseases by clicking image of the crop (Doyle, van der Wal *et al.*2015).

Scope for digitalization in India:

Our climate is slowly and continuously changing day by day. So, there is a challenge of climate change to the farmers. To meet the challenges of climate change use of Digital agriculture is necessary by using ICT tools in agriculture.

E-agriculture plays a vital role to open up opportunities for non-traditional players in the agriculture value-chain. It helps to bridge the current information gap.

Both central and state government take different steps to promote digitalization in agriculture in India by developing various policy initiatives. Government wants to promote virtual agricultural market through electronic platform. By using the platform, farmers sell their produce to all over the country.

Modern equipment and improved technology can enhance production and storage capacity.

Kisan call centres and different mobile apps help the farmers by providing various answers of their queries, opportunities for betterment in field and market.

The component of e-agriculture like sensor, communication network, Unmanned Aviation Systems (UAS), Artificial Intelligence (AI), robotics are helps to use the time and resources more efficiently.

Big data provides modular data to the farmers on rainfall pattern, water cycle, fertilizer requirement to make the farmers taking decision about better productivity and profitability.

By reading the proper weather forecasts, farmers can minimise the impact of drought and climate change.

Farmers can also avail the post-harvest management technologies.

Drawbacks

The sole intension of the digitalization is to bring in huge scale of advantages and development of the agriculture sector. But still there exists certain gap in the process of implementation.

Firstly, the level of education is the main enemy of the whole process. In India, there is a huge gap between educated farmers and uneducated farmers. And this gap effects the implementation of any kind of modern technology which requires a certain amount of education to adopt.

Secondly, the level of awareness of technology is the other important factor that hinders the process. Though the factor is also related to the level of education somehow, because if the farmers become more educated, then automatically they would be drawn to new exciting technologies because they would understand the advantages. Due to lack of awareness, the farming community stands very far from the new technologies.

It has been evident that majority of the farmers also neglect the new digital technologies due to their age group. Unlike young farmers, the middle aged and old farmers show less interest in using the technologies.

It is burning problem that the young generation of our community is less interested in farming. Even from the farming families, the children of the farmers are choosing other career option but farming. So, the number of the young farmers are decreasing which increase the gap between young farmers and those middle-aged farmers who ignore new digital technologies.

There are many more disadvantages in the digitalization process in our community. The inconvenience in the internet service is also one of them. The whole digitalization stands on the internet service and unlike any other developed society, our India is still suffering from the shortage of internet services, and even if it is there, the poor farming community finds it difficult to adopt due to high price of the interest services.

Use of smart phone, computers and other technologies are much more important in the digitalization process. Knowing how to use and operate these gadgets would induce the digitalization in farming. But lack of education, interest hinders the process of learning these. Also, the farmers find it unnecessary to spend on these rather than other necessary product that they need every day.

Conclusion

Digitalization on agriculture is one of such new concepts that is introducing to India which is improving the farm operations at the level of field. Digitalization will boost the confidence in the farming sector by using big data, drones, IoT like components which are very helpful in agriculture for digitalization. It can help to enhance production and storage. Though digitalization is not directly linked to farming activities, however it will allow the farming community to focus only on take care of digital system in agriculture. In Indian environment, when all the research institutes have engaged to develop new technologies, farming communities need motivation and encouragement to adopt the process of digitalization. Then only digitalization will change the Indian agricultural scenario in future.

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Medicinal and Nutritive Importance of Drumstick

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Introduction

Drumstick tree *Moringa oleifera* belonging to the family of Moringaceae and known as the Ben oil tree or the horse radish tree. It is native to the foothills of northwestern India and is now cultivated around the world as a valuable, drought-resistant, multi-purpose crop. Moringa is rich in nutrition owing to the presence of a variety of essential phytochemicals present in its leaves, pods and seeds. In fact, moringa is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach. The fact that moringa is easily cultivable makes it a sustainable remedy for malnutrition. Countries like Senegal and Benin treat children with moringa . Children deprived of breast milk tend to show symptoms of malnutrition. Lactogogues are generally prescribed to lactating mothers to augment milk production. The lactogogue, made of phytosterols, acts as a precursor for hormones required for reproductive growth. Moringa is rich in phytosterols like stigmasterol, sitosterol and kampesterol which are precursors for hormones. These compounds increase the estrogen production, which in turn stimulates the proliferation of the mammary gland ducts to produce milk. It is used to treat malnutrition in children younger than 3 years . About 6 spoonfuls of leaf powder can meet a woman's daily iron and calcium requirements, during pregnancy. Every part of *M. oleifera* is a storehouse of important nutrients and antinutrients. The leaves of *M. oleifera* are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper. Vitamins like beta-carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E also present in *M. oleifera*, Moringa leaves also have a low calorific value and can be used in the diet of the obese. The pods are fibrous and are valuable to treat digestive problems and the colon cancer. A research shows that immature pods contain around 46.78% fiber and around 20.66% protein content. Pods have 30% of amino acid content, the leaves have 44% and flowers have 31%. The immature pods and flowers showed similar amounts of palmitic, linolenic, linoleic and oleic acids Moringa has lot of minerals that are essential for growth and development among which, calcium is considered as one of the important minerals for human growth. While 8 ounces of milk can provide 300–400 mg, moringa leaves can provide 1000 mg and moringa powder can provide more than 4000 mg. Moringa powder can be used as a substitute for iron tablets, hence as a treatment for anemia. Beef has only 2 mg of iron while moringa leaf powder has 28 mg of iron. It has been reported that moringa contains more iron than spinach . A good dietary intake of zinc is essential for proper growth of sperm cells and is also necessary for the synthesis of DNA and RNA. *M. oleifera* leaves show around 25.5–31.03 mg of zinc/kg, which is the daily requirement of zinc in the diet

Medicinal properties

M. oleifera is often referred as a panacea and can be used to cure more than 300 diseases. Moringa has long been used in herbal medicine by Indians and Africans. The presence of phytochemicals makes it a good medicinal agent

Anticancer properties

Cancer is a common disease and one in seven deaths is attributed due to improper medication. Around 2.4 million cases are prevalent in India, while there are no specific reasons for cancer to develop. Several factors like smoking, lack of exercise and radiation exposure can lead to the disease. Cancer treatments like surgery, chemotherapy and radiation are expensive and have side effects. *M.oleifera* can be used as an anticancer agent as it is natural, reliable and safe, at established concentrations. Studies have shown that moringa can be used as an anti-neoproliferative agent, thereby inhibiting the growth of cancer cells. Soluble and solvent extracts of leaves have been proven effective as anticancer agents.

Benefits of moringa

Moringa is believed to have many benefits and its uses range from health and beauty to helping prevent and cure diseases.

Protecting and nourishing skin and hair

Moringa seed oil is beneficial for protecting hair against free radicals and keeps it clean and healthy. Moringa also contains protein, which means it is helpful in protecting skin cells from damage. It also contains hydrating and detoxifying elements, which also boost the skin and hair. It can be successful in curing skin infections and sores.

Treating edema

Edema is a painful condition where fluid builds up in specific tissues in the body. The anti-inflammatory properties of moringa may be effective in preventing edema from developing.

Protecting the liver

Moringa appears to protect the liver against damage caused by anti-tubercular drugs and can quicken its repair process.

Preventing and treating cancer

Moringa extracts contain properties that might help prevent cancer developing. It also contains niazimicin, which is a compound that suppresses the development of cancer cells.

Treating stomach complaints

Moringa extracts might help treat some stomach disorders, such as constipation, gastritis, and ulcerative colitis. The antibiotic and antibacterial properties of moringa may help inhibit the growth of various pathogens, and its high vitamin B content helps with digestion.

Fighting against bacterial diseases

Due to its antibacterial, antifungal, and antimicrobial properties, moringa extracts might combat infections caused by *Salmonella*, *Rhizopus*, and *E. coli*.

Making bones healthier

Moringa also contains calcium and phosphorous, which help keep bones healthy and strong. Along with its anti-inflammatory properties moringa extract might help to treat conditions such as arthritis and may also heal damaged bones.

Treating mood disorders

Moringa is thought to be helpful in treating depression, anxiety, and fatigue.

Protecting the cardiovascular system

The powerful antioxidants found in

Moringa extract might help prevent cardiac damage and has also been shown to maintain a healthy heart.

Helping wounds to heal

Extract of moringa has been shown to help wounds close as well as reduce the appearance of scars.

Treating diabetes

Moringa helps to reduce the amount of glucose in the blood, as well as sugar and protein in the urine. This improved the hemoglobin levels and overall protein content in those tested.

Treating asthma

Moringa may help reduce the severity of some asthma attacks and protect against bronchial constrictions. It has also been shown to assist with better lung function and breathing overall.

Protecting against kidney disorders

People may be less likely to develop stones in the kidneys, bladder or uterus if they ingest moringa extract. Moringa contains high levels of antioxidants that might aid toxicity levels in the kidneys.

Reducing high blood pressure

Moringa contains isothiocyanate and niaziminin, compounds that help to stop arteries from thickening, which can cause blood pressure to rise.

Improving eye health

Moringa contains eyesight-improving properties thanks to its high antioxidant levels. Moringa may stop the dilation of retinal vessels, prevent the thickening of capillary membranes, and inhibit retinal dysfunction.

Treating anemia and sickle cell disease

Moringa might help a person's body absorb more iron, therefore increasing their red blood cell count. It is thought the plant extract is very helpful in treating and preventing anemia and sickle cell disease.

Conclusion and future prospects

The research on *M. oleifera* is yet to gain importance in India. It is essential that the nutrients of this wonder tree are exploited for a variety of purposes *M. oleifera* has great antidiabetic and anti-cancer properties. However, double blind researches are less prevalent to further substanitate these properties of moringa. More studies are needed to corroborate the primary mechanicms of moringa as natidiabetic and anticancer agents. Several puzzling questions are unanswered. Research on the antioxidant nature of aqueous extracts on cancer cells needs further inquiry. Studies have proven that moringa causes ROS in cancer cells that leds to apoptosis or necrosis. However, the aqueous extracts also have antioxidants present in them. The exact mechanism of this irony is yet to be explored. The effect of environmental factors affecting the nutrient levels of leaves and other parts of *M. oleifera* grown across the globe require further analysis.

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Production Technology of Cassava (*Manihot esculenta*)

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Introduction

Cassava (*Manihot esculenta* Crantz.) is a dicotyledonous perennial plant originated in North-East Brazil, with an additional centre of origin in Central America (Rogers, 1963; Hillock *et al*., 2002). From its places of origin, the plant has spread to various parts of the world, and it is today cultivated in all tropical regions of the world. There are 98 species of *Manihot* recognized (Rogers and Appan, 1973), including popular cultivating varieties under *M. esculenta* (eg: Malayan clone-M4 of India) and wild varieties like *M. anomala*, *M. caerulescence*, etc. It is assumed that cassava originated by hybridization between two wild *Manihot* species followed by vegetative reproduction of the hybrid (Nassar, 2000). Cassava is very important staple food crop for many people in Uganda especially for West Nile, Northern and Eastern Uganda. It is also widely grown in other parts of the country as a famine reserve crop. It has high yielding capability, easy to grow and performs well even in marginal areas. Cassava provides a good source of alcohol and industrial starch.

Contains a Few Key Nutrients

A 3.5 ounces (100-grams) serving of boiled cassava root contains 112 calories. 98% of these are from Carbohydrates and the rest are from a small amount of protein and fat. This serving also provides fiber, as well as a few vitamins and minerals. The following nutrients are found in 3.5 ounces (100 grams) of boiled cassava.

Calories	: 112
Carbohydrates	: 27 grams
Fiber	: 1 gram
Thiamine	: 20% of the RDI
Phosphorus	: 5% of the RDI
Calcium	: 2% of the RDI
Riboflavin	: 2% of the RDI

Boiled cassava root also contains small amounts of iron, vitamin C and Niacin.

Overall, the nutrition profile of cassava is unremarkable. While it does provide some vitamins and minerals, the amounts are minimal. There are many other root vegetables you can eat that will provide significantly more nutrients — beets and sweet potatoes, to name two.

Summary : Cassava is a significant source of Carbohydrates and also provides a small amount of fiber, vitamins and minerals.

Ecological requirements

i) Soil: Cassava can be grown on a wide range of soil but best on deep, free draining soils with reasonable fertility levels. Shallow soils which may restrict tuber expansion should be avoided.

ii) Rainfall : Cassava is highly drought resistant and grown in many parts where rainfall is low and unreliable.

iii) Altitude: Cassava grows at all altitudes but best on low to medium altitudes. It is low yielding at altitudes above 1500 Mea Sea Level (MSL)

Varities

Inter-varietal hybridization between superior varieties and/or selection among recombinants resulted in the isolation and release of the first three hybrids in the world viz., H-97, H-165 and H-226 in cassava from CTCRI in 1971. Even though these hybrids are high yielders, culinary quality was not as good as that of the popular local variety M4. However, they are the most preferred varieties in the neighbouring states as an industrial crop due to high extractable starch content and easy peeling of tubers. Later, two high yielding hybrids with improved culinary quality were released under the names Sree Sahya and Sree Visakham during 1977 and the latter has higher amounts of beta carotne (466IU/100 grams). Important characteristic features of the three hybrids are as follows.

1. H-97 is a hybrid between a local variety 'Manjavella' and a Brazilian seedling selection. The plants are medium tall, branched with light brown emerging leaves. The tubers are conical shaped and stout, yielding 25-35 t ha^{-1}. The tuber flesh is white with 27-29% starch content and matures in 10 months.

2. H-165 is a hybrid between two indigenous cultivars viz., 'Chadayamangalam Vella and a clone similar to Kalikalan. The plants are predominantly unbranched with the mature leaves showing a drooping nature.

The tubers are relatively short and conical, yielding 33-38 t ha-1. The variety is comparatively early maturing in 8-9 months.

3. H-226 is a hybrid between a local cultivar ''Etthhakka Karuppan" and the Malayan introduction M4. Plants are tall, occasionally branching and leaves with a characteristic green colour. The tuber yield is 30-35 t ha^{-1} and the crop duration is ten months. Both H-165 and H-226 are the predominant varieties cultivated in Tamil Nadu and Andhra Pradesh for their industrial potential.

4. Sree Visakham (H 1687) is a hybrid between an indigenous accession and a Madagascar variety S-2312. The female parent is unbranched with light yellow tuber flesh, while the male parent is a heavy yielder with good culinary qualities. Sree Visakham is predominantly a non-branching type and tall having compact tubers with yellow flesh due to high carotene content (466 IU/100 g). Tuber skin is brown and rind is cream in colour. The crop duration is ten months and the tuber yield is 35-38 t ha^{-1} with 25-27% starch.

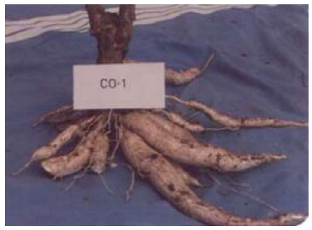
5. Sree Sahya (H 2304) is a hybrid involving five parents of which two are exotic and three indigenous. Plants are tall, generally non-branching with dark brown and a predominant spiny, stipular mark. The tubers are long necked with light brown skin, cream coloured rind and white flesh. Tuber yield is 35-40 t ha^{-1}. Both Sree Visakham and Sree Sahya are improved varieties for table purpose having better palatability than the former three hybrids and are popular in southern Thiruvananthapuram and western Kanyakumari districts.

6. Sree Rekha (TCH 1): Top cross hybrid of cassava *viz.,* TCH 1 was released for general cultivation in Kerala under the name 'Sree Rekha'. The average yield and starch content are 48.0 t ha^{-1} and 28 % respectively. Tubers cook well and give good yields both under upland and lowland conditions.

7. Sree Prabha (TCH 2): Top cross hybrid of cassava *viz.,* TCH 2 was released for general cultivation in Kerala under the name 'Sree Prabha'. The average yield and starch content are 42.0 t ha^{-1} and 26% respectively. Tubers cook well and give good yields both under upland and lowland conditions.

Early maturing varieties

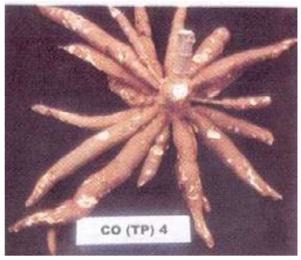
Majority of cultivated cassava varieties take about ten months for maturity and thus occupy the land for a long period. Systematic screening of the germplasm collections has



CO 1

Co 2

Co 3



CO (TP) 4

YTP1

MVD-1

resulted in the identification of three early maturing varieties in cassava which can be harvested at 6-8 months. The early maturing selection 'Sree Prakash' released from CTCRI during 1987 was quickly adopted in paddy based cropping systems in low lands of Kerala state for eg: in Alappuzha district. Later, two more short duration varieties viz. Sree Jaya and Sree Vijaya were also released for this purpose in 1998 and are popular in Kollam and Pathanamthitta district.

1. Sree Prakash is a relatively short statured plant, generally non-branching with high leaf retention. The tubers are medium sized, necked and the tuber yield is 35-40 t ha^{-1}. The duration is 7-8 months. Tubers possess good culinary quality and give a starch content of 29-31%.

2. Sree Jaya is a medium tall variety and produces conical tubers and have white flesh. Its duration is 6 months and tuber yield is 26-30 t ha^{-1}. The cooking quality of the tuber is very good and on par with the popular local variety M4.

3. Sree Vijaya is also medium tall and has conical tubers but yellow flesh. The tuber yield is 25-28 t ha^{-1} and duration is 6 months. It has average cooking quality.

Breeding work outside CTCRI

Cassava breeding research is in progress at the State Agricultural Universities of Kerala and Tamil Nadu as well as the Department of Horticulture and Plantation Crops of the Government of Tamil Nadu. The Kerala Agricultural University has released two short duration varieties viz. Nidhi in 1993 and KMC-1 (Vellayani Hraswa) in 1998. Four varieties viz. CO-1, CO-2, CO-3 and CO-4 were also released for general cultivation from Tamil Nadu Agricultural University. The Horticulture Department of Tamil Nadu released two varieties, MVD-1 and MVD-2 in 1993. These varieties are yet to make a dent into the cultivator's fields except to a limited extent by CO-2 and MVD-1.

Propagation

Cassava is propagated vegetatively using stem cuttings.

Agronomic practices

Land preparation

Good cassava production requires a good land preparation. The land should be well prepared with tillage the land in order to remove the weeds, loosen up the soil, improve soil drainage and make it easy for root development. For tillage system, the soil is ploughed and exposed to the sun for 2 weeks to a month. This helps to kill deeply embedded weed seeds. Second plowing is then done in preparation for planting associated with seedbed pattern. Land preparation can be done by manual, animal drawn and machine land. Cassava and soil productivity can be sustained with proper land preparation and applying an appropriate integrated nutrient management techniques in local context.

Propagation

These are parts of the stem which should be from a mature plant, especially the middle part. They should be 30 – 45 cm long and 2 – 4 mm thick with buds above the leaf scar.

Virus elimination through tissue culture in cassava

The protocol for virus elimination through tissue culture has been standardized for the varieties MVD 1 and H 226 by using meristem culture. The Murashige and Skoog (MS) medium supplemented with BAP at 0.1 mg/l for meristem establishment and shoot growth and MS medium without growth regulators for rooting have to be followed.

The in vitro plantlets are to be hardened in sterile pot mixture (sand : soil : FYM in 1 : 1: 1) under mist chamber for 10-15 days and later kept under shade net for 10 days before transferring them to the open field.

Planting method and spacing

Cuttings may be buried in a horizontal position 71/2 – 10 cm deep or buried half way into the soil. In pure stands (without intercropping), a spacing of 1.5 m x 0.9 m is recommended.

When intercropped, interplant with a cover crop of beans or groundnuts at a spacing of 50cm x 20cm. This combination gives maximum yields of both cassava and bean or groundnuts.

Weeding

Keep the crop weeded in the early first 3 months. Intercropping also helps to suppress weeds.

Pests and Diseases and Their Management

(i) Pests

Most times insect pests are not a threat to cassava production but still need attention. The most notable ones include;

Cassava mealy bug : Attacks mainly the growing points of the plant causing stunting, leaf and shoot deformation. Severe damage leads to tuber quality deterioration.

Control: Use clean and resistant varieties like Nase 1. Biological control is also being tried in some districts.

Cassava green mite: It is a sucking pest which leads to reduces growth, scorching of leaves, tiny leaf production, leaf fall and eventually a plant without leaves. This causes great yield reduction or loss.

Control may be through;

- Use of resistant varieties
- Biological control using predator mites
- Crop rotation
- Planting early at the onset of rains
- Other pests include wild pigs and termites.

(ii) Diseases

- The cassava Mosaic Disease (CMD) is the most feared virus disease at the moment. It causes reduced leaf size, malformed and twisted leaves with yellow areas separated by areas of normal green color. Severely affected plants are stunted. Yield loss due to CMD depends on the stage at which the plant is infected and severity of symptoms. The disease is transmitted by the white fly.

Control

- Roughing infected plants
- Use of resistant varieties
- Use of clean planting materials

Cassava Brown Streak

This is another virus disease but is less damaging than mosaic causing brown streaks on green stems. The marks remain and appear as sunken areas on mature stems. The disease is controlled in the same way as CMD.

Harvesting, yields and post harvest handling

1. Cassava takes 8 – 36 months to mature depending on the variety.
2. Yields also vary depending on variety and soil type. Average yields are 10 – 30 tons/ha.
3. Cassava harvesting may be done piecemeal (one by one) or by uprooting whole plants. A stick or hoe may be used to remove the tubers.
4. Cassava cannot be stored fresh for a long time. It is therefore sliced and dried in the sun. In this dry form, it can be kept for long periods of time in a dry bag in a place such as granary or other food stores. The dry cassava may also be pounded into flour which can be stored for a long period of time in a dry place.

Yield

Yield of 25 t/ha and above can be obtained with good agronomic practices and management.

Cost of production

To reduce cost of production and attain high yields, it is recommended that land preparation be fully mechanized. A power tiller can be used if the total land area under cultivation is not more than 250ha

Production cost for one hectare of cassava to ensure yield of 25 t/ha and above.

Sl. No.	Particulars	Production cost in Rupees
1	Land preparation	10,000.00
2	Cassava cuttings (60 bundles @ N300/bundle)	18,000.00
3	Planting (10 pd* at N700/pd)	7,000.00

4	Pre-emergence herbicides (5 liters at N1000/l)	5,000.00
5	Fertilizer (20:10:10, 9 bags at N2500/bag)	22,500.00
6	Insecticides (2 liters at N1000/l)	3,000.00
7	Application of herbicide	3,000.00
8	Application of insecticide	3,000.00
9	Application of fertilizer (8 pd at N700/pd)	5,000.00
10	One weeding (20 pd at N700/pd)	14,000.00
11	Harvesting (35 pd at N700/pd)	24,500.00
	Total	115, 000.00

* pd = person days. Farm labor wage rates vary by location

Note: Fixed capital investments are not included. Such capital investments include knapsack or boom sprayers, tractors or power tillers, stem cutters, planters, and harvesters. With planters and harvesters, manual labor use can be minimized.

Conclusion

Cassava is grown under many complex and diversified production systems where technology prefernecces and multifarious to suit different socio-economic production systems and objectives. It is necessary to have technology assessments under a wide range of agro-climatic situations through farmer participatory research. However, with better management practices good crop can be harvested.

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In-Vitro Micrografting Technique For Crop Improvement

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Introduction

Micrografting, an *in-vitro* grafting approach, is comparatively a recently developed vegetative propagation technique for propagating plants by grafting miniaturized scions under axenic conditions of culture. Micrografting involves the fusion of small pieces of tissue, either in vivo or *in vitro*. It is a cost-effective and economical technique which facilitates the growers to distinguish incompatibility in a couple of weeks instead of years which are often required to observe incompatibility in vivo, disease indexing, histological studies, producing plants resistant to soil borne pathogens and multiplication of plants difficult to root.

Micrografting is a technique which involves the placement of meristem or shoots tip explant on a decapitating rootstock grown aseptically from seed or micropropagated culture. The progress and shortcomings of the technique is largely dependent upon the compatibility responses that occur between grafting tissues. It pools the benefits of grafting and shoot tip culture thus overcoming certain limitations. It comprehends grafting inability and physiological rejuvenation as an essential requirement for mass clonally propagating mature selected genotypes.

Special techniques have been exploited to increase the rate of successful micrografts by using by using growth regulators, increasing sucrose level, etiolation treatments, silicon tubes etc as it has an enormous potential for improvement and multiplication of horticultural crops at a large scale.

The small shoot apices are transferred onto rootstocks either *in vitro* or in vivo. Navarro in 1988 listed four uses of this technique found to be profound:

Production of virus and viroid free plants

- A method to separate virus and virus-like organisms in mixed infections
- Predictions of incompatibility between scions and rootstocks, and the histological study and physiological aspects of grafting
- Germplasm exchange with a minimum risk for importing plant material through quarantine between countries.

Micrografting stages

The protocols have been standardised separately for the scion and rootstock to grow under *in vitro* conditions.

1) Multiplication and establishment of scion

The meristem tips are collected from actively growing shoots from field, greenhouse or *in vitro* chambers. Explants such as apical shoot tips or nodal cuttings are established in aseptic conditions. The microshoots are transferred to shoot proliferation media to increase the development of auxillary shoots. The microshoots possessing desired thickness, age and length are used as scion for *in vitro* grafting operation.

2) Multiplication and establishment of rootstock

Newly germinated seedlings, rooted cuttings or micropropagated shoots can be utilized as rootstocks. While using the seedling rootstock, all the various stages of grafting, are conducted under aseptic conditions (*in vitro*) and the surface sterilised seeds germinate aseptically in vessels comprising of nutrient solutions such as MS media. To encourage the growth of the branched root system, the seedlings are grown on agar media or on a porous substrate with sterile vermiculite.

3) Development of rootstock and scion for micrografting

Surface placement method is adopted where the top of the seedling rootstocks are cut just above the cotyledon or the micropropagated shoot and placed on small shoot apices over the exposed surface of decapitated rootstock in a manner such that the cambium layers of cut surfaces coincides with each other. For an appropriate union and callus formation, a firm contact between rootstock and scion is vital. To hold the grafts together, several sophisticated techniques such as translucent silicon tubing, elastic strip, filter paper bridge, and glass tubing, nylon bands, aluminium foil tubes, dual layer apparatus of aluminium foil and absorbent paper. When the graft union is successful then rootstock and scion grows together to produce desired plants which are examined regularly and the adventitious shoots arising in the graft reunion are removed. (Hussain *et al*., 2014)

In an experiment, conducted by Zang *et al.,* 2015 watermelon inbred line A7 were used. The Seedlings were cultured for 3 weeks and hypocotyls used as rootstocks. The regenerated shoots of watermelon (D66) cotyledon were used as scions. When incubated for over 45 days, adventitious shoots were cut for grafting. The number of successfully grafting seedlings was counted after 10 days of culture. Shoot tips excised from *in vitro*-raised seedlings were micro-grafted onto rootstocks. Twenty micrografted seeldings were decapitated in each treatment using almost uniform microscions and rootstocks and the graft union was done by using cleft grafting and top hole insertion grafting. It was reported that the survival rate of top hole insertion grafting was higher compared to cleft grafting. The wound healed three days later and the micrografted seedlings survived after 10 days since being grafted.

Advancement in micrografting techniques

Micrografting is a time consuming technique of producing plants and predominantly results into low rate of successful grafts. Technical expertise is essential to device successful grafts using small-scale materials by handling the challenges by preserving delicate graft unions. The failure of the grafts prepared *in vitro* is due to-

a) Browning or blackening of tissue due to exudation of phenolic compounds from cut surface which inhibits growth and development of new cells resulting into death of new scions.

b) Sucrose concentration of the medium

c) Light and dark incubation treatment which leads to significant variation in percentage of successful graft formation.

d) Poor contact between stock and scion

These limitations can be alleviated by using superior technologies along with the use of growth regulators such as auxin and cytokinin for a higher survival rate of grafts, nature of supporting media such as liquid media and vermiculite, preventing desiccation of grafts by using moist agar gel to establish a better connection between grafting partners, proper selection and treatment of the viable apex and suitability of rootstock for mass multiplication.

Implementation of micrografting technique

a) To eliminate virus and viroids: Genetically certified and uniform virus free plants could be produced easily on a commercial scale under controlled environment through micrografting. Micro-shoot tips of size less than 05mm as scions produced virus free plants and were found to be reproductively mature.

b) **Producing plants resistant to pest and diseases:** Micrografting can be used successfully as an efficient method for procurement of plants free from soil borne pathogens.

c) **Assessment of graft incompatibility :** This procedure helps to determine histological, histochemical and other physiological parameters of graft incompatibility between scion and rootstock. Histological study exhibits callus formation and differentiation along with vascular connections. The an atomical study depicts poor vascular connection, phloem disintegration and discontinuity after the establishment of grafts. (Darilova *et al.,* 2011)

d) **Mass multiplication of superior plants:** Micrografting helps in enhancing the productivity by the formation of successful grafts due to superior rootstock and scion combination which can be achieved in tissue culture laboratories.

e) **Safer exchange of germplasm:** The propagated plants could be easily and conveniently exchanged between the countries due to production of virus free plants and those free from pest and diseases.

Study of compatible graft

1) Vascular redifferentiation was observed in *Lycopersicon esculentum* where indole-3-acetic acid (IAA) was applied on the apical end of the grafted internode to produce callus tissue and initiate the formation of vascular tissue.

2) Grating of unwounded callus mass of *Sedum telephoides* and *Solanum pennellii* were allowed to grow in the culture media to promote callus mass interdigitation.

Conclusion

In vitro micrografting system are of utmost importance as it would lessen the time interval and space required to grow horticultural crops free from diseases and pests and thus improving productivity by adopting efforts to determine graft compatibility. The technique would help to examine numerous botanical problems, issues related to nitrogen fixation, flowering, fruiting and thus the growth. Other tissue culture techniques so incorporated would help to determine some aspects related to graft compatibility.

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Organic Farming - The Future of Agriculture

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Introduction

Agricultural soil has been adversely affected for increased food production. Extensive use of chemical fertilizers, pesticides and heavy machinery resulted in exploitation of commercial inputs, food and soil quality. Its impact on human health has also been emerged in the form of different nutritional deficiency disorders. Thus, creating a unique environment for biologically active soil has sprinkled since green revolution, because most of the soil does not respond towards productivity. Moreover, human health is becoming a challenging issue day to day.

To obtain quality food production and buildup of health is urgent need as health of citizens is of prime importance in the overall development of the nation which is achievable only with nutritive food. It has shifted Indian Agriculture from a step of food deficiency to food sufficiency, but due to high and injudicious use of chemicals, fertilizers, pesticides we happen to suffer from serious pest problems i.e., water holding capacity (WHC) of soil, soil fertility column. Besides all these problems have resulted in nutritional deficiency in the food although production is in bulk.

The nutrient need of organic agriculture mainly depends on on-farm inputs which are safe and locally available. In this regard, crop residue plays a critical role in nutrient transformation, soil health and for sustaining the productivity of soils and to minimize the cost of cultivation which is beyond the farmer's reach, low cost organic inputs respondent to soil health and crop productivity. Environment in the largest sense is the complex network of Physical, Chemical, Biological and Ecological components that make up the natural world. Human activities commonly affect the distribution, quantity and quality of every environmental aspect be it: Soil, Air, Water . At this point in time, a keen awareness has sprung on the adoption of "Organic Farming" as a medication to cure the ills of modern chemical agriculture.

"Organic agriculture is a production system sustaining the health of soil, ecosystems and people. It depends on ecological processes, biodiversity and cycles adapted to local conditions, instead of using inputs with adverse effects. Organic agriculture unites tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality life for all involved". Organic farming system focuses for enhancing the soil properties, minimizing food chain associated health hazards and attaining closed nutrient cycles, the key factors for sustainable agriculture.

Over conventional organic agriculture

Organic agriculture relies solely on natural processes for input and recycles nutrients on-site to eliminate the use of non-renewable resources it is relatively small-scale, with independent operations and strictly limiting the use of purchased fertilizers, pesticides, plant growth regulators such as hormones, livestock antibiotics, food additives, and genetically modified crops and other inputs. Organic agriculture is a system that uses ecologically based pest controls and bio fertilizers derived largely from animal and plant wastes and nitrogen fixing cover crops also reduces soil erosion, decreases nitrate leaching into ground water and surface water. Modern Organic agriculture was developed as a response to the environment harm caused due to the conventional farming, and has numerous ecological benefits, research shows that organic products have more minerals, less water and less artificial chemicals usually containing higher level of Vitamin C, protein and other minerals. Alternatively, conventional agriculture requires an incredible amount of energy to produce, prepare, and transport food and at a large scale, often owned or economically tied to major food corporations intensive chemical programs and the excessive usage of agro-chemicals over years like pesticides and fertilizers has distressed the soil health and lead to declining of crop yields and quality of products. Hence, a natural balance needs to be maintained at all cost. The obvious choice would be judicious use of agro-chemicals and more and more use of naturally occurring material in farming systems. However, a 2019 report specifies that organic food is far less likely to contain pesticide residues than conventional food (13% of organic produce samples vs. 71% of conventional food produce samples contained a pesticide residue, when long banned persistent pesticides were excluded).It is significantly more profitable than conventional agriculture and can expand globally.

Goals and objectives of organic farming

The global umbrella organization for organic agriculture, The International Federation of Organic Agriculture Movement (IFOAM) was founded by five organizations from the three continents, Europe, the USA and Africa in 1972 in Versailles, near Paris. The key characteristics and practices of organic farming to be followed:

- To ensure best possible utilization of natural resources for short-term benefit and help in preserving them for future generation.
- To increase and lead to better, more and nutritive yield.
- To reduce human and animal health hazards by reducing the level of residues in the product.
- To nurture and improve biological cycles within the farming systems by improving granulation, good tilth, good aeration, water holding capacity, soil microbial load.
- To maintain environment health and elude all forms of pollution.
- To maintain genetic diversity.
- To improve the soil's chemical properties such as supply and retention of soil nutrients and promote favorable chemical reactions.
- To deliver qualitative food keeping agricultural production at higher level and making it sustainable.

Methods and Techniques

Plants need a well-balanced diet, for the better growth and yield. So, providing a cost effective, simple, easy to produce, suitable production technology, organic farming method strikes balance between what is taken out of the soil with what is returned to it, without relying on outside inputs. It does not lead to the release of synthetic pesticides into the food supply or the environment, but it does allow a few so called natural pesticides, such as those derived from plants for which enhancing soil health is the cornerstone of organic farming. The soil has to hold the organic matter and create conditions for microorganisms to work on it to release nutrients, it is basically the conversion of soil from 'non-living' to 'living'. To sustain life in soil, several techniques are involved like conversion of soil and moisture, maintenance of soil organic matter. Farmers should practice:

Green manuring which increases water holding capacity, decrease soil erosion, weed proliferation and helps in reclamation of alkaline soils.

Compost making, a rich source of organic matter, it improves the physico-chemical and biological properties of the soil making it more impervious to stresses such as drought, diseases and toxicity, possesses an active nutrient cycling activity because of vigorous microbial activity consequently promoting higher yield and higher quality of crops.

Vermicompost is rich in beneficial micro flora such as a fixers, P-solubilizers and in all essential plant nutrients encouraging plant growth, improves soil structure, texture, aeration. It contains valuable vitamins, enzymes and hormones like auxins, gibberellins etc., and have tremendous prospects in converting agro-wastes and city garbage into valuable agricultural input. It also reduces the incidence of pest and diseases.

Use of bio-fertilizers is efficient as they speed up certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants, increases the enzymatic activity since contamination is nil. They are cost effective and renewable source of plant nutrients to augment the chemical fertilizers for sustainable agriculture.

Once that is achieved the soil it will be able to take care of itself with less maintenance cost and minimum external inputs also promoting natural techniques such as crop rotation, animal manure, off-farm waste, crop residues, plant protection and nutrient mobilization.

Profitability of organic farming globally

Organic farming, in general, is much more profitable than conventional farming. In developing countries, the profit margin is much more for organic farms because they have better yields and higher prices than conventional but are much greater under less favourable conditions. Since 1990, the market for organic food and other products has grown speedily, reaching \$63 billion globally in 2012. As of 2019, approximately 72,300,000 hectares worldwide were farmed organically, demonstrating approximately 1.5 percent of total world farmland. In India the organic food market is approximately of INR 5.6 billion and is in an emerging opportunity for generation of employment and income at village level. In 2016 the overall area under organic farming in India stood at 1,490,000.00 ha. Presently India ranks 33rd in terms of entire land in organic cultivation and 88th in terms of the ratio of agricultural land under organic crops to total farming area. Today the land under organic cultivation is 4.43 million hectares and is growing at steady rate. India is home to 30 percent of the total organic producers in the world, but accounts for just 2.59 percent (1.5 million hectares) of the total organic cultivation area of 57.8 million hectares, according to the World of Organic Agriculture 2018 report.

The markets for organic products in North America and Europe are very strong, in 2001, estimated to have \$6 and \$8 billion respectively of the \$20 billion global market. Europe farms 23 percent of global organic farmland (6,900,000 ha 17,000,000 acres), followed by Asia has 9.5 percent while North America has 7.2 percent. Africa has 3 percent. Besides Australia, the countries having the most organic farmland are Argentina (3.1 million hectares - 7.7 million acres), the United States (1.6 million hectares - 4 million acres) and China (2.3 million hectares - 5.7 million acres). Argentina's most of organic farmland is pasture, such as Australia. Spain, Germany, Brazil (the world's largest agricultural exporter), Uruguay, and England follow the United States in the amount of organic land. Globally, organic farming is between 22 and 35 percent more profitable for farmers than conventional methods, according to a 2015 meta-analysis. Farming suffers environmental, health and social costs. Organic agriculture faces an unfair competition in the market place due to the upshot of current subsidy schemes favouring conventional production. So, increase in investment in green agriculture is projected to lead to growth in employment of about 60 per cent compared with current levels and that green agriculture investments could create 47 million additional jobs as many farmers are finding opportunities in organic food production. It will provide ample opportunity for employment and bring prosperity and peace in the nation. So, there is urgent need for favourable policy initiatives to strengthen this sector.

Suggestions to promote organic farming

Organic farming is a freshly emerging concept with massive success and used to increase profits. The most valuable market opportunities we can create are those that benefit people like producer, entrepreneurs, employees or consumers who are living in poverty, creating financial mechanism and market structures with low cost and hassle-free certification. Well-developed domestic market circuits – contracts, contacts, information, pricing should be set up. The Indian government will offer capital Investment subsidy for organic farmers. It is offered through the National Centre of Organic Farming (NCOF) under the Department of Agriculture and Cooperation with the National Bank of Agriculture and Rural Development (NABARD). The prime objective is to readily attainable organic resources for improving from productivity without letting soil health. Organic farming mainly includes the cultivation of plants and rearing of animals in natural means, prioritizing nutritional benefits to enable healthy diets.

Conclusion

Organic Agriculture differs from conventional agriculture not only gradually but fundamentally. Instigating organic methods consequently seems to deliver a new quality in how the agro-ecosystem works. Organic agriculture is one of several way to sustainable agriculture and many techniques used e.g. Inter-cropping, rotation of crops, mulching, digging, integration of crops and livestock practiced under several agricultural systems. Organic farming seems like to improve soil fertility in a way and to a point which cannot be achieved by conventional farming even if the later consistently respects some ecologically principles.

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Scientific Care and Management of New Born Calf in Winter Season

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Introduction

The future of a stock depends upon care and management of the newborn calf. In cattle rearing, good dairy herds are raised rather than purchased. The care and feeding of calves truly before they are born immediately after birth, any membrane or mucous adhering to the mouth, nostrils, eyes and ears of the newborn should be carefully removed to facilitate normal breathing. Use a clean dry cloth for this. In dairy cattle a cow will lick her calf dry. Licking can be induced by sprinkling a little common salt on the calf's body. In total weaning, a calf should be throughly cleaned before shifting it to a warm, well ventilated house.

If the calf's temperature is between 35 to 38ºC this is borderline hypothermia. Below 35ºC you've got to quickly warm that calf. For the ones between 35º and 38º degrees you can probably just put them in a warm room, a hot box, the cab of your truck anyplace warm and tube them with warm colostrum and they will be fine." The warm colostrum helps to warm them from the inside and the high fat content provides energy to create body heat. You don't want the colostrum too hot, but it needs to be cow body temperature.

How to care for a newborn calf

The winter season has started after arrival of November in India. During the first two to three hours of life, calves are unable to regulate body temperature and even a normal calf can become hypothermic quickly if weather is cold. "Those chilled calves are unable to get up, unable to suckle, so they don't get colostrum — and this compounds the problem. Even if they survive, they are likely to get sick later," says Campbell. "One of the rancher's most valuable tools is a digital thermometer, especially when calving in cold weather. These are inexpensive, and a far better indicator of body temperature than just feeling the calf's mouth. If the calf's temperature is higher than 38ºC (about 100ºF) it's normal enough. You still might need to worry about ears freezing, but the calf is not at risk for severe cold stress,"

The cow does a neat job of licking the calf dry and stimulating its circulation and respiration with hard liking. However, some time primiparous cows may be nervous and inexperienced, or it may be that the cow is exhausted after a prolonged labour. Under such circumstances, the husband's man should assist by removing the phlegm (mucus) from the nostril of the newborn calf and wipe it dry with a clean towel. He should also massage the calf vigorously for same time with a handful of straw rolled in to a ball.

Sometimes the respiratory passage of the calf may be blocked by mucus which may cause death due to choking if unattended. On noticing such a condition, immediate attention is needed as described below

1. Hold the calf head down by lifting it holding the hock. The phlegm may flow off.

2. Take a twig of hay or grass and tickle inside its nostrils. The calf will sneeze and expel the mucus.

3. If the above methods fail, little time is left to lose. The attending person should apply his mouth to the nostrils of the animal and suck out the mucus. After that he should blow in his expired air through the calf's nostrils closing its mouth. Carbon dioxide in the expired air which has been blown-in the lungs of the calf will act as a respiratory stimulant to initiate respiration. This should be followed with intermittent pressing and releasing of pressure on the chest wall of the calf to give artificial respiration.

During winter season in North India and other colder parts of the country, the calves need some provision of warmth. If the calving takes place on a sunny winter day just allowing it to bask in the sun is all that is needed. Otherwise, the calf may be shifted to a protected pen with plenty of dry bedding.

Attending to the navel of young once is very important as infections gaining entry through the navel at the time of calving can cause serious ailments like navel ill, joint ill etc., which can debilitate and cause mortality. The calf's navel should be painted with antiseptics like tincture of benzoin or tincture of iodine soon after birth to prevent this. If the umbilical cord is not broken, a ligature may be put 2-3 cm away from the body with a sterile thread and cut 1 cm distal to the ligature with a clean sterile scissors. A small amount of antiseptic lotion may be painted at the cut end and protracted from flies and crows.

Feeding of colostrum:

1. Colostrum, or first milk produced by the mother after birth, is high in nutrients and antibodies. A newborn calf lacks disease protection because antibodies do not pass across the cow's placenta to the fetus' circulatory system. Antibodies in colostrum provide calves with their initial protection.

2. A new born calf should be given 2 liters of colostrum within the first 2 hours of birth and 1-2 liters (based on size) within 12 hours of birth.

3. A calf must receive adequate colostrum to protect it from diseases for the first three month of its life. Colostrum is the calf's passport to life

4. General schedules are worked out for feeding calves economically from birth, giving milk allowance up to 60 days of age. The basis of calculation of milk allowance is 1/10 of body weight for the first 3 weeks and 1/15 of body weight for the next 2 weeks and 1/20 of body weight subsequently.

Composition of colostrum and milk

Constituents	Colostrum (%)	Milk (%)
Total	28.30	12.86
Ash	1.58	0.72
Fat	0.15 to 12.0	4.00
Lactore	2.50	4.80
Casein	4.76	2.80
Albumin	1.50	0.54
Globulin	15.06	-
Total protein	21.32	3.34

Source: Petersen, W.E. 1950 Dairy Scince, 2nd Ed. J.B. Lippincolt Co. Philadelphia.

Conclusion

A good heifer can be gotten by taking good care of the newborn in winter, which means a good profit for the farmer, therefore, focus on the above-mentioned practices so that a good profit is gained by the dairy farm.

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Brief Descriptions and Holistic Cultivation of Field Pea

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Introduction

Pea is the English name. Various names are using as a synonym for pea in Indian local languages *i.e.,* Muttar (Hindi), Motor (Bengali, Assamese), Badachana (Oriya), Paltaani (Tamil), Desavati, Batani (Telgu), Vatana (Gujrati, Marathi) and Mattri (Punjabi).

In the UK, Pea was grown for vegetable in the middle ages. In America, pea was introduced soon after Columbus and later on a winter type pea was introduced from Austria in 1922. Pea was taken to China in the first century.

Probably, pea originated in south-western Asia and spread to the temperate zones of Europe. But, on the basis of genetic diversity, four centers (Central Asis) of pea origin have been recognized. Some archaeological evidence of the use of field peas dating from 8000 BC has been found in Fertile Crescent. The first cultivation of peas appears to have been in Western Asia from where it spreads to China and India. Some Greek and Roman authors also mentioned its cultivation as a pulse and fodder crop. Pea domesticated about 10,000 years ago.

Uses

Pea is in the group of foods known as legumes and increadible source of nutrients. Legumes like pea are also reffered to a poor man's meat as they are good souce of proteins. This crop is also plays a recoginzed role in restoring soil fertility.

Fig. Various recipes with green pea

Nutritive value

Components	Amount (per 100 g)
Fat	00.10 g
Protein	22.50 g
Carbohydrate	62.10 g
Fibre	04.00 g
Copper	00.23 mg
Calcium	20.00 mg
Iron	01.50 mg
Magnesium	34.00 mg
Phosphorus	13.90 mg
Potassium	79.00 mg
Sodium	07.80 mg
Sulphur	95.00 mg
Vitamin A	139 IU
Riboflavin	07.20 mg
Thiamine	00.25 mg
Vitamin C	09.00 mg
Nicotinic acid	00.80 mg
Oxalic acid	14.00 mg
Moisture	72.00 g
Calories	93.00

Source: Das (2013)

Area and Production

The major field pea producing countries are Russia, China, followed by Canada, Europe, Australia, United States raise over 4.5million acres are major exporters of peas. In India pulse crop occupy an area of about 29.81 million ha with production 25.42 million tonnes and productivity about 8.53 q/ha (DES,2017-18). In Uttarakhand pulse productivity is 8.74q/ha(DES 2017-18) and about 7.7% are under irrigated pulses. Pea (*Pisumsativum-vararvense*) is 3rd most important pulse crop of India grown throughout the country. It is grown as winter vegetable in the plains of Northern regions and as summer vegetable in hills. Major.Pea producing states are Uttar Pradesh (49%), Maharasthra, Madhya Pradesh and Bihar.

Botanical Description

Pea plant is an annual herbaceous legume that belongs to family Fabaceae. This family is also known as pea family. Pea plant can be bushy or climbing with slender and hollow stems which attach to a substrate using tendrils with tap root system with nodules on the surface.

Roots

Pea plant has branched tap root system having root nodules due to presence of nitrogen fixing bacteria. First and second order lateral roots appear acropetally on the taproot. The root system of the legumes is less extensive than that of cereals. At every developmental stage, most of the roots (up to 90%) are located in the upper soil layer.

Pea nodules arise from cells adjacent to the root pericycle. *Rhizobium legumino-sarum*bv. *vicae*live saprophytically in soil and attracted towards the plant rhizosphere.

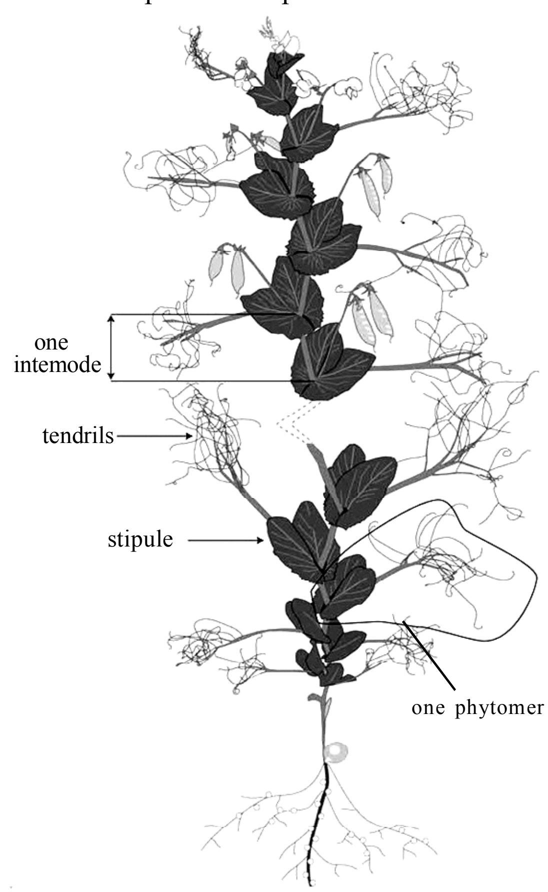


Fig. Botanical description of pea plant

Stem

Stems are erect and climbing, one to three feet high, young stems densely pubescent, somewhat angular, and herbaceous, green and branched.

Phytomers constitute the stem which acts as the functional unit of the pea plant. It consists of an internode, a leaf and an axillary meristem.

Leaves

Alternate, petiolate, stipulate, stipules 1/4 to 1/2 inch long attached near the base, compound leaflets dark green, entire, acuminate, and pubescent on both the sides, reticulate venation. Leaves are in three pair of leaflets and the terminal one is modified into a branched tendril.

Inflorescence

The flower inflorescence of pea is known as Racemes. Flower may be reddish, purple and white in colour. The white colour of flower is due to presence of fewer pigments. Flower contains about 5 Sepals and 5 petals. !0 stamens are present in which nine stamens are fused to form a bundle and 10^{th} one is posterior and free.

Flowering usually begins 40-50 DAS. Flowering is normally 2-4 weeks depending on the flowering habit and weather during flowering.

Fruit

The fruit of pea plant is known as legume.When a legume has one or two seeds, it is also known as pod. Each legume can range in size from 4-15 cm long 1.5- 2.5cm wide. Each legume contains 2-10 seeds.

Seed

Seeds are globose or angled, smooth or wrinkled, whitish, grey, green or brownish.

Genetical Description

Mendal was choosing pea as an experimental model. He was not just a botanist and plant breeder. He was the first to apply calculus of ratios to a biological situation. He began his study on a total of 34 distinct varieties of pea. On the basis of these findings, Mendal proposed the two fundamental principles of genetics, the *law of segregation* and the *law of independent assortment.*

Pea is diploid with chromosome number 2n=14. There are mainly 3 types of peas that are commonly eaten:

1. Garden or Green pea (*Pisumsa-tivum*L.).
2. Snow peas (*Pisumsativum var. Macrocarpon).*
3. Snap peas (*Pisumsativum var. Macrocarpon ser. Cv.)*

In peas induced tetraploids were develop by colchicine treatment of seeds and seedlings. The induced auto tetraploids had low fertility but with increased seed content (11.1- 21.7%). However auto tetraploids were not useful for cultivation.

Cultivation

Sowing time and soil

In India Field pea is sown in month of October to 1^{st} fortnight of November as it is a cool season crop and it can be grown in variety of soil but a well-drained loamy soil free from excessive soluble salts with pH range of 6.5-7.5 is suitable for successful cultivation of the crop.

Seed rate

Seed rate required for tall varieties is 70 - 80 kg/ha and dwarf varieties is 100 kg/ha. Field pea can be sown at depth of 4-5cm with spacing 30×10cm.

Cultivars

Rachana, Indra (K.P.M.R.-400), Shikha (K.F.P.D.-103), Malviya Matar-15, Malviya Matar-2, J.P.-885, PusaPrabhat (D.D.R.-23), Pant Matar-5, Adarsh (I.P.F.-99-15), Vikas (I.P.F.D.-99-13), Jay (K.P.M.R.-522), Sapna (K.P.M.R.-144-1), Prakash, Hariyal, Paalthi

Matar, Pant P.-42, Aman, I.F.P.D.-10-12.

Irrigation

It is grown in rainfed/unirrigated conditions on residual soil moisture. One or two irrigation at 45 DAS and if needed at pod filling stage may be the best recommended irrigation schedule.

Nutrient management

In field peas the recommended dose of nitrogen (20-30 kg/ha), phosphorus (40-60 kg/ha) and potassium (20-30kg/ha) required. 20 kg sulphur per ha is best suited for better growth and fungal diseases. Use the FYM or vermi compost for maintenance organic content and good soil health.

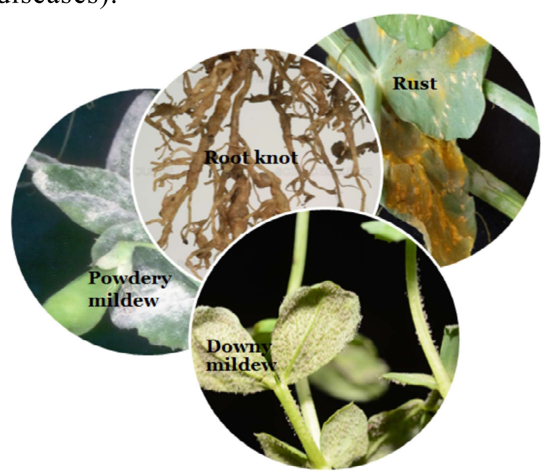
Plant protection measures

Weed management

Weeds are unwanted and undesirable plants which compete with main crop plants for space and nutrition. Main weeds of pea crop are *Chenopodium album, Phalrious minor, Avenaludoviciana,Anagallisarvensis*, *Convolvulus arvensis*, *Melilotusalba, Fumariaparvifolia*, *Galiumaparine*, *Medicago denticulate*, *Phalaris minor*, *Poaannua*, *Polygonum convolvulus*, *Rumexdentatus*, *Spergulaarvensis*, *Stellaria media*, *Trigonellapolycerata*, *Lepidiumsativum and Cyperusrotunds.* The field pea should be free from weeds for the period of 40-45 DAS. Integrated approach of weed management is always welcomed. Chemical strategy integrated with sowing strategy, crop rotation, biological management and hand weeding which increase crop yield.

Diseases management

Pea crop is adversely affected by number of diseasesMain diseases in pea are wilt-*Fusariumoxysporum*f. sp. *pisi*, Fusarium root rot-*Fusariumsolani*f. sp. *pisi* and damping off/ seedling rot-*Rhizoctoniasolani, Pythium*spp. (soil borne fungal diseases); pea cyst nematode-*Heteroderagoettingiana*, root knot-*Meloidogyne incognita*androot lesion nematode-*Pratylenchuspenetrans* (nematode diseases); gray mould-*Botrytis cineria* (IPS) and *Sclerotiniafuckeliana* (PS),Powdery Mildew-*Erysiphepisi,* downy mildew-*Peronosporaviciae,* white mould-*Sclerotiniasclerotiorum*andrust-*Uromycesfabae* (air borne fungal diseases); bacterial blight-*Pseudomonas syringae*pv. *pisi*andbrown spot-*Pseudomonas syringae*pv. *syringae* (bacterial diseases); Alfalfa mosaic disease-AMV, Bean leafroll disease-BLRV, Pea enation mosaic-PEMV, Pea streak disease-PeSV, Red clover vein mosaic-RCVMV and Pea seed borne mosaic-PSbMV (viral diseases).



The management of disease can be done through cultural *i.e.,* crop rotation, changing in sowing date, destruction of plant debris, soil solarization, use of resistant cultivars; chemical and biological management. Cultural and biological strategies are mostly effective at initial stage, specially at sowing time of crops and they can not manage the disease in standing crop and even after appearance of disease. Use of resistant cultivar is also reasonable and easy method for disease management but due to development of new strain among the pathogens, resistant may be break down to susceptible one.

Chemical strategy is very effective but also delicate to environmental pollution, residual effect in grain and killing the non-target organisms. Development of fungicide resistance in plant pathogens is a major obstacle of chemical strategy when use continuous and separately. Therefore, all the methods have some limitations and draw back and due to least efficiency of single strategy of disease management, integration of various strategy (Integrated Disease Management= IDM) is the foremost need for management of plant disease in near future of agriculture. IDM act as safeguarding against the longer term risks of environmental pollution, hazard to human health and reduced agricultural sustainability.

Harvesting and Yield

Field pea should be harvested when they are fully ripe and threshed after sufficient drying in the sun. Field peas should be combined with seed moisture of 14-20%. The clean seeds should be sun dried for 3 to 4 days to reduce the moisture content up to 9-10% to be safely stored in appropriate beans. With improved package of practices, field peas can produce 20-25q/ha of grain and straw (irrigated) and 10-15q/ha in rainfed conditions.

Insect management

Main insects of pea are semilooper (*Thysanoplusiaorichalcea*), pod borer (*Helicoverpaarmigera*), aphids (*Acyrthosiphonpisum*), stem fly (*Ophiomyiaphaseoli*) and pea leaf miner (*Chromatomyiahorticola*).

Insect pests should manage by IPM (Integrated Pest Management) strategy just like IDM (Integrated Disease Management).

Insect pests of pea

Order	Family	Insect pest	Common name	Affected host part	Crop stage
Lepidoptera	Noctuidae	*Thysanoplusia orichalcea*	Semilooper	Leaves	Pod formation-pod maturity
		Helicoverpaarmigera	Gram pod borer	Pods	Pod formation-pod maturity
Hemiptera	Aphididae	*Acyrthosiphonpisum*	Aphid	Sap sucker on leaves, shoot	Vegetative
Diptera	Agromyzidae	*Ophiomyiaphaseoli*	Stem fly	Stem	Seedling-vegetative
		Chromatomyiahorticola	Pea leaf miner	Leaves	Vegetative-pod maturity

Yadav and Patel (2015)

Conclusion

The present article briefly describes the uses, ecofriendly crop production and protection of peas along with physiological characteristics. Pea is the *Rabi* crop can be crow for multi-purpose like vegetable, pulse, fodder etc. For production and protection of pea, mostly strategies are used as safeguarding against the longer term risks of environmental pollution, chemical hazards to human health and reduced agricultural sustainability.

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New Innovations of Improving Agriculture

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Introduction

Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

Problems in Agriculture

"Slow agricultural growth is a concern for policymakers as some two-thirds of India's people depend on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and almost universal lack of good extension services are among the factors responsible.

Farmers access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation. With a population of just over 1.2 billion, India is the world's largest democracy. In the past decade, the country has witnessed accelerated economic growth, emerged as a global player with the world's fourth largest economy in purchasing power parity terms, and made progress towards achieving most of the Millennium Development Goals. India's integration into the global economy has been accompanied by impressive economic growth that has brought significant economic and social benefits to the country.

Technological Needs and Future Agriculture

It is apparent that the tasks of meeting the consumption needs of the projected population are going to be more difficult given the higher productivity base than in 1960s. There is also a growing realization that previous strategies of generating and promoting technologies have contributed to serious and widespread problems of environmental and natural resource degradation. This implies that in future the technologies that are developed and promoted must result not only in increased productivity level but also ensure that the quality of natural resource base is preserved and enhanced. In short, they lead to sustainable improvements in agricultural production. Productivity gains during the 'Green Revolution' era were largely confined to relatively well-endowed areas. Given the wide range of agro-ecological setting and producers, Indian agriculture is faced with a great diversity of needs, opportunities and prospects. Future growth needs to be more rapid, more widely distributed and better targeted.

Responding to these challenges will call for more efficient and sustainable use of increasingly scarce land water and germplasm resources. New technologies are needed to push the yield frontiers further, utilize inputs more efficiently and diversify to more sustainable and higher value cropping patterns. These are all knowledge intensive technologies that require both a strong research and extension system and skilled farmers but also a reinvigorated interface where the emphasis is on mutual exchange of information bringing advantages to all. At the same time potential of less favoured areas must be better exploited to meet the targets of growth and poverty alleviation. These challenges have profound implications for products of agricultural research. The way they are transferred to the farmers and indeed the way research is organized and conducted. One thing is, however, clear – the new generation of technologies will have to be much more site specific, based on high quality science and a heightened opportunity for end user participation in the identification of targets. These must be not only aimed at increasing farmers' technical knowledge and under standing of science based agriculture but also taking advantage of opportunities for full integration with indigenous knowledge. It will also need to take on the challenges of incorporating the socio-economic context and role of markets. With the passage of time and accelerated by macro-economic reforms undertaken in recent years, the Institutional arrangements as well as the mode of functions of bodies responsible for providing technical underpinning to agricultural growth are proving increasingly inadequate. Changes are needed urgently to respond to new demands for agricultural technologies from several directions. Increasing pressure to maintain and enhance the integrity of degrading natural resources, changes in demands and opportunities arising from economic liberalization, unprecedented opportunities arising from advances in biotechnology, information revolution and most importantly the need and urgency to reach the poor and disadvantaged who have been by passed by the green revolution technologies.

The most advanced agricultural technologies employed today

1. Tractors on autopilot

Thanks to GPS tractors, combines, sprayers and more can accurately drive themselves through the field. After the user has told the onboard computer system how wide a path a given piece of equipment will cover he will drive a short distance setting A & B points to make a line. Then the GPS system will have a track to follow and it extrapolates that line into parallel lines set apart by the width of the tool in use. These systems are capable of tracking curved lines as well. The tracking system is tied to the tractor's steering, automatically keeping it on track freeing the operator from driving. This allows the operator to keep a closer eye on other things. Guidance is great for tillage because it removes human error from overlap, saving fuel and equipment hours.

2. Swath control and variable rate technology

Building on GPS technology are swath control and Variable Rate Technology VRT. This is where guidance really begins to show a return on investment. Swath control is just what it sounds like. The farmer is controlling the size of the swath a given piece of equipment takes through the field. This video is a great visual representation of how swath control works. The savings come from using fewer inputs like seed, fertilizer, herbicides, etc. Since the size and shapes of fields are irregular you are bound to overlap to some extent in every application. Thanks to GPS mapping the equipment in the field already knows where it has been. Swath control shuts off sections of the applicator as it enters the overlap area, saving the farmer from applying twice the inputs on the same piece of ground. VRT works in a similar fashion. Based on production history and soil tests a farmer can build a prescription GPS map for an input. By knowing what areas of a field are most and least productive the application rate of an input like fertilizer can be tailored to increase or decrease automatically at the appropriate time. This is a big benefit for farms. Instead of applying a set rate of fertilizer over the entire field (many times a high rate to help those low producing areas) an operator can now apply a rate most effective for a particular section of ground.

3. Your tractor is calling

Telematics is being touted as the next big thing in agriculture. This technology allows equipment to talk to farmers, equipment dealers, and even other equipment. Imagine you have a problem in the field and have to stop working, with telematics your dealer can access the onboard diagnostic system of your tractor. Depending on the problem they might be able to fix your equipment right from dealer. No waiting on a mechanic to drive out to wherever you might be. You're back to work, and the dealer saved a trip too. Farmers will be able to keep track of what field equipment is in, fuel consumption, operating hours, and much more. Usually it was noticed farm as it become more technologically advanced the downtime is often caused by electrical, software, or hardware problems as opposed to mechanical. Tractors can even communicate between themselves. The best example is a combine and a grain cart. Grain carts pull up next to harvesting equipment so the harvester can unload on the move without stopping. Telematics can tell the grain cart operator when a combine is filling up with grain.

4. Your cow is calling too

And it's not saying "Moo!" Collars developed for livestock are helping producers keep track of their herds. Sensors in the collar send information to a rancher's smartphone giving the rancher a heads up on where a cow might be, or maybe she's in some sort of distress, or maybe just in the mood for some mating. I suppose you could say it's kind of like telematics for cows. RFID tags are also a handy device for livestock management. The information kept on a tag helps producers keep track of individual animals, speeding up and making record keeping more precise. I recently read about RFID tags placed in to hay as it is baled. Data such as moisture and weight can be stored in the tag to be scanned later.

5. Irrigate via., smart phone

Mobile technology is playing a big role in monitoring and controlling crop irrigation systems. With the right equipment a farmer can control his irrigation systems from a phone or computer instead of driving to each field. Moisture sensors in the ground are able to communicate information about the level of moisture present at certain depths in the soil. This increased flexibility allows for more precise control of water and other inputs like fertilizer that are applied by irrigation pivots. Farmers can also combine this with other technologies like VRT mentioned earlier to control the rate of water applied.

6. Sensing how your crop is feeling

This is taking variable rate technology to the next level. Instead of making a prescription fertilizer map for a field before you go out to apply it, crop sensors tell application equipment how much to apply in real time. Optical sensors are able to see how much fertilizer a plant may need based on the amount of light reflected back to the sensor. I haven't seen one of these systems in operation yet, but I'm keeping a close eye on them. It's fairly new and pretty expensive, but I see huge potential here. Crop sensors are going to help farmers apply fertilizer in a very effective manner, maximizing uptake and reducing potential leaching and runoff into ground water.

7. Field documentation

Because of onboard monitors and GPS the ability to document yields, application rates, and tillage practices is becoming easier and more precise every year. In fact farmers are getting to the point where they have so much good data on hand that it can be overwhelming to figure out what to do with all of it. And of course, every farmer's favorite form of documentation is the yield map. It sums up a year's worth of planning and hard work on a piece of colorful paper. As harvesting equipments rolls through the field it calculates yield and moisture as it goes tying it in with GPS coordinates. When finished a map of the field is printed. These maps are often called heat maps. I liken then to weather radar maps. Each color on the map relates to a certain yield range. Now the farmer can see what varieties had the best, worst, or most consistent yield over varying conditions. Maps like this can tell a farmer how well a field's drainage system is working.

8. Biotechnology

Biotech or Genetic Engineering (GE) isn't new tech, but it is a very important tool with much more potential yet to be unleashed. The form of GE most people have probably heard of is herbicide resistance. The other would likely be insect resistant traits. Crops can be made to express toxins that control particular pests. Many employ Bt toxin that is the same toxin found in some organic pesticides. That means a farmer won't have to make a pass through his fields to apply pesticide, which not only saves on pesticide, but fuel, labor, and wear on equipment too. New biotech's coming online right now are things like drought resistant traits and nitrogen use efficiency. What does that mean? In short it means that crops are going to be able to protect more potential yield in drought conditions. Another way to look at it would be that farmers who irrigate their crops can cut back on water use and not see yields suffer.

9. Don't forget to flush

Ray Prock dedicated a whole blog post on how he manages cow manure on his California dairy. I'm sure most people know that manure makes good fertilizer, but it's the method Ray uses to collect it for use that is so cool. An automatic system uses water to flush manure away from the cattle into a holding area where all the solid matter dries up. After it dries the solid manure can be picked up and further processed. The liquid manure continues on into another area. From here it can be pumped out and used to fertilize Ray's crop or it can be sent back in to flush out more manure. A metering device lets him know exactly how much liquid is used so that just the right amount is placed on the crops. Excess nutrients are at risk of reaching groundwater, but Ray is all over that too. Irrigation runoff is captured in ponds and is recycled over and over again in the system.

10. Ultrasounds and more for livestock

They aren't just for checking on baby animals in the womb. Ultrasounds can be used to discover what quality of meat might be found in an animal before it goes to market. DNA testing helps producers identify animals with good pedigrees and other desirable qualities. This information can then be use to improve the quality of the herd which helps the farmer improve his bottom line.

11. There's an app for that

Mobile tech is big in agriculture and it's getting bigger all the time. Farmers and ranchers are using all the social media sites for all types of reasons. Some are using apps like foursquare to keep tabs on employees. You might even catch me on a twitter chat tweeting away right from the tractor cab. The tractor is driving itself and my hands are free so why not? Apps can control irrigation and grain storage systems. Want to load grain into a truck without getting out of the cab? Load Out Technologies has you covered. I can't tell you how many times the flashlight app on my phone comes in handy. Even the camera can be put to work on the farm. If you think you might forget how something goes back together after you take it apart take a picture of it assembled. On my phone I have apps that show me soil type via GPS, agricultural news and markets, insect pests, calculations for mixing herbicide solutions, and one that tracks growing degree days. GDDs are an index based on temperature that gives a grower an idea of how mature a crop may be. If you plan on visiting the National Farm Machinery Show in Louisville, you won't have to carry around a map all day that shows vendors booths and event schedules. There's an app for that too.

12. Smile for the camera

Putting up cameras around the farm is a trend that's catching on. We have a rear-facing camera on the back of the combine that shows up on a monitor in the cab. I can think of all kinds of places to put cameras on large pieces of equipment to help eliminate blind spots. Our grain cart is wide enough that you can't see around it so I'd like to have one out back to I know if I'm holding up traffic when driving from field to field. Another idea would be to have a camera or two looking at the implement behind the tractor. Craning your neck around left and right all day to look behind you gets a little painful after a while. Livestock managers are wiring up their barns, feedlots, and pastures with cameras that send images back to a central location like an office or home computer. They can keep a closer eye on animals when they are away or home for the night. Val Wagner told me she is setting up cameras to monitor cows during calving season. Her hope is that by being able to watch the cows during this critical time they can lessen the chance of calves being born outside on those well below zero North Dakota nights. So now you're up to speed on some of the latest and greatest things going on in agriculture. It's all about more data, efficiency, and precision. Farmers and ranchers have a lot of awesome stuff to help them produce a bountiful harvest. So long as Mother Nature chooses to play along. She'll come up with at least one monkey wrench each year no matter what you do, but that goes with the territory

13. Nitrogen Modeling

Nitrogen N is the most important nutrient in agricultural systems, and it plays a significant role in the economic viability, long-term sustainability, and enhancement of cropping systems around the world. To meet the nutritional demands of over six and a half billion people and the world's continued population expansion, an adequate supply of this element in the rooting zone of cropping systems is required to maintain and boost yields. Nitrogen has been critical in maintaining agricultural production increases, yet nitrogen utilisation efficiency (NUE) is typically stated to be less than 50%. Farmers, consultants, and policymakers want effective tools to identify, prioritise, and learn about how nutrient management strategies affect economic returns and regional environmental quality. Combining computer models with GIS techniques can aid in the development of public policy that promotes a region's economic, environmental, and social well-being. BMPs that promote NUE are continually being developed and improved by researchers. It is impossible to undertake field plot or whole-farm studies that cover every possible situation due to the variety of geographical areas, cropping systems, management scenarios and weather. Computer simulation and decision support (DSS) models for soil-crop systems that emphasise the nitrogen cycle, particularly when combined with economics and geographic information systems (GIS), are viable options for evaluating different management scenarios and how they affect the recovery of nitrogen by a cropping system for a given set of conditions. These models are made up of a complicated set of algorithms and databases that can interact with a variety of settings and serve as mechanistic tools for evaluating various nutrient management scenarios and their impacts on NUE and system sustainability. These simulations may be used to create and apply the optimal management techniques for maximizing economic returns, improving NUE, and conserving the environment.

14. Electrical Conductivity Sensing

The ability of a material to transfer

electrical current is measured by its electrical conductivity (EC). Various soil qualities, such as soil texture and water holding capacity, are related to the EC of the soil. The EC of sandy soils will be lower than clay soils. Mapping the EC within a field gives you more information on the soil variability in that field, as well as year-to-year trends like salinization and compaction. Because the application efficiency of herbicides and nitrogen fertilizers is dependent on soil texture, this information can help with deciding on variable rates. In light-textured soils, for example, a split nitrogen treatment may be required. Other approaches for determining soil electrical conductivity focus on determining the EC of the soil-solution, and thus its salinity. The key difference between both strategies is the soil moisture level. Depending on the moisture level of the soil, the electrical conductivity of the soil-solution fluctuates over time. As a result, all EC measurements must be done at the same moisture content for uniformity. In precision agriculture, EC sensors are a helpful tool for better understanding soil variability and trends. This is notably true for soil EC mapping, and to a lesser amount for single soil sensors that are immobile.

15. Robotics

Many of the robots have been developed as a result of recent technology advancements. Machine vision technology is used in many agricultural robotic breakthroughs to avoid risks, recognise crops, and even decide when they are ready to be harvested. A camera or numerous cameras transmit information to the robot, allowing it to locate and access the crops surrounding it, which is known as machine vision. Robots can conduct jobs including weeding, growth monitoring, harvesting, sorting, and packing thanks to machine vision. Many breakthroughs in agricultural robots have also been made possible by satellite location systems like as GPS. GPS data is frequently used by robotic farm equipment to position and locate themselves on farms. Robotic ploughing trucks may employ a combination of computer vision sensors and GPS to navigate and act as the driver in autonomous field ploughing, seeding, or navigating tractors and equipment.

Machine learning is another technique used in agricultural robots. Machine learning is a sophisticated approach of determining collision paths that can assist autonomous cars in learning to adapt and avoid new or unforeseen hazards in their paths. It also allows picking and quality control robots to learn as they go, allowing them to develop the most effective strategies for detecting and carrying out their responsibilities.

Conclusion

The development of agricultural food industry and integrated supply chains with globalization, technological and corporate advancements and environmental effects have all widened the scope of agriculture. Additionally, global financial crises in recent years have revealed a weakness in the implementation and sustainbaility of current growth models and agricultural policies. New sturcutral solutions are therefore required. Aside from these issues, modern growth theory considers technological change as the engine of economic development. It is often pointred out that the use of technology will contribute significantly to rural development and a decline in poverty. Developments in science, technology and engineering are main instruments to help reach these goals and to bring about the changes stated above.

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Vision of Building Sustainable Food Production Systems while Ensuring Development of Rural Economies

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Introduction

The Global population expected to reach 8.6 billion by 2030. A finite, and reducing, supply of natural resources to be safeguarded. And the livelihoods of billions who work along the agricultural value chain at stake.

Making our food systems more sustainable will depend on innovative tools and approaches being developed and deployed around the world. To be economically sustainable, these innovations must provide income and create jobs. To be socially sustainable, they must include poor and vulnerable communities and reduce levels of hunger and malnutrition and also provide opportunities for growth to be environmentally sustainable, they must help us safeguard water, soil and air quality while minimizing greenhouse gas emissions.

The sustainability of a food system is well designed by its success in meeting core objectives related to the three pillars of sustainability: economic, social, and environmental. These objectives include providing safe and nutritious food for all; providing decent incomes and wages for farmers and those working across the system; and conserving natural resources for the benefit of current and future populations.

As the rural economy mainly depends on farming, 65% workforces:

- Basic education to understand scientific approach in farming ie., To make farming economically viable need to use tech tools like Farm machination, scientific approach in cultivation, value addition, storage and marketing.
- Local crop advisory, market infrastructure network to be created.
- Establish own system of marketing through models like Cooperative, Self-help group (SHG) and Famer Produce Organization (FPO's) with proper funding by government at initial levels which should be linked to local marker and other market channels.
- Make use of low cost sustainable models that intern reduce cost of production e.g., use farm waste into organic nutrients and proper livestock.

The sustainability of a food system begins well before a crop is grown or an animal is raised. This pre-production stage includes how genetic resources are conserved and used to improve the quality and productivity of domesticated crops and livestock for the future. It also includes innovations in agricultural inputs, such as inputs or crop protection products. These can help to boost yields and incomes while preventing further land from being converted for cultivation. And it also includes advances in agricultural practices themselves to ensure that farmers can continue to thrive in the face of climate change and other increasingly unpredictable conditions.

The case studies below offer a range of pre-production solutions, from the development and maintenance of gene banks to safeguard genetic diversity and support breeding efforts, to developing best practices around fertilizer and water stewardship, integrating alternative or improved food sources like fruit trees into mixed crop farming systems, and developing hardier, more productive seeds through biotechnology, to be used for the benefit of all.

In the production stage, farmers must contend with the myriad challenges involved in growing and harvesting, including pests and disease, severe and unpredictable weather, food loss management and fluctuating market conditions. Under current projections, 60 per cent more food will be needed by 2050, yet current production efforts are falling short of this target and global hunger levels are on the rise again after decades of progress. This is in addition to the two billion people already suffering from malnutrition globally today.

Explore the case studies below for a range of production solutions. These include how to reduce dangerous aflatoxin levels in groundnuts and maize and how to use fertilizer to fend off the impacts of fall armyworm. It also includes text-based early warning systems for farmers, rice cultivation in lowland areas, and the creation of 'climate-smart villages' to tap into technologies and practices for adaptation and mitigation.

The second part of the transformation involves the promotion of inclusive, sustainable, and nutrition-sensitive agricultural production, processing, distribution, and marketing. It should consider the multiple functions of, and demands made on, agriculture and food. Sustainable agriculture can create decent jobs, support inclusive growth, improve livelihoods, and adapt to climate change. It must be implemented in ways that are tailored to each context.

None of these changes are attainable in the absence of healthy ecosystems and their associated services. The challenge is to increase agricultural production on existing agricultural lands in ways that ensure biodiversity, maintain the integrity of ecosystems, and sustain ecosystem services: it is one of the world's core sustainability challenges. Patterns of agricultural production and the measures of agriculture's performance and effects must be reconsidered in ways that take account of the multiple functions expected from agriculture, including adaptation to and mitigation of climate change, biodiversity management, the provision of ecosystem-based services, people's incomes, and just societies.

Pioneer farmers are pursuing ecologically sound agricultural practices and are well able to contribute to this part of the transformation. Numerous technical advances have been developed and subjected to scientific analysis—including agroecology (Wezel *et al*. 2009; IPES-Food 2016) and organic agriculture (Halberg and Müller 2013). Agroecology—in its many incarnations—is now considered by many global leaders as an approach that can promote the transformation, as stated during a symposium organized by the FAO in April 2018.

A renaissance of rural territories

The sustainable food system transformation reflects the extraordinary potential for territory-based institutions to stimulate people's well-being through providing a range of social, economic and environmental functions and services that are essential to the whole of society (OECD/FAO/UNCDF 2016). Effective action at territorial level contributes to the food and nutrition security of rural and urban populations, to steady and shared economic growth, to decent jobs for young people, and to reducing root causes of frustration and conflict, which can lead to unrest, violence, and forced migration (Mercandalli and Losch 2017). In practice, this requires the establishment of trusted means to encourage—among others—greater equality of opportunity including gender equity, the sustainable management of natural resources, resilience in the face of climate change, as well as access to clean air, to water and sanitation and the most important to conserve existing flora and fauna.

Conclusion

The food production ensuring development of rural economy, without affecting biodiversity as well as the natural resources is a biggest challenge of this era, to address this issue one should follow a comprehensive approach from government, policies and people's who are engaged in the system.

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Pest and Disease Management through Precision Farming

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Introduction

Insects, diseases and weeds are the major pests that the farmer encounters during crop cultivation. Plant diseases detection is essential and critical operation and can affect crop yield. Pesticides play an important role in pest control but their role is under criticism due to perceived excessive use and potentially harmful to the environment and persons. Although, there are various means of pest management *viz*., cultural, mechanical, biological control etc., farmers continue to rely upon chemical control for its greater efficacy, easy handling and quick results. But, the over application of pesticides lead to the problem of chemical residues in soil as well as in the produce. Hence, it is essential to apply appropriate amount of pesticides. Considerable variability exists in the population dynamics of pests over every piece of land. However, in conventional agriculture, without considering this variability pesticides are being applied at a uniform rate throughout the field. Precision pest management (PPM) and disease management emphasizes on this aspect and deals with judicious pest and disease management at micro-level wherein only required quantities of pesticides are applied giving due consideration to the existing variability of pests and diseases.

Integrated Pest and Disease Management (IPM and IDM)

Agricultural pesticides are potential pollution threats to surface and groundwater quality. Integrated pest management (IPM) and integrated disease management can help protect water quality by minimizing the amounts of pesticides and fungicides that producers use and by helping producers to apply pesticides in ways that decrease the risk of chemicals washing off fields into lakes and rivers or leaching into groundwater. This High Intensity IPM and IDM practice provides an opportunity for the producer to develop multiple management strategies that will integrate all aspects of pest and disease management within the agricultural production system – this is called Integrated Pest Management, or IPM and integrated disease management or IDM.

The IPM and IDM philosophy of pest and disease management involves three fundamental steps:

- Use cultural methods, biological controls, and other alternatives to conventional chemical pesticides when practical.
- Use field scouting, pest and disease forecasting, and economic thresholds to ensure that pesticides are only used against real and not perceived pest problems.
- Match pesticides with field site features so that the risk of contaminating water is minimized. Substitute lower risk pesticides when feasible, and alternate the use of pesticides from different chemical classes.

Precision pest management (PPM)

PPM deals with judicious pest management at micro-level wherein only required quantities of pesticides are applied giving due consideration to the existing variability of pests. It is also defined as the art and science of utilizing advanced technologies for enhancing crop yield while minimizing potential environmental threat to the planet.

Precision disease management

Precision Agriculture (PA) techniques were used to improve soil-borne disease management. Inoculum levels were often found to differ between PA management zones. Satellite imagery or ground-based data (yield, electrical conductivity and elevation) were best for defining disease risk zones. Differences in inoculum level between zones were frequently associated with differences in root damage and plant growth, but were only sometimes associated with yield differences. Methods were devised to define disease risk zones using soil sampling.

Components of precision pest and disease management:

Geographical information system (GIS), Global positioning system (GPS), remote sensing (RS) and Farmer are the major components of precision farming.

- **Geographical information system (GIS):** As the precision pest and disease management is information based and concerned with spatial and temporal variability of pest and disease population, GIS is the part and parcel of it. GIS is the key to extracting value from information on pest population dynamics. GIS is the brain of precision farming system and it is the spatial analysis capabilities of GIS that enable precision farming. But due to complex nature of available GIS software packages, non-specialists may find it difficult to practice in pest management. Therefore, some simple, easy to use formats need to be developed for suitability of this technology in production agriculture including pest and disease management. The pest and disease population dynamics could be better understood through computer simulation modeling and linking of GIS with these models is crucial for precision management.
- **Global positioning system (GPS) :** All the aspects of precision agriculture require positioning information and it can efficiently be provided by the GPS. It was initially developed by the US military. GPS provides accurate positional informational which is useful in locating the existing spatial variability. The inherent accuracy of GPS is about 5m, which is based on a 95 % probability that the position given will be within 5m of the true value position. Development of precise GIS/GPS auto-navigation systems increased the efficiency of the field operations in precision agriculture. Although the GPS signal is ubiquitous, there are problems in making available GPS for pest and disease management and the agricultural practices at the required precision. Simplification of the system with wider use is urgently needed to solve the problem.
- **Remote sensing (RS) :** Remote sensing is already being used for soil mapping, terrain analysis, crop stress, yield mapping and estimation of soil organic matter, but on a scale larger than what is required for precision agriculture. Remote sensing at high resolution can be of great use in precision pest and disease management because of its capacity to monitor the spatial variability.
- **Farmer:** Precision pest and disease management is information and

knowledge based practice. Therefore, farmers have to be trained adequately so that they can monitor the dynamics of pest and disease and take right decision at the right movement.

Insect-Pest and Disease Management

Insect pests and diseases are significant issues in crop protection. For this reason, improved sensors for precision farming are constantly being improved. Such modern technology includes pest detection sensors which detect disease and insect pest occurrence on crops. Basically, the sensors provide real-time data from the field.

Sensors for Accurate Insect Pest Detection

Farmers can use various sensors for insect pest detection on crops. These range from simple to the most complex work principle. Some of the most common sensor types are:

- **Low-power Image Sensors :** The low-power image sensor is an wireless autonomous monitoring system that is based on a low-cost image sensor. Placed in a single trap, the wireless sensor periodically captures images of the trap contents and sends them remotely to a control station. Sent images are then used for determination of the number of pests found at each trap. Based on insect population number, a farmer can plan when to start with crop protection and in which field areas. Farmers use this sensor to monitor large areas with very low energy consumption. Low image sensors provide many benefits in farm production. Some of them are:

  1. Significant reduction of pest monitoring costs.
  2. No human intervention in the field required.
  3. Applicable for small and big areas.
  4. Low maintenance cost.
  5. Real-time insect pest monitoring

- **Acoustic Sensors :** An acoustic sensor is an insect pest detection sensor which works by monitoring the noise level of the insect pests. How does it work? Wireless sensor nodes connected to a base station are placed in the field. When the noise level of the pest crosses the threshold, a sensor transmits that information to the control room computer, which then accurately indicates the infestation area. These sensors help detect an infestation at a very early stage, thus greatly reducing crop damage. These are a great tool for the monitoring of large field areas with very low energy consumption. The occurrence of insect pests can be also monitored with sensors for Leaf Area Index (LAI) measuring. Insect pest feeding destroys leaves. This causes plants to lose chlorophyll. This leads to a reduction in the total leaf area, and as a result, the reduction of the plant's capacity to photosynthesize. By measuring the leaf area index, the sensor can identify an insect attack at an early stage and warn farmers to take the appropriate actions. This sensor uses radiation measurements and other parameters to accurately calculate leaf area index in real-time, in the field. This type of sensor is also used for crop disease detection.

Sensors for Early Crop Disease Detection

Crop diseases, if not treated timely and properly, can significantly reduce the yield, thus endangering global food security. For this reason, disease protection is the most important task for every farmer. Since early detection can successfully control disease, farmers use modern farm measures to protect their crop. These measures include direct and indirect disease identification methods.

Direct detection methods are mainly laboratory-based techniques of disease detection. The most common are polymerase chain reaction (PCR), immuno-fluorescence (IF), fluorescence in-situ hybridization (FISH), enzyme-linked immunosorbent assay (ELISA), flow cytometry (FCM), and gas chromatography-mass spectrometry (GC-MS). Although providing accurate data, these methods can't be used for on-field disease detection.

Unlike direct, indirect methods are used directly in the field. Based on plant stress and levels of plant volatility, indirect method sensors can identify biotic and abiotic stresses, as well as pathogenic diseases in crops. These are optical sensors which, based on thermography, fluorescence imaging, and hyperspectral techniques, are able to predict plant diseases.

- **Thermography Disease Detection Method :** Thermography sensors measure the differences in surface temperature of the plant leaves and canopy. The sensor captures infrared radiation emitted from the plant surface. If there is a pathogen infection, the plant surface temperature will increase due to the transpiration reduction. Based on the change in temperature, the sensor can analyze disease presence. Thermography sensors can detect the changes due to the disease before it even appears. Precision disease control is limited due to its high sensitivity to the change of environmental conditions during measurements. Another problem is that the thermography method can't be used to identify the type of infection.
- **Fluorescence Disease Detection Method :** Sensors using the fluorescence method measure the chlorophyll fluorescence on the leaves and measure the incident light and the change in fluorescence parameters. It measures changes in chlorophyll and photosynthetic activity, thus detecting the pathogen presence. Although fluorescence measurement provides sensitive detection of abnormalities in photosynthesis, the practical application of this technique in a field setting is limited.
- **Hyperspectral Disease Detection Method :** Sensors implementing the hyperspectral method use a wide range of spectrum, between 350 and 2500 nm, to measure plant health. They measure the changes in reflectance that are the results of the biophysical and biochemical characteristic changes experienced upon infection. Hyperspectral cameras collect the data in three dimension, with X- and Y- axis for spatial and Z- for spectral, thus providing more detailed and accurate information about plant health. In order to monitor a large field area, sensors are usually fitted to an unmanned aerial vehicle (UAV). Hyperspectral sensors are used for early crop disease detection, thus allowing a farmer quick and timely crop protection.
- **Gas Chromatography Disease Detection Method :** This is a non-optical sensor used for crop disease detection and is used to determine volatile chemical compounds released by the infected plants. Pathogens on plants release specific volatile organic compounds (VOCs) that are characteristic of each pathogen type. The same thing happens when the plant is stressed due to mechanical damage. In this regard, sensors using gas chromatography can accurately identify the type and nature of infection. The only lack of this method is required sampling of pre-collected volatile organic compounds for a longer time before data analysis, which severely limits its on-field application.

Precision survey in agriculture for pest management

Various types of precision systems have been applied in agriculture. The use of remote sensing in agriculture in India started with the detection of wilt disease in coconut at Kerala Coast. But later main emphasis was shifted to crop acreage estimation, crop condition assessment and yield forecasting using different crop simulation models. Optical and video imaging in near-infrared and microwave regions were used to quantify even the nocturnal flight behavior of *H. armigera*. Recently, forecasting methods of potato late blight, apple scab, mango powdery mildew and rice blast are available. The application of remote sensing in pest monitoring, detection, early warning and management aspects in the field of agriculture are summarized as follows:

- **Survey of ecological conditions and forecasting locusts :** Over the years, strategies of Desert Locust control have evolved from curative efforts to an emphasis on prevention, *i.e.* finding and treating infestations before they form large hopper bands and swarms. This requires regular monitoring of locust breeding areas and the ability to quickly mount small scale control operations in many of the 60 countries affected by the Desert Locust. It has only been during this century that our understanding of the Desert Locust and its relationship with the environment has increased to a point that allows for better management of this pest through improved strategies of monitoring and control. Remote sensing imagery can assist in the detection of green vegetation and thereby help to guide ground survey teams. These locust data helped to prioritize the different areas according to their interest for the locust ecology.
- **Assessment of crop infested with insect pests:** Initial recognition of pest infestation by means of remote sensing will spreads, for precision farming practice. Normalized Difference Vegetation Index (NDVI), Standard difference indices (SDI) and Ratio Vegetation Index (RVI) are used for analyses using ENVI 4.8 and SPSS software. Using these indices as indicator can clarify the threshold for zoning the outbreaks.
- **Early detection of wild hosts and reducing the populations build up :** Remote sensing has been used to detect the wild host plant areas early in season and also to detect pest infestations within cotton fields and crop maturity levels related to these pest infestations during the cropping season.
- **Early detection of insect pests :** Early detection of the pest infestation could reduce overall applications of pesticides using variable rate application technology, thus saving the producer's money. During non-cropping periods, tarnish plant bugs feed and reproduce on broad leaf wild host plants. Remote sensing and spectro-radiometry showed distinct differences between broad leaf hosts and non-host grasses. High spectral resolution remote sensing imagery with more bands and narrower bandwidth is required for remote sensing diagnosis of crop disease stress.
- **Locating hot spots of pest infestation in crops :** Preliminary remote sensing revealed spider mite infestations reddish hot spot patterns in cotton fields and discerned them from healthy and drought stressed cotton in 1999. This information may be useful in the targeting of precision pesticide applications. Because spider mites and

aphids occur in heterogeneous areas of the fields, it is possible that these "hot spots" can be differentiated from other sources of variation, using the wavelengths in the NIR.

- **Monitoring conditions favourable for pest outbreak :** Various factors such as intensive cultivation, mono-cropping, changing weather conditions and indiscriminate use of pesticides have resulted in frequent outbreaks of crop pests and diseases causing huge crop losses. Minimizing these losses is one way of enhancing grain production and remote sensing tool has been found very useful in monitoring large areas frequently. The Earth observing systems are useful in monitoring weather and ecological conditions favorable for crop pests and diseases. Weather conditions such as temperature, humidity (moisture), sunshine hours (light) and wind play major influence on the densities of pest population and their natural enemies. Among the weather parameters that can be remotely sensed, type of cloud, extent of cloud cover, cold cloud duration (a surrogate for rainfall) are the most easily retrievable.

- **Remote sensing of individual species of insects :** 1. Locusts: Remote sensing (satellite information) appears a promising tool in locust monitoring. Satellite data are increasingly used for monitoring and forecasting two locust species, the desert and the Australian plague locust. 2. Moth flight: Entomological radar observation programs have, up until now, been strongly focused on large insects (moths, migratory grasshoppers) ?ying under stable boundary layer conditions at night. 3. Aphids and spider mites: Wavelengths in the NIR were fair to moderately accurate predictors of aphid-and mite infestation. Concentration of airborne aphids up to 1200 m. above the sea level have been detected by using very powerful 10 cm RADARS. 4. Plant hoppers and leaf hoppers: India used hyper-spectral remote sensing to detect the brown planthopper (BPH), *Nilaparvata lugens* (Stal), stress on rice plants under glasshouse as well as field conditions and revealed that variation in plant reflectance due to BPH damage was smaller at shorter wavelengths (350-730 nm) and larger at longer wavelengths, *viz*., NIR (740-925 nm) followed by mid infrared (MIR) (926-1800 nm), which indicated the possibility of detection of BPH stress on rice and thereby issuing prompt forewarning to stakeholders.

- **Survey of insect pests of crops and fruit trees :** Sooty mould has been used to indicate the presence of corn leaf aphid, *Rhopalosiphum maydis* and sweet potato white fly, *Bemicia tabaci* Glover. In a study, photographs were taken from 2000 meters and different levels and areas if infestation were successfully measured with the aid of photographic enhancements and computerized area estimation methods. The white fly induced sooty mould could be detected on cotton from 300 meters and photographs from 2000 meters yielded good resolution of mould growth patterns. A number of insect pests like soft scale, *Coccus hesperidium*, infesting citrus groves; citrus mealy bugs, *Phenococcus citri*, citrus black fly, *Aleurocanthes woglumi* produce honey dew that serves as host medium for sooty mould fungus. This mould blackens foliage and thus provides a clue for quick detection of insects by aerial photography. Wavelengths in the NIR were fair to moderately accurate predictors of aphid and mite infested cotton.

- **Mapping of geographical distribution of pests along with GIS :** GIS is another tool, which can be used effectively for mapping geographical distribution of pests, delineating the hotspot zones. GIS methods can be divided into two sub groups- Remote Sensing and Digital Cartography. Fundamentally, GIS techniques create data abstractions to describe the real world life systematically classifying features into a series of thematic layers. Each layer can be evaluated independently or features between two or more layers can be analyzed together. Remote sensing has also been used in conjunction with GIS for monitoring changes in crop conditions.
- **Rainfall and outbreak of pests :** Flying moths of the east-African armyworm, *Spodoptera exempta*, are concentrated by convergent winds associated with rain storms and the subsequent mass laying of the aggregated moths leads to massive outbreaks of destructive caterpillars. Remote sensing of rain storms in the appropriate areas thus presents the prospect of rapidly locating potential outbreaks.
- **Survey of habitats of insect vectors of plant disease :** Remote sensing imagery (from high-resolution aerial photography to coarse-resolution satellite imagery) when combined with GIS spatial analyses techniques can play an important role in existing vector surveillance and control programs at local and regional scales. By applying the remote sensing and GIS techniques for mapping vector habitats, vectors' presence, abundance and density, assessing the risk of vector-borne diseases, disease transmission, spatial diffusion, we can find the root cause of the disease infection, and source of infection. With the availability of multispectral, multi-temporal and real time satellite data products, GPS assisted geo-referenced epidemiological data are being integrated under the umbrella of the GIS software for mapping distribution of vector borne diseases.

The Future of Pest Detection Sensors

Along with the aforementioned, there are many more sensors that can be used for crop disease and insect pest detection using electrical, chemical, electrochemical, optical, magnetic, or vibrational signals. However, farm technology is modernizing rapidly. New sensors are constantly being developed in order to support early pest identification based on bio-recognition elements such as DNA/RNA, antibody, and enzymes. In aiming to produce enough food to feed the growing population and to secure a sustainable future for society, farmers need all the help they can get in order to get the best from their farmland. This can be achieved by using sensors in crop production. Knowing what is going on in the field at any given time makes farming easier, secures harvests, and boosts yields, all of which work to protect the environment.

Conclusion

The use of geospatial data and technology plays a significant role in improving the production of yield and overcoming food security issues. As the population grows, the production of crop needs to be increased as well to ensure all the people in whichever country or region get enough nutrients. This paper has reviewed the role of geospatial technologies to tackle the issue of pest and disease affecting plant health that has a big impact on crop yield production in producing food for the world population. Geospatial technology has been used, from the early tasks of surveying the status of crop health to managing the collected data. From the review, there are many studies which have applied remote sensing technology in monitoring plant health for large groups that become commodities for a country, such as oil palms, paddy and wheat, whereas less study has been applied on the crops planted on a small scale, such as in the orchard. This might be due to the high cost to use the technology, which might not feasible to apply for a small area. Moreover, it is not easy to detect plant health for crops that are planted randomly on the ground, especially on a mixed land use, from the satellite images. Therefore, GPS technology has been applied to complement the ground crew during field survey to automatically record the location of affected plants for further action. Distribution of pest and disease incidence on the affected crops has been mapped to visualise the events from a large-scale view. The power of spatial analysis has been used in predicting the possibilities of incidence likely to be occurred in a few years time. Global trade liberalisation and climate changes have presented major challenges for the local crops to produce good products and to secure food for the world population generally. Nevertheless, the advancement of geospatial technology has made the activities of combating various pests and diseases affecting plant health much easier than before.

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Effect of Salinity Stress on Physiology of Plants

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Introduction

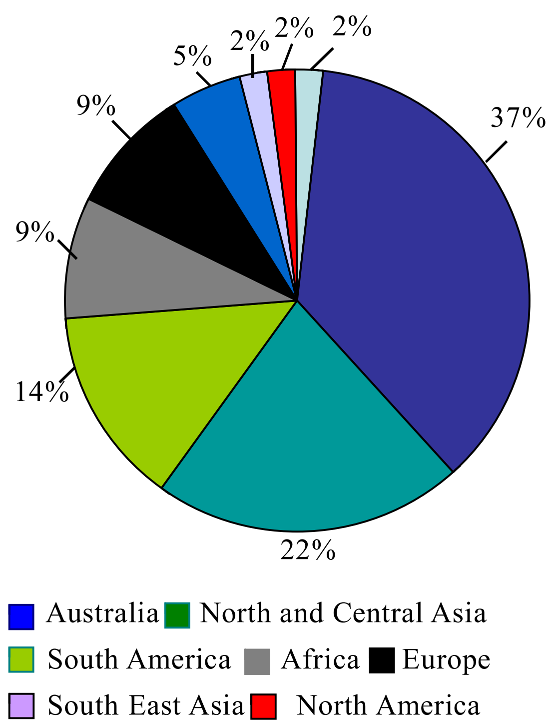
One of the major environmental facet that reduce plant productivity is salinity, and this stress cause reactions in plants due to water stress; moreover, this environmental concerns affect plants more than is commonly thought Serrano (1999). All soil in which water-soluble salts exceed 4 dS m^{-1} is considered saline. Water stress due to salinity is probably the most significant abiotic factor limiting plant and also crop growth and development. Salinity stress induce osmotic stress and metabolic responses of the affected plants. Water deficit affects the germination of seed and the growth of seedlings negatively.

Salinity in soil or water is one of the major stresses and, especially in arid and semi-arid regions, can severely limit crop production. The deleterious effects of salinity on plant growth are associated with low osmotic potential of soil solution (water stress), nutritional imbalance, specific ion effect (salt stress), or a combination of these factors. Salt stress is also one of the most significant environmental constraints limiting crop productivity in arid and semi-arid regions (Asraf and Harris, 2004). Salinization problems are on the increase mainly due to poor irrigation drainage or agricultural practices, low quality water, thus leading to net accumulation of ions in the root zone. Salt stress is first perceived by the root system and impairs plant growth by inducing an osmotic stress caused by reduced water availability and from the ion toxicity due to solute imbalance in the cytosol (Munns, 2005).

Figure 1.**Global distribution of salt-affected areas (Khan *et al.,* 2011)**

EFFECTS OF SALINITY ON PLANT LIFE-

The effects of salinity on plants cover a spectrum from mild osmotic effects which are



not easily detected, reduction of shoot and root growth that are more obvious and on the other extreme, chlorosis, necrosis and senescence of young and old leaves (Munns, 200). Salt stress adversely affects plant growth, development and productivity by generating ion toxicity (accumulation of toxic level of Na^+ and Cl- ions), oxidative Stress (excess ROS production) inducing nutritional deficiencies/ imbalance (decreases mineral uptake and mineral solubility) creating osmotic stress and water deficits.

Physiological effects of salt stress

Salinity effects on photosynthesis

Salt stress causes decrease in plant growth and productivity by disrupting physiological processes, especially photo-synthesis. The accumulation of intracellular sodium ions at salt stress changes the ratio of K : Na, which seems to affect the bioenergetic processes of photosynthesis.Iyengar and Reddy (1996) noted that decreases in photosynthetic rate in saline condition resulted from a number of factors including:

- High osmotic potential and reduced water availability to plants result in cell membrane dehydration and reduction the permeability of CO2 and consequently photosynthetic electron transport decreases via shrinkage of intercellular spaces.
- Due to toxicity of NaCl ions, the Cl- ion inhibits photosynthetic rate through its inhibition of NO^{3-}N uptake by the roots, consequently reduced NO^{3-}N uptake combined with osmotic stress may explain the inhibitory effect of salinity on photosynthesis.
- Stomata closure causes reduction in CO_2 supply so that the availability of CO_2 for carboxylation reactions restricted.
- Advancing senescence induced by salinity.
- Changes in cytoplasmic structure enzyme activities.
- Reduction in sink activities as a result of negative feedback.
- Some evidence showed that growth is reduced more rapidly at lower concentrations of sodium in the leaf than in photosynthesis. This means that plants can withstand a certain loss in photosynthetic rate without any effect on growth.

Salinity effects on water relations

Two components of a plant's water relations are water potential and hydraulic conductivity. Water potential refers to the potential energy of water relative to pure water, and therefore determines the direction of water movement, where water moves from a location with a higher water potential to a location with a lower water potential. Hydraulic conductivity refers to the ease with which water can flow from one location to another and therefore affects the rate of water movement.

- In high salt concentration, plants accumulate more Na^+ and Cl^- in the tissues of the leaves than normal situation. Subsequently, by increasing Na^+ and Cl^- within the leaf tissues lower osmotic potentials occurs and resulted in more negative water potentials.
- Root hydraulic conductance reduction decreases the amount of water flow from the roots to the leaves, thus, causing water stress in the leaf tissues.

Salinity effects on photosynthetic pigments

Several researchers showed that generally the chlorophyll and total carotenoid contents of leaves decrease under salinity where the chlorosis start from oldest leaves during the salt stress.It is observed that the total chlorophyll content of the mature leaves increases considerably due to increasing concentrations of NaCl. Chlorophyll content in plants correlates directly to the healthiness of plant. The resistance of photosynthetic systems to salinity is associated with the capacity of the plant species to effectively compartmentalize the ions in the vacuole, cytoplasm and chloroplast.

Salinity effects on ion levels and nutrient contents

In saline conditions, absorption of Na^+ and Cl^- competes with up taking nutritional elements such as K^+, N, P, and Ca^{2+} by plants, which create nutritional disorders result in yield quantity and quality reduction. Several researchers indicated that increased NaCl concentration in root zone of plants causes accumulation of Na^+ and Cl^- in shoot tissues and decline Ca^{2+}, K^+ and Mg^{2+} levels in a number of plants.

Salinity effects on leaf and root growth

There is some evidence that with increasing salinity, the leaves of plant change anatomically, for example, in *Atriplex sp*., cotton and bean increase of spongy cell diameter, palisade diameter, palisade cell length, mesophyll thickness and epidermal thickness occurred. Adversely, Parida*et al.* (2005) noted that by increasing salinity both epidermal and mesophyll thickness and intercellular spaces in leaves of *Brugueiraparviflora*decreased, also Delfine*et al.* (1998) showed that intercellular spaces in leaves of spinach declined with increasing the salinity. Romero-Aranda *et al.* (2001) in a study on salinity effects on tomato indicated that in the face of salinity a reduction in stomatal density was observed.

The root is the first organ of plant affected by salinity. Munns (2005) showed that root influences on ion accumulation and leaf growth, they noted it can be one of the mechanisms of salt tolerance. Vaughan *et al.* (2002) investigated effects of salinity on different alfalfa rooting (low- and high-fibrous rooting characteristics) of populations under increasing salinity condition and found that root production in high-fibrous root types was stimulated more than low-fibrous root types at low and medium salinity. They noted across salinity treatments, final root length density (cm root length per cm^3 soil volume) was 24% higher for high-fibrous root types, and herbage yield of high- fibrous root types was 14% higher than low-fibrous root types. High fibrous rooting in alfalfa is a trait with potential usefulness as a salinity stress avoidance mechanism. Root growth has been used as a standard for screening of alfalfa salinity tolerance (Vaughan *et al.,* 2002).

Salinity effects on seed germination

Salinity not only delays but also decreases seed germination. Due to the toxic effects of salt and water uptake and root growth is restricted preventing seedling emergence. Germination of seeds is one of the most critical phases of plant life greatly influenced by salinity (Misra and Dwivedi, 2004).

Ansari *et al.* (2012) reported a significant reduction in the germination percentage; seed reserve utilization as well as growth of rye. Earlier, Ansari *et al.* (2012) had shown relation to seed performance, germination percentage and seedling indices. Decline in seed reserve utilization, seedling growth and different indices of seeds under stress conditions were also reported for mountain rye.

Conclusion

Soil salinity is causing a great threat to global food productivity, leading to similar basic challenges in cultivating crops in a sustainable manner under saline conditions in developing and developed countries.In the future, some techniques such as gene editing systems may be used to address this global issue. It will promote biotechnological applications and molecular breeding of salt-tolerant crops, which can increase the usage of saline land and crop production.

Refernece

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Lilium Cut Flower Production Under Polyhouse

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Imtroduction

Lilium one of the most important bulbous flowers, belongs to *Liliaceae* family and is commercially grown in India for cut flowers. Recently, this crop has become popular in many states of India.

Lilies have a very good demand in the flower market as cut flower and pot plants. Out of the different types of lilies, Oriental and Asiatic hybrid lilies and Asiatic hybrid lilies and to some extent, the Easter and tiger lilies are the most popular ones as they are excellent cut flowers. The popularity of these lilies is gradually increasing in India. Some varieties resistant to leaf scorch should preferably be selected for commercial cultivation.

Lily is a common name used for several different plant species. But day lily, calla lily, toad lily, and surprise lily are not "true lilies." True lilies are members of the genus *Lilium*. They originate from underground bulbs and produce large, showy blossoms in the summer. True lilies are excellent plants for almost any garden situation. They are not only versatile and durable, they also offer gardeners a wide variety of heights, flower forms, and colours. In fact, their presence in the garden is so striking that they are often called the "Queen" or "Grande Dame" of the summer garden.

Varieties

Arbatax, Nello, Tresor and All Choice are the important cultivars of *Lilium*.

Soil and Climate

Soil with good texture and proper drainage is preferred. The soil should be light and porous but rich in organic matter. Lilies are sensitive to high concentration of salt which adversely affects the plant growth. The soil used for cultivation of lilies, has to be in good structure particularly the top layers and should also be kept well drained during the entire growing period. Maintaining the correct pH of the soil plays a major role in the root development and uptake of nutrients. It is advisable to maintain a pH of 6 to 7 for the Asiatic and longiflorum hybrid groups and a pH of 5.5 to 6.5 for the oriental hybrids.

For good plant growth and quality flower production, the night temperature should be around 10-15^{0}C and the day temperature should be 20-25^{0}C. Higher temperature will produce a dwarf crop with less number of flower buds per stem. The plant should not be grown under direct sunlight. In summer months, due to high light intensity, the plants become stunted in growth. A shading screen with 50-75% shade will be beneficial.

Sowing/Planting

As a thumb rule, the bigger the bulbs, more is the stem length and the number of flower per stem. Bulbs less than 10-12 cm in circumference should not be used for flower production in Oriental hybrid lilies, where as bigger bulbs (as big as 22-24 cm) should be planted for production of Asiatic lilies.

Sowing on Beds

Planting Density

Bulb Size (cm)	Bulbs/m^2	Planting Distance (cm)
08 - 10	49	15 × 15
10 - 12	42	16 × 15
12 - 14	36	16 × 18
14 - 16	36	16 × 18

Planting Depth

It is important, that the bulbs are healthy and should have well formed and healthy roots before planting because the water and nutrient absorption during the first three weeks is dependent on these roots. When the shoot emerges the so called stem roots start to develop on the stem just above the bulb. These stem roots instead of bulb roots will soon start supplying water and nutrients to the plant. In order to get excellent quality flowers, the stem roots should be allowed to develop properly. The depth of planting should be 10 – 12 cm winter.

Fertilization

Since lilium is a bulbous crop, most of its nutrients are already present in the bulb itself. Lilium is a very salt sensitive crop and therefore one should take care while applying fertilizers. It is advisable to apply 12:61:00@ 2kg/100m^2 at least one week before plantation. Later on during the first three weeks when the stem rooting takes place, no additional fertilizers are required. Good root development is important at this stage.

Three weeks after plantation- Calcium Nitrate @ 1 kg/100m^2

Six week after plantation- Potassium nitrate @ 1kg/100m^2

If plant show symptoms of weakness during growing period due to Nitrogen deficiency then a top dressing of Ammonium Nitrate@ 1 kg/100 m^2 can be applied up to three weeks before harvesting.

Irrigation

Irrigation is one of the most important factors that promote growth in the cultivation of lilies. Soil is watered before planting the bulbs. After planting the bulbs water is given liberally so that the soil properly adheres to the bulbs and roots. Since the stem roots develop in the top soil, it is essential that this top (30cm) soil should be kept continuously moist. However, there should not be any water stagnation. During the dry spell, the water consumption may be as high as 10 litres/m^2/day.

Staking

Staking is an important operation in lilly cultivation to keep the plants erect. The most practical way to support the crop is by using netting which should be gradually raised as the plants grow in height so as to get long stems during harvest.

Harvesting

Flowers are ready for harvesting between 90- 120 days after planting. As soon as first bud shows distinct colouration, the lilies should be harvested. If this is done at a premature stage, the buds will not develop properly. Cutting too late *i.e.* when the bulbs have opened fully will cause damage to the flowers during transit. Cut stems should be placed in cold water immediately after harvesting. If necessity arises, the flowers can be stored at 2-5^{0}C for a week or so. Sucrose @ 5% + HQS @ 200 ppm significantly increase the vase life of the flowers.

Grading

After Harvesting, the lilies are usually sorted by number of flower buds per stem and length of the stem. The leaves from the bottom 10-15 cm of the stem should be removed to improve the keeping quality of the flowers.

Nutrient Deficiency

Iron (Fe) deficiency

Symptoms

The leaf tissue between the veins of young leaves becomes yellowish-green, particularly in plants with rapid growth. The greater the iron deficiency the more yellow the leaves look.

Management

- Soil should be well drained with low pH level
- Chelated- Fe should be applied @ 2-3 gm/ m^2 before planting and maximum 2 gm / m^2 after planting.

Nitrogen (N) deficiency

Symptoms

The whole leaf becomes lighter in colour and this is often more noticeable when plants are about to bloom.

The plant often seems rather light green in appearance. Soil with a low nitrogen level produces a crop with stems which are lighter in weight with less number of flower buds. The foliage in the vase will turn yellow more quickly.

Management

- Always apply sufficient quantity of nitrogen, preferably based on the results of soil sample.
- If the nitrogen deficiency is diagnosed during cultivation apply an additional rapid action nitrogen fertilizer. However, bear the risk of leaf scorch in mind during this procedure and make sure the crop is always washed off thoroughly.

Abnormalities

Leaf Scorch

Leaf scorch occurs when there is a disturbance in the balance between absorption and evaporation of water.

This is the result of inadequate absorption or evaporation which causes a calcium deficiency in the cells of the youngest leaves. Cells are destroyed and eventually die. A sudden change in the relative humidity inside the greenhouse also affects this physiological imbalance that leads to poor root system and high salt level in the soil. Large bulbs are more susceptible than smaller ones.

Management

- Disease and pest which could damage the roots should be controlled effectively.
- Soil should be moistened before planting.
- It is better not to use susceptible varieties but if this cannot be avoided do not use larger bulbs as these are extra sensitive.
- Plant bulbs with a good root system.

- Plant to an adequate depth i.e., allow 6-10 cm of soil on top of the bulb.
- Prevent large differences in greenhouse temperature and air humidity levels during period of increased susceptibility. Try to maintain RH level of approx. 75%.
- Ensure that plants maintain even transpiration and avoid excess transpiration by shading.
- Rapid growth must be prevented.

Diseases

Bulb and Scale Rot

This disease is caused by the fungal pathogens. Plants affected by these diseases are retarded in growth and the leaves have a pale green colour. The under-ground part of the stem may show orange-brown to dark brown stains, which afterwards become larger and spread to the inside of the stem. The infected bulb's scales will show dark brown stains and the rotting starts at the base of the bulb sand scales. The plant finally dies prematurely.

To prevent the diseases, bulbs should be planted in pre-sterilised soils. Bulbs should be dipped for one hour in 0.2% captan + 0.2% benlate to minimize the disease infection. Also keep the soil temperature as low as possible during the entire period of cultivation by frequently irrigating the field.

Foot Rot

This is caused by the *Phytophthora* fungus. The infected plants have violet –brown spots spreading upwards. The plants are retarded in growth or may wither suddenly. The leaves start turning yellow from the bottom of the stem.

To control the diseases, sterilize the soil before planting the bulbs. Dithane M-45 may be applied @ 200g / 100 m^2 as soils drench.

Root Rot

This disease is caused by the fungus *Pythium*. These fungi prefer moist condition and thrive best at 25– 30^0C. The infected bulbs and stem roots show light brown spots and signs of rotting. The infected plants remain short in height leaves are narrow and dull in colour. Such plants will show more bud drop than normal plants. The flowers are smaller in size and often do not open fully.

The soil should be disinfected chemically. The affected plants may be sprayed with Dithane M-45 @ 0.2 %.

Leaf Spot Disease

Leaf Spot disease is mainly caused by *Botrytis* under moist condition. *Botrytis* produces spores which are spread by rain and wind to nearby plants. Under dry condition the disease will not spread. When infected, the leaves show dark brown spots of 1-2 mm diameter which will increase in size to form round or oval spots. The affected leaves and flowers will ultimately die.

To manage the diseases, reduce irrigation to make the soil dry.Spray Benlate @ 5gm per 10 m^2.

Virus Diseases

Lilies are infected by different types of virus *viz.,* Lily Symptomless Virus, Cucumber Mosaic Virus, Tulip Colour Breaking Virus *etc*,. The plants raised from virus infected bulbs become weak in vigour and produces inferior quality flowers. In case of severe infection, the plants become stunted and deformed. For production of quality flowers diseases free bulbs should be used.

Insect pests

Aphids

Aphids live only on young leaves particularly at the backside of the leaves .Young buds may also be affected resulting in deformed flowers. Spray Nuvan @ 2ml/litre of water.

Thrips

This is also a sucking type of insect. A severe attack will adversely affect the plants growth and flowering. Those flowers will not be accepted in the market. Regular spraying with Monocrotophos @ 2 ml/litre of water will protect the plants from the attack of thrips.

Post-Harvest Management

Immediately after harvest, the lower portion of the cut spikes should be immersed in water for prolonging the vase life of spikes. A holding solution consisting of silver nitrate (50 ppm) + 3 % sucrose is best to extend vase life, delaying leaf senescence and enhance post harvest keeping quality of Lilium cut flowers. Among the varieties evaluated, Brindisii had a vase life of 8.33 days followed by Serrada (8.03). Silver nitrate recorded longest shelf life (9.47 days) which was closely followed by Citric acid (9.00 days) and control treatment recorded a shelf life of 7.33 days. Interaction effects between varieties and treatments revealed that Serrada flower pulsed in silver nitrate 50 ppm + 3 % sucrose could keep well for 10.60 days which was closely followed by Brindisii pulsed in citric acid (10.20 days).

Conclusion

Flowers celebrate love, comfort in sorrow, congratulations in achievement and friendship. Flower messages have varied over the centuries. Flowers are true symbols of love, and thus, they are the perfect gift to give to your loved ones on special occasions. You can give flowers to anyone on almost every occasion because they are everyone's favourite. Whether you can wish your friend a happy birthday or honour your mother on Mother's Day, the bouquet of flowers can never be wrong. Even if you are going to surprise your lover on Valentine's day, you can choose Flower Basket as a Valentine gift for her or him. They can be used in herbaceous borders, woodland and shrub plantings, and as patio plants. Some lilies, especially *Lilium longiflorum*, form important cut flower crops. These may be forced for particular markets; for instance, *Lilium longiflorum* for the Easter trade, when it may be called the Easter lily.

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For the welfare of the Farmers, the society "Society for Advancement in Agriculture, Horticulture and Allied Sectors" willing to publish E-magazine in the name of "KrishiUdyanDarpan E-Magazine (Hindi) **/ KrishiUdyanDarpan** E-Magazine (English**, Innovative Sustainable Farming), which covers across India.**

AUTHORS GUIDELINE

All authors submitting articles must be annual or Life member of SAAHAS, KrishiUdyanDarpan E-Magazine (Hindi) / KrishiUdyanDarpan E-Magazine (English, Innovative Sustainable Farming). Articles must satisfy the minimum quality requirement and plagiarism policy. Authors can submit the original articles in Microsoft Word Format through provided http://saahasindia.org portal only along with scanned copy of duly signed Copyright Form. Authors can get **Copyright Form** from website of SAAHAS. Without duly signed Copyright Form, submitted manuscript will not be processed.

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- Avoid the **Repetitions** of word's, sentences and Headings.
- The main body of an article may include multiple paragraphs relevant to topic. Add brief subheads at appropriate places. It should be informative and completely self-explanatory.
- Submitted manuscript are only running article and contains the field of Agriculture, Horticulture and Allied sectors.
- All disputes subject to Prayagraj Jurisdiction only.

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ABOUT THE SOCIETY

Father of Nation Mahatma Gandhi's concept of rural development meant self-reliance, and least dependence on outsiders. India is an agrarian country and about 65% of our population lives in rural areas. But unfortunately, most of us do not have any idea about the extent of poverty and the real conditions of rural India.

With the purpose of serving the agricultural fraternity and farming community the Society for Advancement in Agriculture, Horticulture and Allied Sectors (SAAHAS) was founded in 2020 (under Society Registration Act, 1860). Among multifarious ways of serving farming community we are involved in training of the farmers by organising technology dissemination programmes in villages, guiding them to adopt good agricultural practices involving planned crop management. It helps in reducing farm base losses and motivating them to become farmer level entrepreneur rather than a simple producer. It involves initiating skill based knowledge to the student of agriculture, horticulture and allied sectors to encourage them to serve the farmers in the best possible ways.

SAAHAS calls us to look into the genuine problems of farmers and address those issues for their betterment in the arena of Agriculture, horticulture and allied sectors. Besides agriculture, horticultural crop production has been given a major focus by Govt. of India in future crop diversification, improving livelihood through doubling farmers' income, economic opportunities through export and job opportunities. While good beginning is made, much is to be achieved in different areas in agro-horticulture sector.

Apart from that, SAAHAS helps developing the culture to involve more number of women in farming, processing of crops and value addition thereof for higher returns in terms of total income. SAAHAS eagerly involves with the farmers and agriculture entrepreneur to motivate them for introducing hi-tech farming, which includes growing of high value horticultural crops in hydroponics, aeroponics, polyhouse, net house and greenhouse. The society has geared up its activities to take up the challenges of biotic and abiotic stresses, emerging needs of quality seeds and planting material and reducing cost of production.

There are several government and non-government organisations intended of farmer's welfare; still there is dire need for more involvement and attachment with the farmers. Our society's noble initiative can ensure diminishing of the persistent gap between agro-technocrats, scientists with the needy farmers. We not only ensure that the farmers choose right variety of right crop, better nutrient management through diagnosis recommended system and pest diagnosis but we also help them to sale their produce at premium rates. There is a major issue of chemical residues in food, soil and ecology which is also a big concern of the century. The Society also aims to motivate the farmers either for minimal use of chemical inputs or total adoption of organic farming. Consultancy, training, awareness programs, national and international seminars and symposia and technical services are the prime activities of the SAAHAS.

Society for advancement in Agriculture, Horticulture and Allied Sectors publishes peer reviewed scientific journal, 'Journal of Applied Agriculture and Life Sciences (JAALS)', biannually since January 2020 focusing on articles, research papers and short communications of both basic and applied aspect of original research in all branches of Agriculture, horticulture and other allied sciences. To apprise the scientists and all those who are working in the field of Agriculture, horticulture and allied sectors about recent scientific advancement is the aim of the Journal.