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Agriculture Education Digitally DISCONNECT

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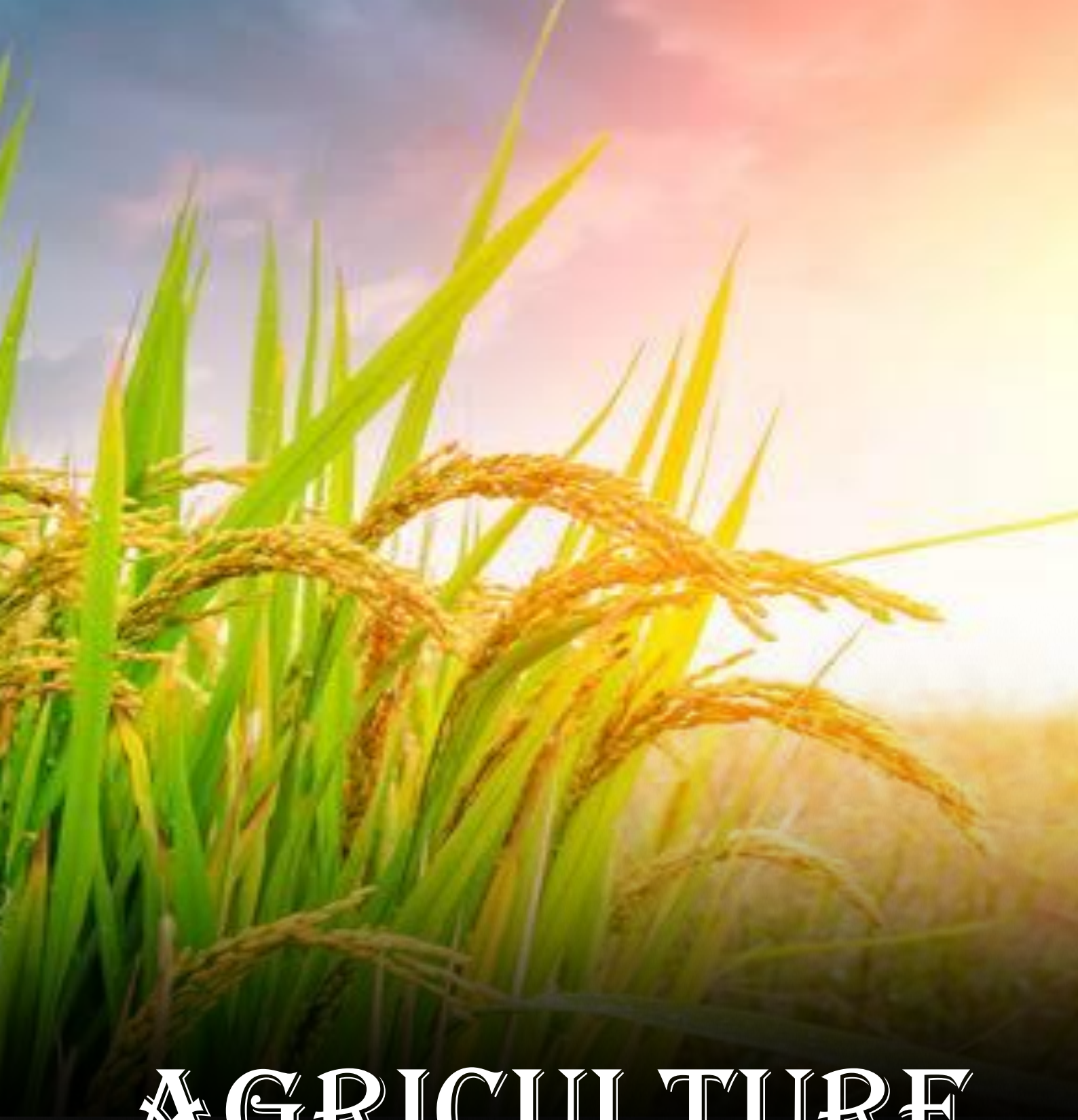


AGRICULTURE UPDATES

Government bans export of all varieties of onion

The Central government on Monday, 14 september prohibited the export of all varieties of onion except those cut, sliced or broken in powder form amid a shortage in supply due to heavy rainfall and floods.The export of all varieties of onion…is prohibited with immediate effect," the Directorate General of Foreign Trade (DGFT) said in a notification. The ban also includes Bangalore rose onions and Krishnapuram onions.

Organic Food Processing Unit in Uttar Pradesh

With the inauguration of this food processing unit, 5000 farmers will be benefitted and it is expected to leverage an investment of Rs 50.33 crores, said Smt. Harsimrat Kaur Badal, Union Minister for Food Processing Industries. Inaugurating the food processing unit located in Barabanki, Uttar Pradesh.

PM launched PMMSY

The Pradhan Mantri Matsya Sampada Yojana (PMMSY) is a flagship scheme for focused and sustainable development of fisheries sector in the country with an estimated investment of Rs. 20,050 crores for its implementation during a period of 5 years from FY 2020-21 to FY 2024-25 in all states/union territories, as a part of Aatma Nirbhar Bharat Package. PMMSY aims at enhancing fish production by an additional 70 lakh tonne by 2024-25.

Systomus Gracilus,a New Species of Freshwater Fish

The researchers from Kerala and West Bengal have identified systomus gracilus, a new cyprinid (family) fresh water fish from Ganges river at Naihati of West Bengal.

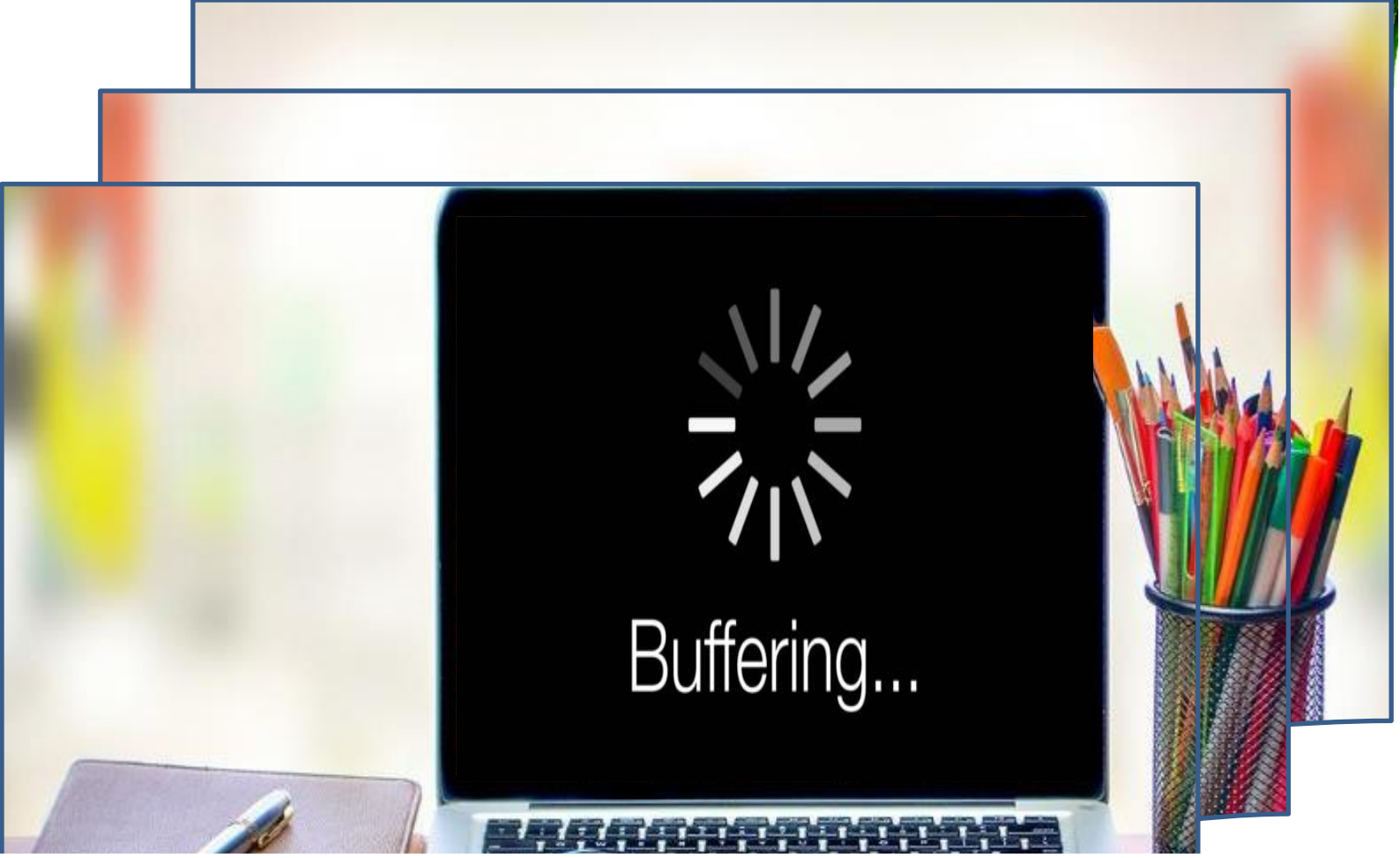
e-Gopala app launched by PM

e-Gopala App is a comprehensive breed improvement marketplace and information portal for direct use of farmers. At present no digital platform is available in the country for farmers managing livestock including buying and selling of disease free germplasm in all forms (semen, embryos, etc) availability of quality breeding services (Artificial Insemination, veterinary first aid, vaccination, treatment etc) and guiding farmers for animal nutrition, treatment of animals using appropriate ayurvedic medicine/ethno veterinary medicine. There is no mechanism to send alerts (on due date for vaccination, pregnancy diagnosis, calving etc) and inform farmers about various government schemes and campaigns in the area. The e-Gopala App will provide solutions to farmers on all these aspects.

SAFAL- for organic cotton growers by SBI

The product Safe and Fast Agriculture Loan is primarily focussed on organic cotton growers who don`t have any credit history. State Bank of India is planning to launch a loan product, SAFAL, primarily focussed on organic cotton growers who don`t have any credit history, said a top official of the country`s largest lender.

State Bank of India



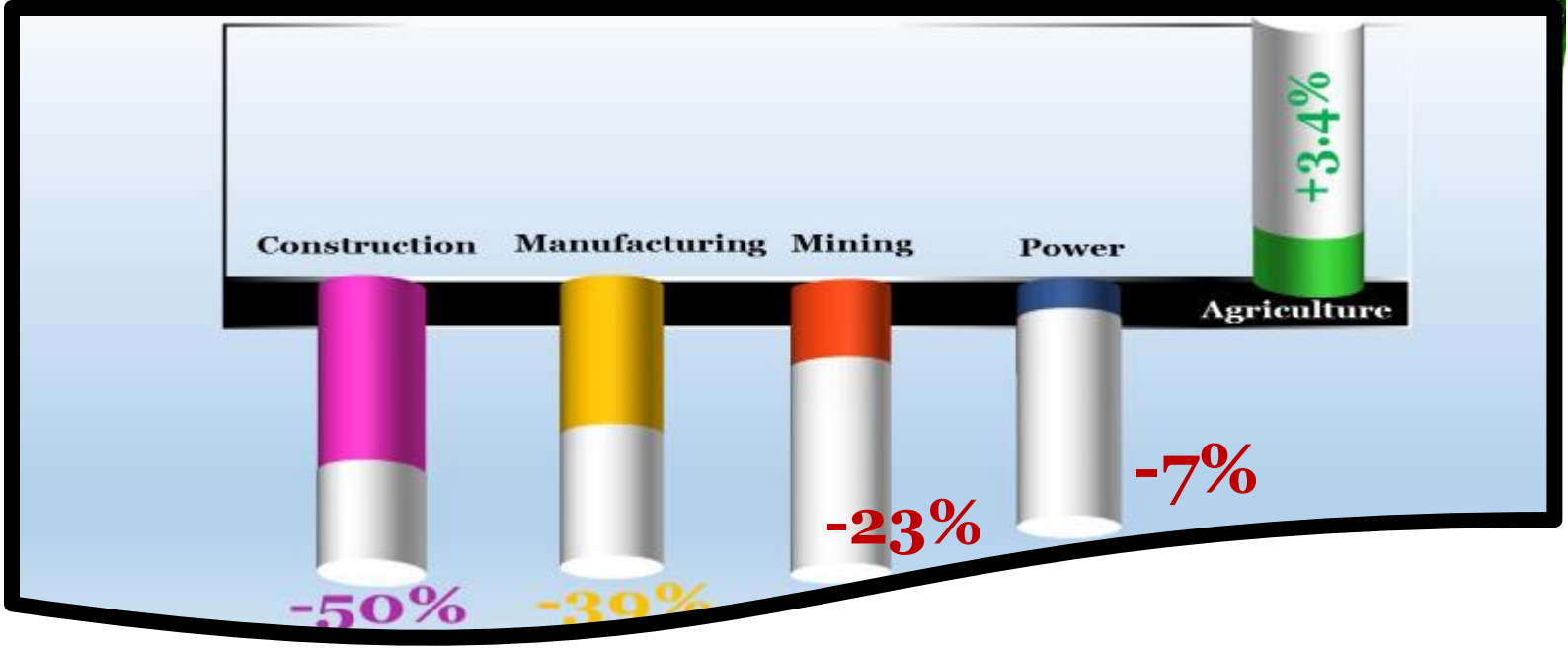
Agriculture Education:

Digitally Disconnect

In this terrible period of pandemic, where other departments like medical, engineering, management, etc. are moving towards online education, in such a situation, it is a challenge to all the agricultural institutions that how to make their education accessible to the students. In such a situation, we feel that we are still far from digitization in this era. As the survey has shown that connectivity at many agricultural universities, agricultural institutes and krishi Vigyan Kendra is at a very low level of internet connectivity, due to which the agricultural students and agricultural scientists are facing difficulties.

In such a situation, all of us need to make efforts towards the digital medium, through various types of training, awareness programme. An efforts should be made to provide training for old employees to bring them into the mainstream by connecting them through digitalization. As an initiative, farmer also need to be trained through this, in which in future, the agricultural world may not face any difficulty in dealing with such disasters.

It is not that online education is unavailable in all the universities, Some universities have connect their students through online education, even during this lockdown time, not only their classes started but also they were successfully conducted online exams. But it was not possible for some universities, most of the universities not even conducted their last semester examination, so it becomes a serious issue that in a country like India, where more than half of the population is depend on agriculture, the education qualites are not available in this field.

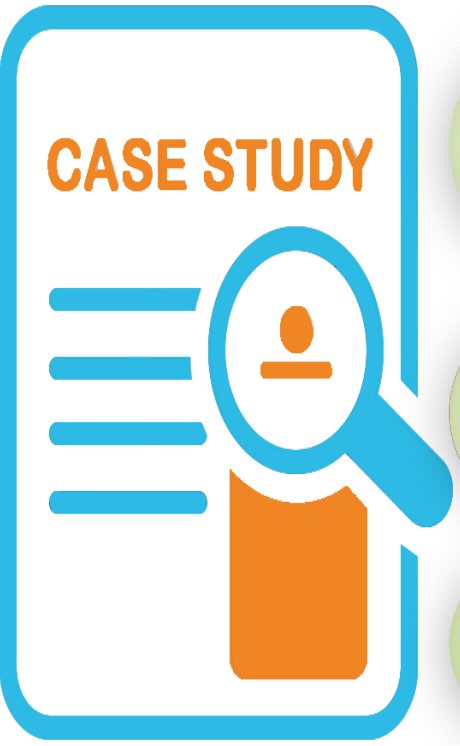


During this disaster, as we all witness, agriculture was the only such field in which GDP was in positive direction but when it's comes to agricultural education we witness limited numbers of universities, lack of research facilities and digitalization of agricultural education. Whereas the GDP of the rest of the sector had fallen, in such a time, agriculture became the shield of the Indian economy. The positive GDP of agriculture has showed that the Indian economy is still agriculture based. When agriculture has such an importance in our life, why do we not give importance to its education?

There is a need today that the government should also understand its importance. Because just speaking the name of the agricultural country is not going to work. Rather, there is also a need to give priority to agriculture and there is a need to increase the budget on all broad levels in the agricultural sector. When the budget on agriculture will increases, then the period of technological invention and innovation will be automatically seen in agriculture. Today all of us need to learn from this epidemic that there can be no more self-reliance than agriculture, so **this area should not be crippled but should be paved the way for self-sufficiency** by bringing it into the mainstream through technical and digital medium. This route will be extended only when the Students, Research Scholars, Employees and Scientists associated with agricultural education are successfully connected with today's technology.

History of Online Education

The first online course was offered in the year 2000 by National institute of information technology online learning limited. From then, online education started to penetrate in Indian education system. By the era of 2010 mobile phone penetration was higher so was internet consumption and it was easy for students to complete the course via mobile. Current year 2020 saw its peak in the field of online education due to the spread of covid 19.



Study conducted
Government City College, Hyderabad

By Dr. Vipalv Duth Shukla

Study conducted 100

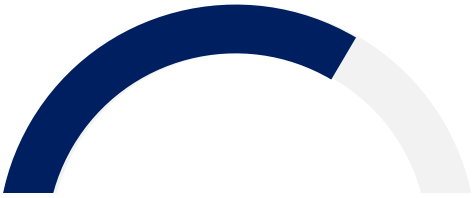
Result

61 %Students

It as a good option for classroom learning

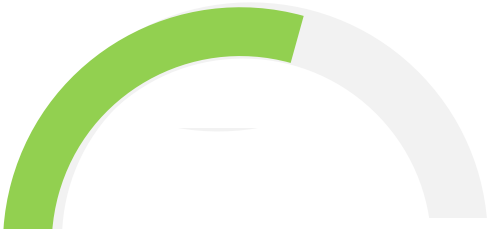
54 %Students

By online learning syllabus can be completed



65% Students found

It is flexible

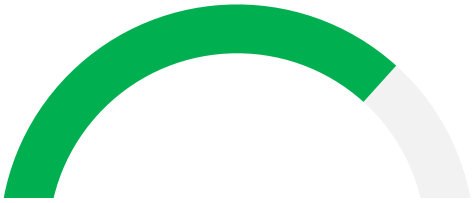


55% Students found

No stress due to online learning

70% Students felt

40 minute of duration per class is sufficient



59% Students preferred

Direct teaching

32 %Teachers

Had no training in computer and majority of teacher were in the favor for online learning.

Application In Agriculture

Agriculture education needs to be modernize with the changing times. Agriculture education is an essential stream students should learn about. There is need to online education in agriculture stream as well. As agricultural University are situated at the outskirts of the town or village, internet access is generally hard.

There is need for agricultural students to learn trending technologies emerging in the world. Now a days, research in agriculture higher education are continuously repeating in many universities but when there will be digitalization in agriculture education, students/researchers will come to know about recent technologies, and areas of research which will be benefited for agriculture.

In addition to this there are many development in agriculture throughout the world, through the help of online education in agriculture stream students will be able to learn about advance areas in agriculture and distance won't be the barrier. As many agriculture university are located at remote areas there is problem in the proper internet access. Many agriculture University are not even providing free wi-fi for students which is also a main issue at present time.

With the development of technology, teachers should also aware about technologies because it is future of nation and in many universities even teachers don't know about the use of internet and it's integration in education.

Why online education is not popular in agriculture

1 Far From Digitalization

While in many stream like engineering, medical etc. online education was popularized and it's importance was known to students as well as faculties. But far from this agriculture education didn't integrated the online education in the traditional education because they didn't recognize the need of online education. There are many agriculture University they don't even offer free wi-fi to students because of which students are not able to assess the internet.

2 Lack of knowledge of teachers and students

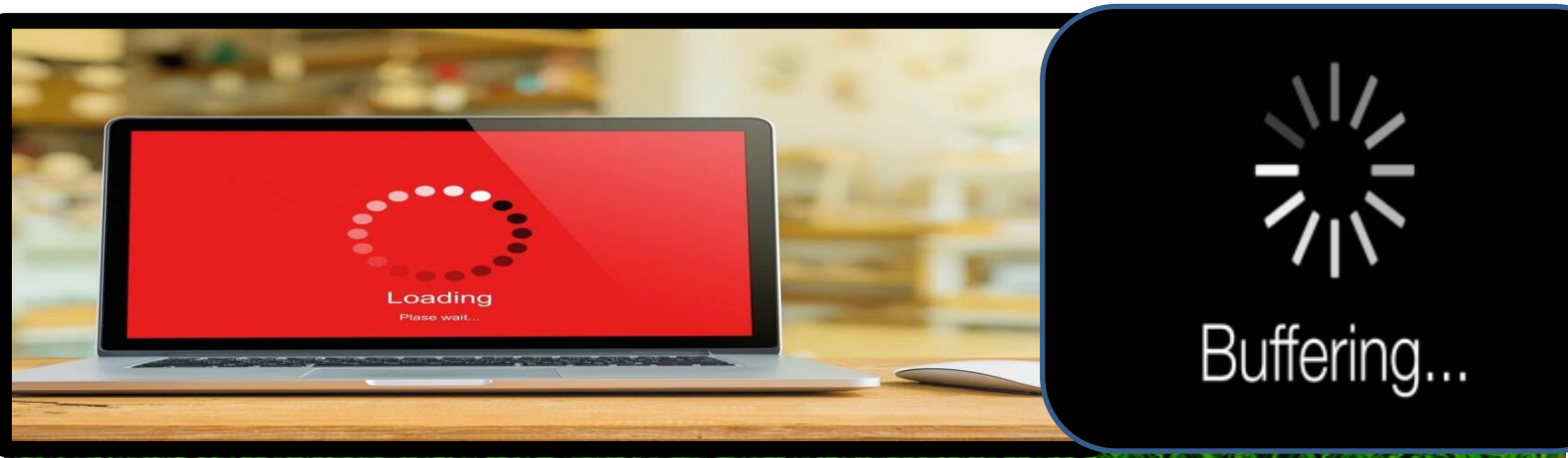
When it's comes to technology many teachers are unaware about use of technologies. Research shows that many professor who are excellent in knowledge but they even don't know the use of internet. The data is less for students but there are students who also had little or no knowledge about technologies. So when they don't know the use of technology how they will integrate the online education in traditional education. So it's the demand of present time to make teacher as well as students aware about online education.

3 Lack of online platform in agriculture

There are many apps and platforms for others stream but in agriculture education there is less platform which is developed in the field of agriculture education. In this field only few websites has been developed for agriculture like e-course by ICAR, agMOOCS. So it's very important to develop certain platform and application for agriculture education.

4 Lack of Resources

In today's digital age, where every area is being connected to digitization, the facilities of laptop, smartphones and better internet connections are not easily available in agricultural universities, colleges etc. There are many Institute where digital content is available for students and staff but due to lack of better connectivity, the pace of their education is being disrupted.



5 Teaching is Poaaible but not Research

It is often seen that the research work of students and agricultural scientists is going well, but there is a huge loss of research work. Since agricultural universities depend on their three dimensions i.e. **Teaching, Research and Extension**, if there is no work on these three dimensions then agricultural education will be meaningless. Therefore, there is still a need to improve on a large scale in the field of digitization in agriculture.

6 Never prepared for such situation

It has been seen a fundamental drawback that many employees and students are not able to establish themselves in such situations for which all these require a wide level of training. If we are successful in doing this, then in fact a big improvement in the state of agriculture in India can come in the form of revolution.

Initiative of ICAR

ICAR from past years doing many efforts for online education department. For this ICAR has developing many platform, running projects. And as this present situation of lockdown arose, ICAR has developed **15,820 e-courses in agriculture** and other allied stream for UG and PG programs. In addition to this ICAR has also asked agriculture University to develop thereown online portal for continuous online education in this lockdown period.

Some of ICAR initiative

1. Online learning portal- Online learning portal has been developed by ICAR and this portal provide open call for course content creation for agriculture education and review of contents under National agricultural higher education project. The main aim of this portal is to develop digital infrastructure system in agriculture education.

2. Consortium in agriculture- It is also known as Cera and and it's is integration of different online libraries in agriculture. It was developed in May 2007 and it was first of its kind which provides open assess to selected journal in agriculture at free of cost on 24×7 basis. This platform is useful for researchers, professional.

3. AU project information management systems- This platform is developed by ICAR with the financial assistance of World Bank on 50-50 basis under the national agriculture higher education project. This platform is useful for the information about research areas in agriculture. This is very beneficial for Ph.D. research scholar, project developers, professional as this platform provide necessary information to start a project.

4. agMOOCs- MOOC stands for massive open online course and it is developed to dissimiate and enhance knowledge in agriculture for students as well as professionals. This platform provide free access to online course which has been created by best faculties of different agriculture Universities. MOOCs are in the form of short video of 10-20 min and duration of one course is 6-8 weeks. At the end of course participants are provided an e certificates.

Future Aspects

As we are in 20th century and everything is possible by the online mediums it is demand of time to develop the online education in agriculture also. Online education is comparatively low from offline education and there are many advantages of online education so it should be developed in agriculture. Government should focus in assimilation of online education in agriculture and they should make a proper plan for this view. Universities should provide free wi-fi assess to students and encourage them to learn online. Teachers should given training for use of technology and online education. Some more websites and app should be developed in agriculture. In an addition to above, there has a vast need to work on particular areas in the field of agriculture to bring change in field of agriculture.

Digitalization of agricultural education- Streams like engineering, medical education has been digitalized from before. There are some colleges in India which are providing online education in those courses before pandemic. So it was easy for their students to assess the classes online in the time of covid. But agricultural education is beginners in this field. There is a vast scope of the agriculture education, students are opting agriculture as their career so it's demand of time to digitalize the agriculture education.

Awareness- There are teachers as well as students who don't know the use of technology for education. It's a high time to train teachers as well as students to utilize the technology for education and class purpose also. The country's new education policy talks about teacher training for online education. Because Government wants to blend the online education in traditional education.

Development of online platform- In agriculture stream there are only 2-3 online platform in which students can learn and enhance their knowledge. In a country like India, where agriculture is future of nation it's important to develop and promote the platforms for online education.

Conclusion

As because of corona virus everything is was closed from March 25, continues education was only possible because of online mediums. Students can attend classes, gave there exams and in some agriculture University thesis submission was done through online mode and students years was not wasted so we can say it's a good option for traditional classroom education. Government in his new education policy also focused on the integration of online education in classroom education and teachers training for online education. And reports also reveals that online education market is big and India is world's second largest country which provides online education so online education future is good and we can conclude that online learning is a best substitute of offline education.

Bamboo, A green gold: Importance & *in vitro* Propagation and Multiplication

Fig.1 Source: Green gold: bamboo is a winner when it comes to land restoration Retrieved from https://www.unccd.int/news-events/green-gold-bamboo-winner-when-it-comes-land-restoration

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> "India has the second biggest bamboo genetic resource in the globe with over 136 species covering an area of around 13.96 million hectares in the nation. Bamboo is known as "poor man's timber" as it is useful for the construction of hut and sheds for the people in the lowest ring of the social and economic ladder. It is also considered as "Green Gold" due to its economic importance."

Introduction

Bamboos are evergreen perennial flowering plants and one of the finest and flexible groups of monocotyledonous plants familiar to mankind. It is a member of Poaceae family and subfamily Bambusoideae. Bamboos occur from tropical to subalpine zones. India has the second biggest bamboo genetic resource in the globe with over 136 species covering an area of around 13.96 million hectares in the nation. The word "Bamboo" comes from Dutch or Portuguese languages which are taken from Malay.

As the bamboo plant is providing livelihood over 500 million peoples and providing housing and shelter for over 1 billion people. It is considered a very important plant in the tropics. Bamboo is known as "poor man's timber" as it is useful for the construction of hut and sheds for the people in the lowest ring of the social and economic ladder. It is also considered as "Green Gold" due to its economic importance. Bamboo is widely used as a building material, scaffolding, agriculture implements, stabilizer of soil, plywood and practical board manufactured. It is estimated that about 4.5 million metric tonnes of bamboo is used in the paper industry out of annual production of nearly 9.5 million metric tons. The principal source of paper and pulp of acceptable quality in India are *Dendrocalamus strictus* and *Bambusa arundinaceae*. Industrial technologies being investigated may make possible efficient ethanol production from bamboo that is up to 160 gallons of ethanol from one dry ton of bamboo.

Fig.2 Source: World Bamboo Day: India's green gold is sustainable and versatile Retrieved from https://indianexpress.com/article/lifestyle/art-and-culture/world-bamboo-day-2019-indias-green-gold-5998641/

Cabinet Committee on Economic Affairs (CCEA) approved **National Bamboo Mission** on 25-04-2018. By acquiring area-based, regionally changed plans and to expand the bamboo cultivation and marketing area, this mission predicts promoting the holistic growth of the bamboo sector. To enhance the availability of quality planting material measures have been taken like supporting the forming up of new nurseries and maintaining the existing ones, under this mission. The Mission is taking various measures for building up marketing of products made by bamboo, especially those of handicraft items to address forward merging. In Sericulture leaves are also used as fodder while bamboo pulp clothes are being manufactured which is an example of green chemistry. In addition to farm income and contribute towards resilience to climate change as well as the availability of quality raw material requirements of industries, objectives are been taken to increase the area under bamboo plantation in non-forest government and private lands. In various areas like in farmers' fields, homesteads, community lands, arable wastelands, and along irrigation canals, water bodies, etc. the bamboo plantations will be mainly upgraded. By reducing the

dependency on the import of bamboo and its products by the suitability of domestic raw material for industry and improved productivity, the efforts have been realigned to enhance the income of the primary producers. In comparison with Poplar and Eucalyptus bamboo-based Agroforestry models provides much faster and higher economic returns.

Bamboo contains a moisture 88.8%, protein 3.9%, fat 0.5%, minerals 11%, and carbohydrates 5.7% per 100 grams of its edible portion. Its vitamins and minerals constitute Calcium, Phosphorous, Iron, Thiamine, Riboflavin, Niacin, and vitamin C. The bamboo leaves are a good source of hydrocyanic and benzoic acid and stimulant, aromatic and tonic. For preventing spasmodic disorders and arrest secretion or bleeding, and for treating stomach problems, the leaves are beneficial. They are also an effective aphrodisiac. The taste is not specific. The leaves of bamboo are used in the form of decoction to treat diarrhea in many parts of India. It is beneficial for women in promoting and regulating the menstrual cycle. The intestinal worms, especially threadworms are killed by the consumption of these leaves. Various enzymes like nuclease, deamidase, a proteolytic enzyme, amylase, catalase, peroxidase, amygdalin splitting, and silicon splitting enzymes are found in tender bamboo shoots and leaves. For curing the respiratory diseases and cleaning wounds and maggot infected sores these tender shoots are used effectively. Apart from this, for abortion especially during the early stage of pregnancy (first month) decoction of the tender bamboo shoot, mixed with palm jaggery (tad-ka-gud), is given once or twice a day for a week. It is used for easing the process of the expulsion of the placenta and prevents excessive loss of blood after childbirth.

Prerequisite of *in vitro* propagation and multiplication of bamboo

With immense eco-sociological and commercial importance, bamboos are considered as the most versatile plants. The natural stands of bamboos are diminishing at a very fast rate, due to the rapid industrialization and an increasing population. Because of harvesting and the lack of knowledge of propagation methods, many species of bamboos are endangered. Bamboo could become a chief crop used in many purposes in most of the countries if authentic means of mass propagation were available.

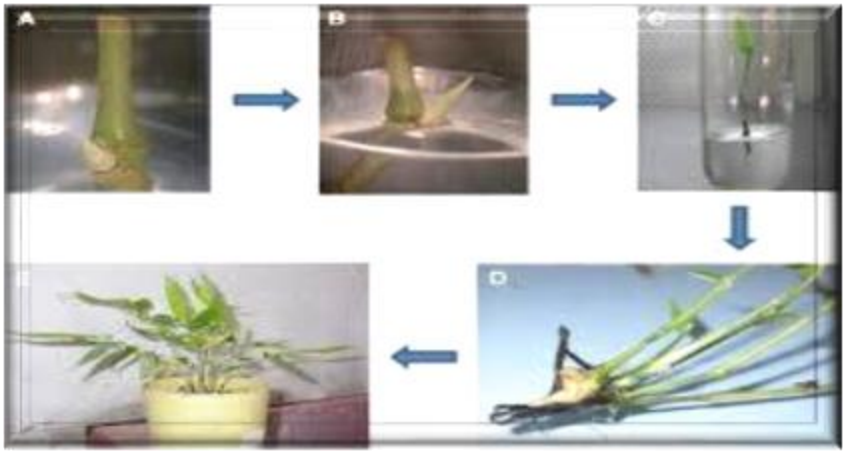

Fig. 3 Various stages of bamboo in-vitro propagation and multiplication

To produce a greater number of bamboos plants, use of culms needs significant time and labor. As *in vitro* propagation is considered to be a rapid and successful means of propagation, tissue culture techniques adopted here have become important and are used commercially. The INBAR Technical report contains 17 papers on various propagation and management aspects and the conference recommended on these subjects in volume 1 of propagation and management. Bamboo propagation is essential as this resource has been exhausted at a higher rate due to its increasing usage and mismanagement of natural stocks. Due to the vigorous loss of viability and damage to seeds, the propagation of bamboo by seed is unreliable. Tissue culture offers rapid and reliable means of plant propagation as compared to multiplication by the vegetative method which is very slow. Propagation through *in vitro* culture is the only viable method. Three major components are important, for the development of a commercially feasible process of bamboo propagation and another improvement. These are:

1. Research on the development of tissue culture techniques for bamboo hybridization and also research on genetics and physiology of bamboo.
2. With high clonal fidelity and very high efficiency, the development of axillary branching into a universal technique is done.
3. To optimize the added value of micropropagation, forward integration is necessary.

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Demand of Modern Farming: Conservation Agriculture

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"Conservation agriculture has a potential to improve the use efficiency of natural resources such as soil, water, air and fossil fuel. They can improve soil biodiversity, carbon status, soil health, input use efficiency as well as soil fertility status."

Introduction

Ever-increasing global population, particularly in many developing countries requires increased supply of food, fibre and oil, which poses a grave challenge before the scientist to produce more and more from limited, shrinking and degraded land and water resources. Tilling soils continuously without adding organic matter has adverse effects on soil health and quality of the produce. The concerns for soil erosion, soil quality deterioration and chemical hazards loom large in recent years and have compelled the researchers to look back to past towards evolving conservation agriculture based systems, which aim at higher productivity and profitability through rational and sustainable use of available resource on a long term basis. Conservation Agriculture is a concept for resource- saving agriculture crop production, which is based on enhancing natural and biological processes above and below the ground (FAO, www.fao.org.ag/ca). It contributes to environmental conservation as well as to enhanced and sustained agricultural production. It can also be referred to as "resource- efficient agriculture".

Conservation agriculture (zero tillage + soil cover through residues). CA was evolved in the USA because of land degradation and increase in oil price. E.H. Faulkner regarded as the "father of conservation agriculture".

Scope

Conventional mode of agriculture practices with intensive tillage operation, clean cultivation (bare with no cover), monocropping or fixed crop rotation, imbalanced fertilizer use and little use of organics resulted in a host of problems in global agriculture, which are as follows:

1. Declining factor productivity (water, nutrient, labour and energy).
2. Deteriorating soil health (physical, chemical and biological).
3. High surface water runoff and erosion.
4. Higher global warming potential.
5. Air and groundwater pollution.

Conventional vs. Conservational agriculture

Conventional agricultural systems encourage clean cultivation through intensive tillage operations to prepare fine seed bed for sowing to ensure proper germination and initial vigour, control of weeds and other pest, mixing of fertilizer and organic manures, resulting in bare soil with no plant cover.

Table 1: Difference between conventional and conservational agriculture

S.N.	Conventional agriculture	Conservation agriculture
1	Based on excessive tillage	Based on no tillage
2	Residue burning	Surface retention of residues
3	Use of ex-situ FYM	Use of in-situ FYM
4	Crop based management	Cropping system based
5	Single or sole crop used	Intercropping used
6	Green manure used	Brown manure used

Table 2: Area under conservation agriculture

Country	Area (Mha)	Percentage of global area
USA	35.61	22.7
Brazil	31.81	20.3
Argentina	29.18	18.6
Canada	18.31	11.7
Australia	17.7	11.3
India	3.5	2.3
Total (World)	156.99	100

Source: www.fao.org/ag/ca/6c.html

Principles of conservational agriculture

Conservational agriculture has three basic principles:

1. Direct seeding involves growing crops without mechanical seedbed preparation and with **minimal soil disturbance** since the harvest of the previous crop.
2. A **permanent soil cover** is important to protect the soil against the deleterious effects of exposure to rain and sun; increase micro and macro organisms in the soil with a constant supply of "food"; and alter the microclimate in the soil for optimal growth and development of soil organisms, including plant roots.
3. The **rotation of crops** is not only necessary to offer a diverse "diet" to the soil microorganisms, but as they root at different soil depths, they are capable of exploring different soil layers for nutrients.

Fig. 1: Principles of conservation agriculture
Source: http://www.fao.org/zhc/detail-events/en/c/238478/

Conservation agriculture practices

A. Laser Land Levelling

It is a precursor technology for adopting conservation agriculture practices like zero tillage, bed planting. Laser levelling provides an accurate, smooth and graded field on which irrigation water reaches to the tail-ends in less time, helping saving irrigation water by 20% and improves N-use efficiency under surface irrigation. Land levelling can reduce evaporation and percolation losses by enabling faster irrigation times by eliminating depressions. Other benefits like save water by 25-30% and increase yield by 5-15 % (Jat *et al*., 2009).

B. Conservation tillage (Zero/minimum tillage)

Conservation tillage is a collective umbrella term, commonly given to zero tillage, direct drilling, minimum tillage and ridge tillage to denote that the specific practice fulfils some resources conservation objectives. Usually, the retention of residues for covering at least 30 % of the soil surface characterizes the lower limit of classification of Conservation tillage. Zero tillage was first started in 1980 in India promoted by Imperial Chemical Industries to promote Paraquat, a non-selective herbicide for controlling weeds in zero tillage wheat. Major benefits of ZT is reduced costs owing to saving in fuel and labour up to Rs. 2500-3000/ha, timely planting of crops, reduced weed density, saving of irrigation water up to 15-20% and improved input use efficiency.

C. Direct Seeded Rice (DSR)

DSR is an alternative to puddle transplanting for saving in labour and water. It is a labour, fuel, time, and water saving technology, which gives similar yield to puddle transplanted rice if weeds were controlled with judicious use of herbicides. It avoids water required for land preparation and reduces overall water demand of the puddle transplanted rice. DSR does not affect rice quality and can be practiced in different ecologies, including upland, medium and lowland, deep water areas. Soil health is maintained and fertilizer and water use efficiencies are higher in DSR (saving of 35-40 % irrigation water). Thus, DSR is technically and economically a feasible alternative to puddle transplanted rice.

D. Brown Manuring with Sesbania

In brown manuring, both rice and Sesbania are sown together and allowed to grow for 25-30 days. Rice is sown in lines with a seed drill and Sesbania is broadcast on the moist soil. Sesbania plants are knocked down with 2,4-D ethylester @ 0.25-0.50 Kg/ha or Bispyribac- Na @ 25 g/ha. Sesbania while growing with rice smothers weeds, reduces herbicide use and irrigation water and supplies 15-20 Kg N/ha with fresh biomass of 10-12 t/ha. These practices can be followed in crops like maize, pearl millet, sorghum. In broad-leaved crops (soybean) 2,4-D can not be used, but Sesbania can be cut manually and spread as mulch between crop rows for controlling weeds, and conservation of moisture and nutrients.

Advantage of Conservation Agriculture

- ✓ Time saving and thus reduction in labour requirement.
- ✓ Reduction of costs, e.g. fuel, machinery operating costs and maintenance, as well as a reduced labour cost.
- ✓ Higher efficiency in the sense of more output from lower input.
- ✓ Increase soil organic matter.

- ✓ In-situ soil water conservation.
- ✓ Improvement of soil structure, and thus rooting zone.
- ✓ Reduce soil and water erosion
- ✓ Improvement quality of air and water.
- ✓ Increase soil biodiversity.
- ✓ Enhance carbon sequestration.

Limitations of Conservation Agriculture

- ✓ CA is highly machine depended and management intensive practice.
- ✓ Its success depends largely on the availability of sufficient quantity of crop residues, required for surface retention.
- ✓ Continues zero tillage results in infestation of more perennial weeds such as *Cyperus rotundus*, *Cyperus esculentus* and *Cynodon dactylon* etc.
- ✓ Under residue laden conditions, pre-emergence herbicides are usually less effective when applied at the recommended doses, which needs some higher doses tried and optimized with higher volume rates of water.
- ✓ Band placement of nutrients is difficult without the help of suitable machine.
- ✓ Released chemical from residues over a long period may result as allelopathy.

Economics of Conservation Agriculture

Under zero tillage, fuel consumption was reduced to 11.30 L/ha compared to 34.62 L/ha by conventional tillage, resulting in fuel saving of 24 L/ha (69%) (Patle, 2013). He also observed that conservation tillage increased B:C ratio and lowered operational energy (5.1-26.1%) compared to conventional practice. An estimated saving in CO_2 emission would be 62 kg/ha due to zero tillage.

Conclusion

Conservation agriculture has a potential to improve the use efficiency of natural resources such as soil, water, air and fossil fuel. They can improve soil biodiversity, carbon status, soil health, input use efficiency as well as soil fertility status. However, their utilization needs to be optimized across locations, cropping seasons and crop based on sound benefit-cost economics.

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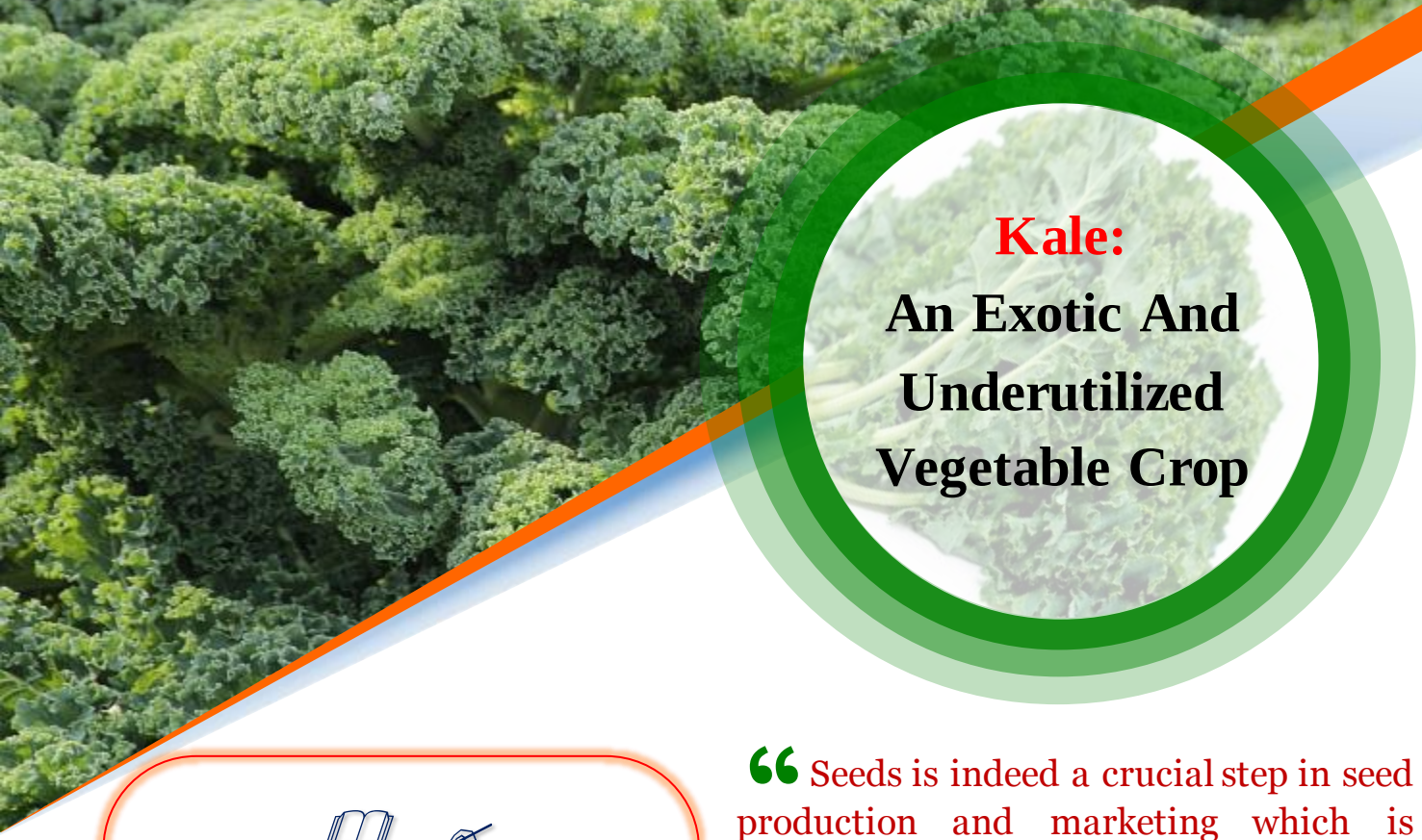

Kale: An Exotic And Underutilized Vegetable Crop

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"Seeds is indeed a crucial step in seed production and marketing which is generally done to maintain high-quality seeds standards and making them available to farmers for maintaining good and quality yield. In this system varieties of crops are generally grown aiming checking the purity, viability and physical identity and characteristics of seeds."

Introduction

Kale is a lord of verdant vegetables, near undomesticated cabbage, and referred to as "Cabbage's cousin". This verdant vegetable is a negligible calm vegetable that is presented in the nineteenth century. The business development of its leaves is restricted in the country. This leaf has a place with the group of "Brassicaceae" and the class of "Brassica". Kale leaves include amazing medical advantages also. Kale is botanically known as *Brassica oleracea* var. *acephala*, belonging to the family Cruciferae /Brassicaceae.

Benefits and uses of kale

- It is a great wellspring of 'Ascorbic Acid' and 'Phylloquinone'
- Kale is stacked among ground-breaking cell reinforcements
- Brings down cholesterol, henceforth lessening the danger of coronary illness
- It has various disease battling things in it
- It is rich in beta carotene

- It is a decent wellspring of minerals too
- Also aids in getting in shape
- It is included in one of the most supplement thick nourishments on the earth

Significant kale producing states

Cultivation of kale is confined to very few states of Northern India blessed with good agro-climatic conditions that are Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Punjab, Haryana, and Nilgiris hills.

Climatic requirement

The vegetable is the toughest (hardiest) harvest that can resist frost minimally from10^0 C to15^0 C. Fundamentally, it is inclined toward a calm mild ambiance and is capable of being developed in the regions possessing chilly season also.

Soil requirement

The yield favors very much depleted sandy topsoil soil with a great natural issue. The solid harvest endures salts in the specks of dirt. The absolute soil pH of 5.5 – 6.5 (somewhat acidic) will bring about a great yield.

Cultivars of Kale

Generally, three important cultivars are described as:

1. Dwarf (below 40 cm),
2. Medium (40-80 cm)
3. Tall (above 80 cm).

Long growing cultivars have slight creation sheds the leaves at an early stage. Primary bantam sort assortments are bantam green twisted scotch, bantam greenery twisted, greenery twisted and cheeseburger market (average to large). Karam Saag (average large), a well-known assortment generally developed in J&K. Siberian and Scottish are most appropriate for developing in calm districts.

Order by type of the leaf

- Bumpy leaf (dark cabbage, better known by its Italian interpretation 'cavolo nero', and known as Tuscan cabbage, Tuscan Kale, lacinato, and dinosaur kale)
- Curly leaf (Scots kale, blue twisted kale)
- Plain leaf (level leaf types like Red Russian and White Russian Kale)
- Leaf and skewer, or padded type leaf (a combination of a wavy and plain leaf)
- Ornamental (less acceptable and harder leaves)

Ornamental kale

Numerous assortments of kale, as well as cabbage, are developed essentially for decorative purposes. The leaves grown are splendid white, red, pink, lavender, blue, or violet in the inside of the rosette. The various kinds of elaborate kale are peacock kale, coral sovereign, kamone coral sovereigns, shading up kale, and Chidori kale. Elaborate kale is as eatable as some additional assortment, yet possibly not as attractive. The leaves of kale are progressively utilized as an element for vegetable bundles and nuptial bunches.

Propagation

The most widely recognized method of spread is through seeds. Seeds are generally planted in nursery beds to raise the seedlings and relocated to the principle mainland.

Land preparation and transplanting

The field ought to be set up till it achieves fine tilth stage by permitting a few profound ploughings that additionally aid in eliminating any weeds from the mainland. In helpless sod, enhancing with thoroughly decomposed Farm Yard Manure will expand the dirt ripeness henceforth the great harvest.

A normal seed rate of 400-500 grams is considered adequate for a one-hectare land. Generally, months August to October is considered as the most excellent sowing hour for North Indian conditions. August to September month sowing is an ideal opportunity for Himachal, Kashmir, and Nilgiri districts. Nursery elevated sapling of a month old and a half age ought to be relocated and transplanted at a spacing of 45 cm X 30 cm. For planting in late, dividing can be decreased.

Weed control and Irrigation

Weed management is a fundamental and crucial step while cultivating this vegetable. Ordinary light hoeing and weeding ought to be done to construct the field weed-free. Generally, 3-4 hoeing and wedding are adequate and once the leaves cover the sod, there is no requirement for hoeing. The starting water system ought to be given following relocating in the field and successive irrigation should be done at 3 weeks span.

Manures and fertilizers

Adding 25 tonnes of Farm Yard Manure/hectare to the field at land planning hour is generally recommended for good and quality yield and production. Inorganic manures of P and K of 75 kg/ha (full dose) ought to be applied as full dose before transplanting while N of 150 kg/ha ought to be applied in equivalent split dosages, one portion at planting time, one portion following multi-month of planting, and last portion 3 weeks before first reaping.

Pests and diseases and their management

Aphids, Flea scarabs, Whiteflies, and Caterpillars are the fundamental bugs inspected in this vegetable. Making the growing arena clean and weed-free and implementing neem oil will be the best solution to manage these vermin. The choice of solid seeds and infection safe seeds will be a smart thought for possessing decreased ailment.

Harvesting process

The leaves begin to develop and, reaping begins in November and proceed up to January. Aiming towards the superior grade, it ought to be gathered at the privileged vegetative period. Collected leaves are packaged, pressed, and showcased.

Yield

Kale is a hardy crop and requires a cold climate for good growth and development. Kale leaves taste better when the leaf maturation occurs in cold temperatures. If proper variety and farm management methods like proper crop production, and crop protection practices are followed during the cultivation of kale a standard yield of 100 to 200 quintals per hectare can be obtained and can fetch a good market price.

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Role of Indian Agricultural Women in Environmental Sustainability

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"India is home to the fourth largest agricultural sector in the world. Agriculture in India defines familial tradition, social relations and gender roles. Female in the agricultural sector, whether through traditional means or industrial, for subsistence or as an agricultural labourer, represents a momentous demographic group."

Agriculture involves not only crop raising but husbandry, agro forestry and pisciculture etc. It is the science of cultivating the soil, harvesting crops and raising livestock. Any economic endeavour that utilizes directly the natural resources of soil and water for production is included in agriculture. Major Agricultural products include rice, wheat, oilseeds, cotton, jute and tea.

Agriculture plays a vital role and is one of the strongest sectors of the Indian economy. This sector provides approximately 52 % of the total number of jobs available in India and contributes 18 % to the total GDP. Over 70 % of the rural households depends on Agriculture and it is the only means of living for almost two-thirds of the employed class in India.

India is home to the fourth largest agricultural sector in the world. Agriculture in India defines familial tradition, social relations and gender roles. Female in the agricultural sector, whether through traditional means or industrial, for subsistence or as

an agricultural labourer, represents a momentous demographic group. Agriculture is directly tied to issues such as economic independence, decision-making abilities, agency and access to education and health services and this manner has created externalities such as poverty and marginalization, and compounded issues of gender inequality.

As farmers, labourers, and entrepreneurs, women play an important role in the agriculture sector and development of rural economies. Mainly rural women are engaged in agricultural activities in three different ways depending on the socio-economic status of their family and regional factors. They work as:

- Paid Labourers.
- Cultivator doing labour on their own land.
- Managers of certain aspects of agricultural production by way of labour supervision and the participation in post-harvest operations.

The types of agricultural activities taken up by women include the following:

- Sowing
- Nursery management
- Transplanting
- Weeding
- Irrigation
- Fertilizer application
- Plant protection
- Harvesting, winnowing, storing etc.

Women have direct contact with natural resources like fuel, food and fodder, forest, water and land especially in rural areas where 70% of Indian population reside and directly dependent upon natural resources. Women are also responsible for using these resources to satisfy the basic needs of their families.

Besides, that woman even played a leadership role for conservation and enhancement of environment. In communities around the world, women manage water, sources for fuel, and food, as well as both forests and agricultural terrain. From the high level to the grassroots, the 1992 UN Earth Summit, India's Chipko movement and Kenya's Green Belt Movement all highlighted the role of women's voices and perspectives in sustainable development. Similarly, nowadays Medha Patekar, a social worker, Menaka Gandhi, an environmentalist and politician, are playing key role for the conservation and promotion of the environment.

Therefore, conservation of natural resources and promotion of environment cannot be done without involving the women in planning and training for promoting the values for conservation and promotion of environment.

The impacts of climate change affect everyone. However, not everyone is equally vulnerable, and not everyone has the same capacity to adapt to these impacts. It is clear that climate change will be felt by different groups of people in different ways. Due to differences in socially constructed gender roles and social status, women and men experience the impacts of climate change differently.

Thus, women actively participate in environment protection than men as women are directly affected and influenced by nature than men. Women have been involved in several governmental & nongovernmental forestry & environment programs.

a. Chipko movement / vriksha andolan / vriksha mitra
b. Community forestry programs
c. Social forestry programs
d. Individual conservation programs
e. SHGs conservation programs
f. Green-Belt movement
g. keep the city clean programs
h. green India clean India programs

The sustainable use of the environment by women is the result of their closeness to nature. Most women, especially in rural areas, are involved in household activities like the collection of food, water, fodder and fuel, which enhance their knowledge of the environment, thus enabling them to implement the appropriate conservation practices and technologies.

Climate change has a serious impact on the availability of various resources on the earth especially water, which sustains life on this planet. Changes in the biosphere, biodiversity and natural resources are adversely affecting human health and quality of life. Agriculture production is directly dependent on climate change and weather. Possible changes in temperature, precipitation and CO_2 concentration are expected to significantly impact crop growth. The overall impact of climate change on worldwide food production is considered to be low to moderate with successful adaptation and adequate irrigation. India is home to 16% of the world population, but only 4% of the world water resources. Agriculture is directly dependent on climate, since temperature, sunlight and water are the main drivers of crop growth. While some aspects of climate

change such as longer growing season and warmer temperatures may bring benefits in crop growth and yield, there will also be a range of adverse impacts due to reduced water availability and more frequent extreme weather conditions. These impacts may put agricultural activities at significant risk. Climate change has already caused significant damage to our present crop profile and threatens to bring even more serious consequences in the future.

Climate change will have a progressively increasing impact on environmental degradation and environmentally dependent socio-economic systems with potential to cause substantial population displacement.

When people are faced with severe environmental degradation, they have one of three options:

i. stay and adapt to mitigate the effects;
ii. stay, do nothing and accept a lower quality of life; or
iii. leave the affected area.

Environmental degradation is the disintegration of the earth or deterioration of the environment through consumption of assets, like, air, water and soil. The destruction of environments and the eradication of wildlife. Air pollution, water pollution, garbage, and pollution of the natural environment are all challenges for India.

The major causes of the environmental degradation are modern urbanization, industrialization, over-population growth, deforestation etc. Environmental pollution refers to the degradation of quality and quantity of natural resources. Various types of the human exercises are the fundamental reasons of environmental degradation. These have prompted condition changes that have turned out to be hurtful to every single living being. The smoke radiated by the vehicles and processing plants expands the measure of toxic gases noticeable all around. The waste items, smoke radiated by vehicles and ventures are the fundamental driver of contamination. Spontaneous urbanization and industrialization have caused water, air and sound contamination. Urbanization and industrialization help to expand contamination of the wellsprings of water. So also, the smoke discharged by vehicles and ventures like Chlorofluorocarbon, nitrogen oxide, carbon monoxide and other clean particles dirty air. Neediness still remains an issue at the base of a few ecological issues.

The primary causes of environmental degradation in India are attributed to the rapid growth of population in combination with economic development and overuse of natural

resources. Major environmental calamities in India include land degradation, deforestation, soil erosion, habitat destruction and loss of biodiversity. Economic growth and changing consumption patterns have led to a rising demand for energy and increasing transport activities. Air, water and noise pollution together with water scarcity dominate the environmental issues in India. According to World Bank estimate, between 1995 through 2010, India has made one of the fastest progresses in the world, in addressing its environmental issues and improving its environmental quality. Still, India has a long way to go to reach environmental quality similar to those enjoyed in developed economies.

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Drone Application Technology Use in Horticultural Crops

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"According to UN Food and Agriculture Organization, the population will increase by 2 billion by 2050. However, only 4% additional land will come under cultivation by then. In this context, use of latest technological solutions to make farming more efficient, remains one of the greatest imperatives. While Artificial Intelligence (AI) sees a lot of direct application across sectors, it can also bring a paradigm shift in how we see farming today. AI-powered solutions will not only enable farmers to do more with less, it will also improve quality and ensure faster go-to-market for crops."

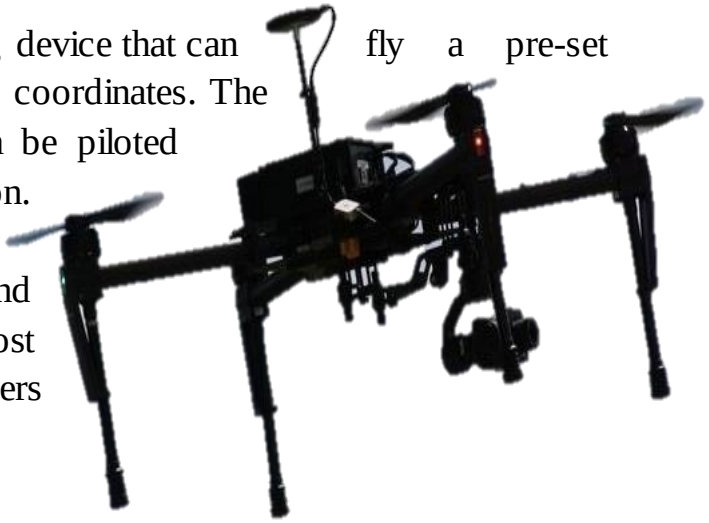
Introduction

The world population has increases day by day and projected to reach 10 billion people by 2050, so the expert expect that the horticultural consumption will also increase in the same time period. In order to feed this larger, more urban and richer population, food production must increase by 75 percent. Horticulture sector is the most promising sector and challenging sector because it is depends on condition of the soil, weather, irrigation water quality and quantity and their application rate.

This report argues that the required increase in food production can be achieved by adopting the advance technologies in horticultural production. The Use of advanced technologies such as drone in horticulture offer potential for facing several major or minor challenges. The major applications of drone in Horticulture are crop monitoring, irrigation, soil and field analysis and bird control.

Drone or UAV

An Unmanned Aerial Vehicle is a flying device that can fly a pre-set course with the help of an autopilot and GPS coordinates. The device also has normal radio controls; it can be piloted manually in case of a fault or dangerous situation. Sometimes the term UAV is used to refer to the complete system, including ground stations and video systems, however the term is most commonly used for model planes and helicopters with both fixed and rotary wings.



Advantages of Drone

Unmanned Aerial Vehicle offers less stressful environment, it is used for better decision making, it presents safer environment, and they can fly longer hours as long as the vehicle allows for it. There is no need for the qualified pilot to fly it, in the long run, UAV can stay in the air for up to 25 hours, doing the repetitive tasks, performing the precise, repetitive raster scan of the region, day-after-day, night-after-night in the complete darkness or in the fog and under computer control.

UAV performs the geological survey, it performs the visual or thermal imaging of the region, it can measure the cell phone, radio or TV coverage over any terrain, the drone pilots or operators can easily hand off controls of the drone without any operational downtime. Drones can have more pin point accuracy from greater distances.

Basic Principle - How do drone work?

The 4 propellers of a drone or quad copter are fixed and vertically orientated. Each propeller has a variable and independent speed which allows a full range of movements. The core components of a drone are as follows given below:

Sr. No.	Core components	Fuction
1.	Chassis	The skeleton of the drone which all components are fixed to. The chassis design is a trade-off between strength and additional weight, which will require longer propellers and stronger motors to lift.
2.	Propellers	Principally effect load the drone can carry the speed it can fly and the speed it can man oeuvre. The length can be modified; longer propellers can achieve greater lift at a lower rpm but take longer to speed up/slow down. Shorter propellers can change speed quicker and thus are more maneuverable; however they require a higher rotational speed to achieve the same power as longer blades. This causes excess motor strain and thus reduces motor life span. A more aggressive pitch will allow quicker movement but reduced hovering efficiency.
3.	Motors	1 Per propeller, drone motors are rated in "kV" units which equates to the number of revolutions per minute it can achieve when a voltage of 1 volt is supplied to the motor with no load. A faster motor spin will give more flight power, but requires more power from the battery resulting in a decreased flight time.
4.	ESC	Electronic Speed Controller provides a controlled current to each motor to produce the correct spin speed and direction.
5.	Flight Controller	The onboard computer which interprets incoming signals sent from the pilot and sends corresponding inputs to the ESC to control the quad copter.
6.	Radio Receiver	Receives the control signals from the pilot.
7.	Battery	Battery generally lithium polymer batteries are used due to high power density and ability to recharge.

Further to this, sensors can be used such as accelerometers, gyroscopes, GPS and barometers for positional measurements. Cameras are also frequently mounted for navigation and aerial photography.

Drone mechanism - How do you fly a quad copter drone?

A drone is controlled manually with a handheld radio control transmitter which manually controls the propellers. Sticks on the controller allow movements in different directions and trim buttons allow the trim to be adjusted to balance the drone. Screens can also be used to receive live video footage from the on-board camera and to display sensor data.

Further to this, on-board sensors can provide helpful settings such as;

- Auto altitude where the drone will move at a fixed altitude.
- GPS hold, where the drone will remain at a fixed GPS position.

Drone can also be flown autonomously, modern flight controllers can use software to mark GPS waypoints that the vehicle will fly to and land or move to a set altitude.

Applications of drone

Horticulture

Farmers and horticulturists are always looking for cheap and effective methods to regularly monitor their crops. The infrared sensors in drones can be tuned to detect crop health, enabling farmers to react and improve crop conditions locally, with inputs of fertilizer or insecticides. It also improves management and effectuates better yield of the crops. In the next few years, nearly 40% of the horticultural market will comprise of drones. Power and pipeline inspection: Many systems such as power lines, wind turbines, and pipelines can be checked by drones.

Horticultural applications of drone

Soil and field analysis

Drones can be instrumental at the start of the crop cycle. They produce precise 3D maps for early soil analysis, useful in planning seed planting patterns. After planting, drone-driven soil analysis provides data for irrigation and nitrogen-level management.

Planting

Startups have created drone planting systems that achieve an uptake rate of 80 percent and decrease planting costs by 85 percent. These systems shoot pods with seeds and plant nutrients into the soil, providing the plant all the nutrients necessary to sustain life.

Crop spraying

Drones can scan the ground and spray the correct amount of liquid, modulating distance from the ground and spraying in real time for even coverage. The result increased efficiency with a reduction of in the amount of chemicals penetrating into groundwater. In fact, experts estimate that aerial spraying can be completed up to five times faster with drones than with traditional machinery.

Crop monitoring

Vast fields and low efficiency in crop monitoring together create farming's largest obstacle. Monitoring challenges are exacerbated by increasingly unpredictable weather conditions, which drive risk and field maintenance costs.

Irrigation

Drones with hyper-spectral, multispectral, or thermal sensors can identify which parts of a field are dry or need improvements. Additionally, once the crop is growing, drones allow the calculation of the vegetation index, which describes the relative density and health of the crop, and show the heat signature, the amount of energy or heat the crop emits.

Health assessment

It's essential to assess crop health and spot bacterial or fungal infections on trees. By scanning a crop using both visible and near-infrared light, drone carried devices can identify which plants reflect different amounts of green light and NIR light. This information can produce multispectral images that track changes in plants and indicate their health.

At beginning of 21st century, people looked forward to new millennium. No one could imagine what kind of new technology take place. In that way, horticultural drone is an amazing advance technology, which is becoming a tool like any agricultural equipment. Various reasons have behind this, like comparatively cheap horticultural drone with advanced imaging capabilities and sensor are giving specific data to the farmer. By using this data, farmer can increase yields and reduce crop damage. Moreover, less use of pesticides reduces environmental damages. However, Farming is an input-output problem. With using of drone, farmer can reduce inputs – water and pesticides and maintaining same output, it will be overcoming the food shortage. Horticultural drone changes farmer's ability to monitor and manage the key aspect of farm business that is impossible to sustain in remote place. Conclusively, we can say Drone, which started as a military technology may end up better known as a green-tech technology.

General India drone laws

Drone use is allowed in India, but there are several drone laws that need to be

followed when flying in the country. Operators must ensure that they follow the following drone laws when flying a drone that weighs over 250 grams in India, Do not fly your drone over densely populated areas or large crowds. Respect others privacy when flying your drone. Do not fly your drone within 5km of airports or in areas where aircraft are operating. You must fly during daylight hours and only fly in good weather conditions. Do not fly your drone in sensitive areas including government or military facilities. Uses of drones or camera drones in these areas are prohibited. You must be at least 18 years old and have completed a training course. All drones must be equipped with a license plate identifying the operator, and how to contact them.

You must only fly your drone within visual line of sight. You cannot fly more than one UAV at a time. Do not fly your drone within 50km of a border. Do not fly your drone more than 500 meters into the sea, from the coastline. Do not fly within 5km of Vijay Chowk in Delhi. Do not fly over national parks or wildlife sanctuaries. All drones must have liability insurance.

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Medicinal Value of Honey

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"A valuable product of nature having antibacterial properties due to its acidic nature and enzymatically, produced hydrogen peroxide. Though honey has been proved beneficial in various studies in Ayurveda, Scientists are now looking for ways through which they can make use of honey in modern medicine."

Introduction

Honey is a valuable product of nature that can be used singly or in combination with other ingredients in treatment of various diseases. Various ingredients of honey have helped it to become not only a sweet liquid but also a natural product with high nutritional and medicinal value. Honey has antibacterial properties due to its acidic nature and enzymically, produced hydrogen peroxide. Though honey has been proved beneficial in various studies in Ayurveda, Scientists are now looking for ways through which they can make use of honey in modern medicine. Highest Honey Producing States Uttar Pradesh > West Bengal > Punjab.

Uses of Honey

- Sugars in honey are quickly absorbed by our digestive system and converted into energy that can be used as instant energizer.
- Honey acts as both a natural preservative and sweetener.
- Honey is used in traditional folk medicine. It enhances the medicinal qualities of herbal preparations and also helps them to reach the deeper tissues.
- The main uses of honey are in baking, spreading on bread or toast, and as an addition to various beverages such as tea.
- Honey is the main ingredient in the alcoholic beverage mead, which is also known as honey wine.

Therapeutic uses of Honey

- Constant use of Honey strengthens the white blood corpuscles to fight bacterial and viral diseases.
- Natural Honey when taken prior to bed is believed to fuel the liver, speed up fat-burning metabolism, ease stress hormones and help insomnia.

- Honey's anti-fungal and anti-bacterial properties draw out impurities from the skin, thus targeting breakouts, reducing redness and calming inflammation.
- Anti-inflammatory activity of honey reduces edema , minimizes scarring and protects wounds from additional infection.
- Initiates growth of healthy granulation tissue.
- It is a very good antioxidant, it plays a major role in the prevention of cancer as well as heart disease.
- Possesses anti-tumour properties.
- It is very useful in healing ulcers, worm infestations, bronchial asthma, cough, nausea and vomiting.
- Honey is said to normalize kidney function, useful in urinary tract disorders.
- Acts as a sedative and is very useful in bedwetting disorders.
- Keeps the gums in the healthy state, increasing their vascularity.
- It improves the appetite.
- It helps to reduce fat and to clean the bowels.
- Honey may be beneficial to athletes by reducing fatigue.
- It acts as an immune booster, increases the vitality of body.
- Perfect antidote against the tiring stresses and strains.

Few home remedies with honey

- Mix 2 teaspoon of honey with carrot juice and consume regularly one hour before breakfast. This helps to improve eyesight and is very helpful those who sit before computer for long time.
- Gargling with honey water is very useful in gingivitis due to inflammation of the gums.

- Consumption of 2 tsp of honey with equal quantity of ginger juice cures cold, cough and congested chest. The concoction helps to expectorate mucus, providing relief for the common cold, coughs and sore throat.
- To stop hiccups, mix 1 teaspoon honey and 1 teaspoon castor oil in a container. Dip your index finger into the mixture and link it. Repeat every 10 minutes until your hiccups stop.
- Apply a paste of apple cider vinegar and honey on the affected part of the body and massage slowly to get rid of Arthritis.
- One glass of luke warm water taken with two teaspoon of honey and 1 tsp of lemon juice in early morning reduces fat and purifies blood.
- Consuming one spoon of honey daily helps us to lead a healthy life.
- Chewing small pieces of pineapple with ½ teaspoon of honey before smoking helps to reduce the craving for cigarettes.
- For a persistent cough with mucous, mix a pinch of black pepper with a teaspoonful of honey and link the mixture from a spoon after meals.
- For abdominal pain, take a mixture of ¼ teaspoon ground bay leaf, ¼ teaspoon ajwan (celery seeds, and 1 teaspoon of honey before lunch and dinner daily.
- Mix a spoonful of honey and lemon juice from half a lemon into a cup of warm water and drink it. This acts as a cleansing tonic.
- Fasting on honey and lemon-juice is beneficial in the treatment of obesity without the loss of energy and appetite.
- Use honey and clove oil or powder, make paste and apply on the aching tooth. This may be applied 2-3 times a day till the tooth stops aching.
- A glass of hot milk with a teaspoon of honey neutralizes the excess of stomach acid.
- Modest amount of ginger tea with honey is a great remedy for nausea and vomiting.
- Apple cider vinegar and honey treatment is known to be a effective remedy for rheumatism, Premature aging, Obesity, Food poisoning, Arthritis, High blood pressure and High cholesterol level.
- Intake of 15 ml of bee's honey leads to sound sleep.
- A mixture of 2.5g of black pepper powder, 5ml each of honey and juice of ginger consumed thrice daily help to relieve the symptoms of asthma.

Honey in beauty

- Mix honey in some ground almonds and lemon juice to make a homemade facial scrub.
- Make your hair shiny and bright by adding one teaspoon honey to one quart of water.
- Mix almond oil, beeswax, and honey to a consistency you prefer and use as a natural lip balm.

- Honey, when mixed with eggs and some flour, is an effective skin moisturizer.
- A mixture of honey and alcohol is believed to promote growth of hair.
- Mix four tablespoons of honey with a couple of egg whites and a few tablespoons of flour and use it as a hand and body lotion or a moisturizing face mask, eliminating the effects of dry skin.

Precautions to be taken before using honey According to Ayurveda

- Honey should not be heated or consumed warm as it causes toxic effect.
- Honey should not be consumed when you are working in hot environment.
- Honey should never be mixed with hot, spicy foods, and alcoholic beverages, ghee and mustard oil as it enhances the poisonous properties when mixed with honey and causes imbalance.
- Honey should not to be used in excessive quantities. If taken in excess quantity, produces a condition called MADHVAJIRNA (indigestion of honey).
- Honey should not be given to infants under the age of 18 months because some honey contains low count of naturally occurring bacterial botulinum spores, which bees collect together with the nectar.
- As a thumb rule in the case of a normal diet, not more than 10 teaspoons of honey (about 50ml) per day is recommended.
- During full fasting, taking in only liquids and no other foods about 150ml to 200ml honey mixed with water or tea every day for a few days is recommended.

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Bonsai: Their Forms and Planting Techniques

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"The art of bonsai has spread all across the world, turning the once rather restricted discipline into an appealing and relaxing hobby that anyone can enjoy. The bonsai differs from a pot plant where, either the foliage or the flower is the main criterion but here the artistic look of the plant in a miniature form is maintained. This fascinating hobby is not at all difficult to maintain and is an interesting art form. Anyone who sees bonsai is amazed by the art and it quickly spread joy to the ones who sees it."

Introduction

A bonsai is one of the beautiful art form of plants that originated in China. The art form thrived in Japan for hundreds of years and was categorized according to their growth habit and different types. In around 13th century, there grew a culture of Japanese collecting the forest trees that were dwarf by nature and by several training practices they trained the trees for pot culture and reduced them more in size and were beautifully designed. Whereas the naturally formed miniature trees plants were one of the first

bonsai. These plants were found naturally in the mother nature and were beautifully crafted by Japanese.

Instigation of the word Bonsai is from Japan. Word bonsai is formed by combination of two Japanese words- 'Bon' means shallow pan and 'Sai' means plant, which rendered as the pot or tray planting. As you can see in nature the old trees have more prominent rounded canopy as compared to young trees, and also have more drooping branches which makes them appear aged and elegant in looks and considered more desirable for bonsai. Size of bonsai range from 5 inches to 30 inches in height.

Criteria for Selection of Plants

The selection of suitable plant for good bonsai is one of the most important choice for the beginners. As we know that optimum size of Bonsai may be only upto 30 to 60 cm in height. For this all parts of the plants mainly trunk, branches, twigs, leaves etc should be in the perfect proportion with the size of tree. The depth of the container and the type of container used for planting should also be taken care of to provide better space to the plant roots. And the material used should be eco-friendly. The plants selected should also be according to the environmental conditions of that area. The plants should be hardy in nature, and the various species of plant trees can be adopted according to their growth habit and choice of the customers for market purpose. Mainly the small leaved plants are preffered over broad and larger shaped leaves for making bonsai. The leaves should be well managed, healthy and bright in colour that is having well shaded green colour. The leaves should be dried up or of disorted shape.

The bark should be appealing and the trunk should be thicker at bottom as compared to the top givng the illusion of maturity. Such trees gives good appearance whose branches in the lower side are longer and bigger in diameter, as compared to the upper side of the trunk. The upper side branches should be smaller in diameter giving natural appearance to the tree. The adaptability of the plant to that area is also one of the important factor for selection of tree for bonsai planting.

Plants suitable for Bonsai making

It was known several decades before that the Bonsai requires specific type of plants but bonsai can be made from any of the naturally occurring pereninial woody stemmed tree or the shrub species. From broad leaved evergreen to pines and conifers, and also the deciduous trees can be used. The most popular plants used for bonsai are : *Ficus* spp, Juniper Bonsai (*juniperus*), *Bougainvillea* spp, *Duranta* spp, *Jasminum* spp, *Murraya spp, Hamelia patens, Hibiscus rosea sinensis, Juniper chinensis*, Neem, Pine, Pomegranate, Poinsettia, Mini Kumquat, Sapota, Schefflera, Bottle Brush, Cypress are some of the plants that make good bonsai.

Styles of Bonsai

The art of Bonsai has groomed over the years and many creative styles came into existence.

Formal Upright

1. Formal Upright (Chokkan)

The most common style used in bonsai is formal upright. It also resemble to the naturally growing of plants only when trees does not face any natural harsh conditions. The trunk is kept straight for upright growing and must be thicker at the bottom. The trunk should be lower in proportion to the entire height of the tree. The branches should be kept alternate to each other that is kept to suggest the age of tree sometimes.

Informal

2. Informal Upright (Mayogi)

It is also one of the most commonly used art of bonsai. This art also resemble the natural habitat of the trees. This styles dispay the curved trunk resembling harsh elements of nature. This style is characterized by a lightly curving trunk displaying the harsh elements of nature. The plants are trained and bend by use of wire and sometimes also give 'S' shape to the plants. The preference is given to the deciduous trees and conifers as they are easily adaptable in this style.

Broom

3. Broom (Hokidachi)

The broom style of bonsai are mostly suited for deciduous trees having widespread and fine branching. The trunk is straight and begins to divide into several branches resembling broom shape. It makes a thick and ball shaped crown and gives a amazing look in the winter months. Some of the examples used in broom style are beech, elm, false cypress, and maple.

4. Slanting (Shakan)

Slantin

This style of bonsai shows the tree is bend in one of the particular direction. Mainly the leaned tree resembles tree grown in shadow or bend towards sun. The branches are kept horizontal droop slightly downward. The roots of the plants should be kept in good care and well developed to keep the plant standing. The roots in the surface of the plants shows unusual appearance and well-anchored impression.

5. Windblown (Fukinagashi)

The plants of windblown style resemble the struggle for survival. This type of trees are found rarely in nature, and are mostly seen in cliffs or mojuntains. The trunk and branches are trained in one direction to give the effect of strong wind and storm.

Windblo

6. The Clasped-to-Stone (Ishisuki)

In this style, the roots of the tree are trained over the rocks. This means that the tree struggle for its survival as there is not much room for the roots and they starts growing over the rocks and in the holes of stones. In this type the plants should be fertilized and watered often, because there is proper space available to plant to store water. Plants of clasped-to-stone style resemble age and tenacity.

Clasped to stone

7. Semi cascade (Han-kengai)

The semi cascade is somewhat similar to the cascade style. In nature they are found in the cliffs or banks of rivers or lakes. The trunk grows upright upto a considerable length and then is bend sidewards or downwards. The crown is above the rim of the container or pot and branching occurs below the rim of the container.

Semi-Cascade

8. Cascade (kengai)

In this style, the tree resembles as if planted in the steep cliff and is bend downwards as if hanging over the ledge of the mountain. Cascade style is one of the most difficult styles of Bonsai as it opposes the natural growing tendency of the tree. The crown of the tree mostly grows above the rim of the tree whereas the branches grows subsequently below the rim of the container or vase.

The best time for planting of bonsai is in the autumn season when the trees shed their leaves. The planting is done in the months of February-March or July-August. You can also start planting when the new buds open. The temperate plant crops such as cherry, plum peach etc. are planted during the months of (Feb.-March). The potting of the plants should not be done during severe hot months and during very harsh winter months of the year.

Cascade

Source plants for making bonsai

1. From seed: Seed are one of the most easily used method of planting of Bonsai. The seeds are mostly sown in autumn season. The plants takes long time, for making of this type of Bonsai but gives the best shape to the Bonsai. It makes the best bonsai.

2. From vegetatively propagated plants: For vegetative propagation of bonsai plants cuttings are mostly used. It is one of the most commonly used methods and is also easily available. The growth of plants is faster as compared to other methods. The other methods such as grafting, budding and layering can also be adopted.

3. Seedlings from local origin/countryside: the seedlings of locally originated trees can also be used for bonsai. The seedlings can be trained to an appropriate style without injuring the plant parts. While collecting of seedlings of the trees care must be taken not to injure the plant roots.

Shaping and styling bonsai

To get the better shape of plants one should have the proper knowledge about the plant species used for bonsai. Most people generally think that the plants grown for bonsai are genetically dwarf plants. But the plants are normal plants which are trained by various classy techniques and maintained to a miniature sizes. One has to decide the final shape and size of the bonsai tree even before planting. A proper plan should be made on the paper sheet, and a sketch of the style that you wish to create.

Shape and style on the bonsai includes basic methods such as pruning, wiring, and pinching. The methods have to perform regularly or in a particular time interval. The plant has to be pruned to maintain and refine the shape of the tree. The regular pruning has to be done in the top of the trees. It can be done throughout the year but mostly during the months of March and September. As the upper part of the tree has the most apical dominance, to encourage growth to inner parts of the tree. Pruning has to be done with proper care and in a good proportion. Pinching is to be done to reduce the total leaf area if the ratio is not maintained properly the plant may wilt. The pinching ot the branches is also done to give the plant an artistic shape. The root pruning is also one of the essential operation in plants to give the proper proportion to the plants and maintain its size. Also it helps the roots to not bulge out of the container. Root pruning is done during the transplanting and repotting of the plant.

Another important technique to shape Bonsai is the wiring. It is the crucial technique to train the bonsai trees. For bending the branches, copper wire is best as it is pliable. Before using the wire it should be heated to make it pliable, then cooled before using. When wiring a branch, first wind the wire around the trunk several times and then around the branch. While winding a branch the union with the trunk is to be held with one hand or otherwise the joint may snap. The wire coils should be spaced evenly by about 0.5 to

0.6cm apart. To give the specific shape, the wire has to be in place for several years, but rewinding is to be done every six months to avoid injury to the bark mainly done during the growth seasons as the wire may cut into the bark. This may create scars in the branches therefore should be taken care and trees have to be unwired in a regular time period.

Bonsai Containers

The selection of container is one of the most important consideration in bonsai trees. The container should be of proper depth and must be in proper proportion to the plant growth. It must look attractive and should be durable. The shape of the container can be round, oval or rectangular. For a single upright stem, an oval or round container will suit better while for the cascade style a rectangular container looks more artistic. An unglazed container is preferred as it allows aeration of the soil. The color of the container should be as natural as possible.

Care and maintenance

Soil mix

The soil mix used for bonsai should be of such a nature that it will not become waterlogged or sour and should not be rich in manures. The chemical reaction of the soil should be close to neutrality. Good soil mix will be made up of 2 parts of Loamy Soil or Coco-Peat, 1 and 1/2 parts coarse river sand, and 1 part leaf litter.

Watering

As Bonsai grows on shallow containers, watering is an important aspect. During the summer months, watering three times a day is necessary. The compost should be filled in a container leaving about 2 – 3cm space from the brim to facilitate watering. One way of ensuring whether a plant needs watering is to tap the container with a wooden hammer on the sides. If a dull sound comes out, the plant should not be watered. But if there is a ringing tone, the plant needs watering.

Manuring

Manuring is needed for proper vegetative growth and to encourage flowering or fruiting. Generally, manuring is done twice a year, once during the spring and again during the rainy season. Too much manuring should be avoided as this may cause soft and sappy growth.

Repotting

The fast-growing plants need repotting every year, while the slow-growing plants may be repotted every 2- 3 years. The plant is removed out of the pot gently with the

earth ball and all drainage materials are removed. 1/3 of the old subsoil is removed. Soil stuck up between a few of the roots may be removed. Any root that is longer than what is accommodated in the container, is cut with a secateur. The plant is then placed in a position in the container and compost is filled in. The plant is immediately watered.

Conclusion

In this article you must have learned some facts about bonsai but there is more you can learn just by practicing this beautiful art form. The art of bonsai has spread all across the world, turning the once rather restricted discipline into an appealing and relaxing hobby that anyone can enjoy. The Bonsai differs from a pot plant where, either the foliage or the flower is the main criterion but here the artistic look of the plant in a miniature form is maintained. This fascinating hobby is not at all difficult to maintain and is an interesting art form. This art form brings patience in the individual. It has long been admired in the art of Feng Shui thought as they bring positive energies to the room or the place grown. Anyone who sees bonsai is amazed by the art and it quickly spread joy to the ones who sees it. The oldest bonsai is believed to have lived over 800 years. That Bonsai you buy today could become an heirloom, passed down in the family, and treasured by generations to come.

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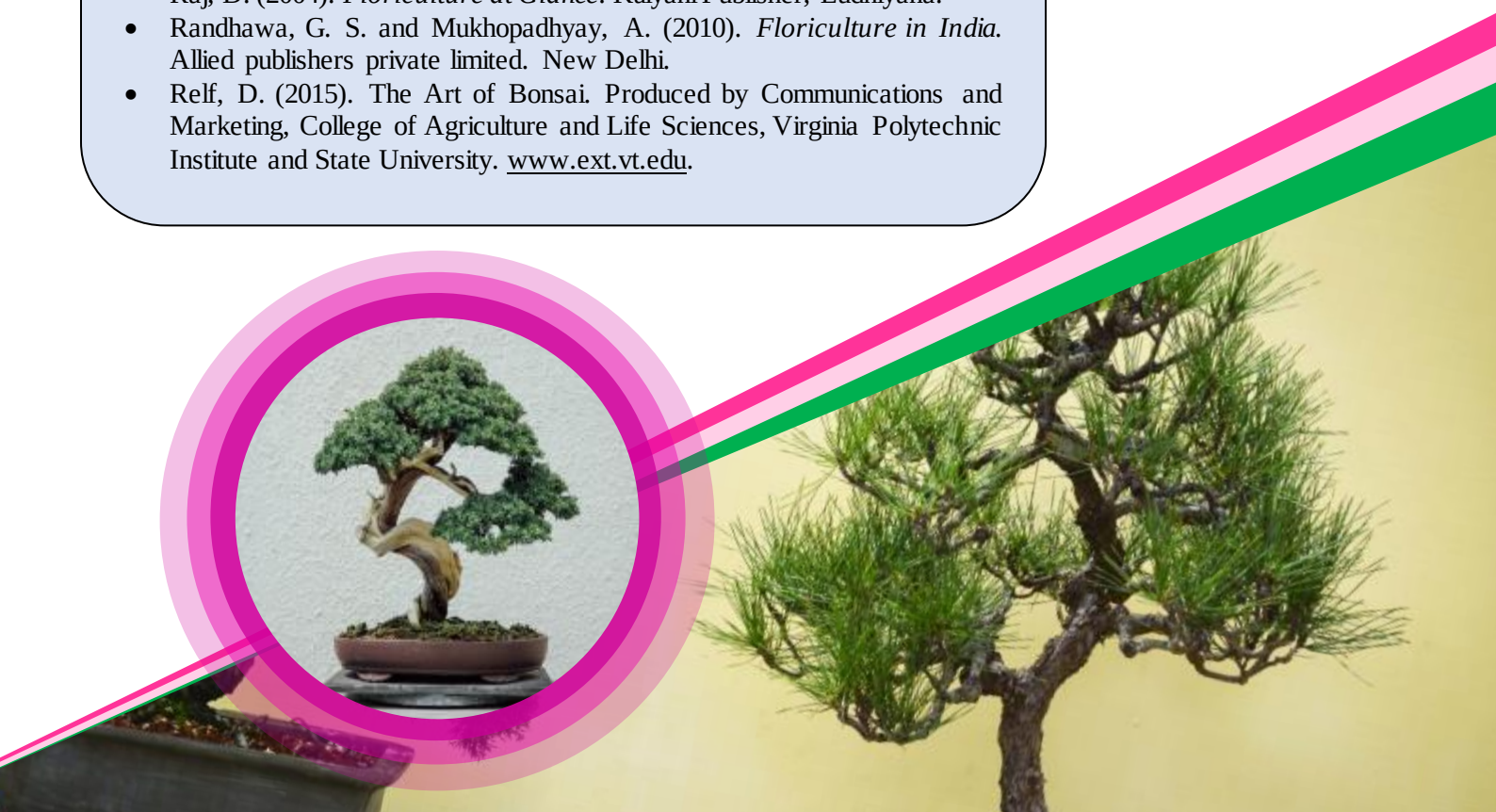

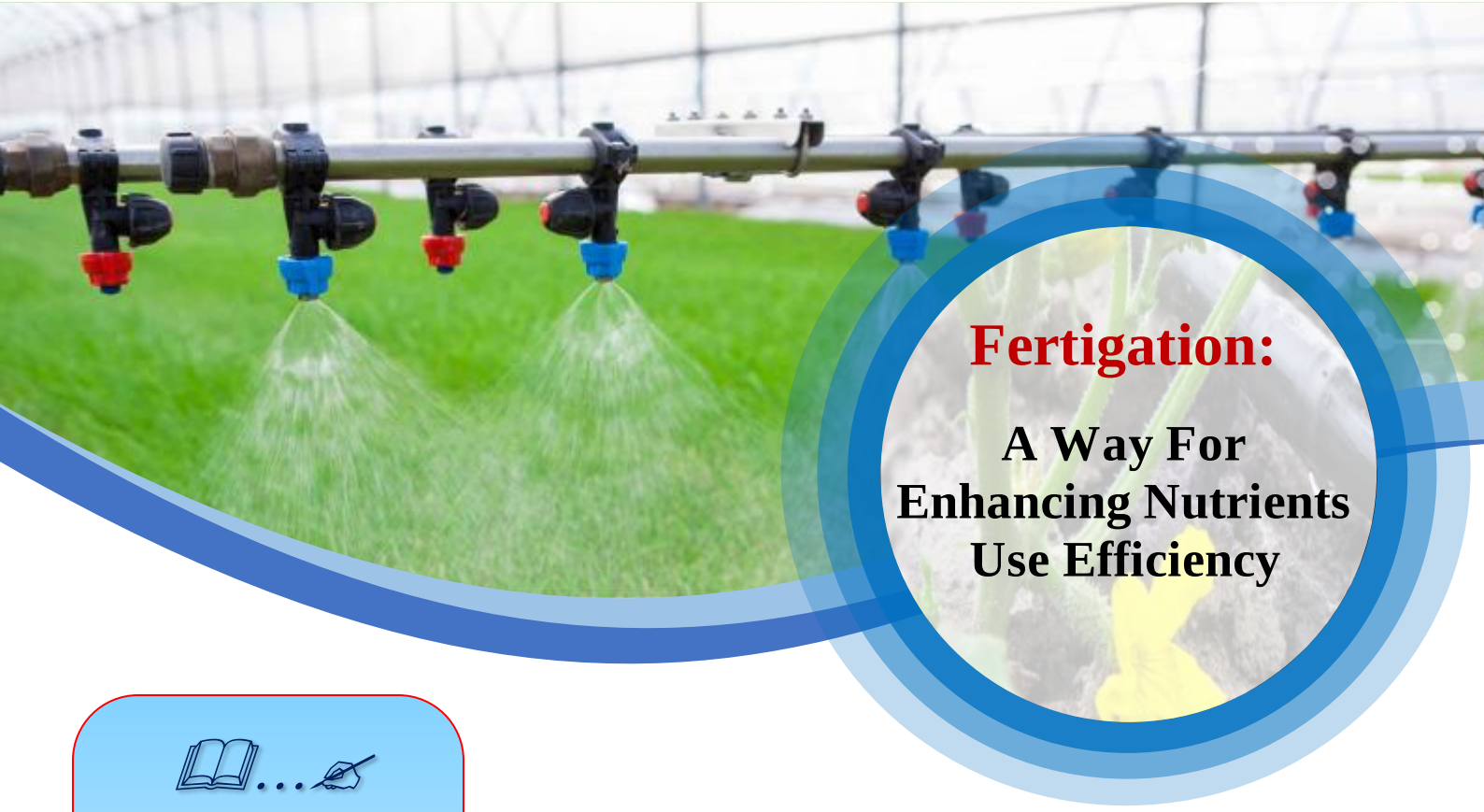

Fertigation:

A Way For Enhancing Nutrients Use Efficiency

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"A modern technique to enhance the water as well as nutrient use efficiency of the crop plant. It also reduce the much labour charge in crop production. But it requires skilled person for the calibration of nutrients concentration for the particular crop. And therefore, now it is being adopted by the innovative farmers at commercial level of crop production."

What is fertigation?

Fertigation is a field technique which precisely delivers the plant nutrients via irrigation system in the crop root zone according to the crop demand during crop growing season.

Nutrients Use Efficiencies (NUE) under various application methods:

Nutrient	Nutrients Use Efficiency (%)	
	Soil application	**Fertigation**
Nitrogen	30-50	95
Phosphorous	20	45
Potassium	50	80

Fertigation devices

1. Ventury
2. Fertilizer Tank
3. Fertilizer Pump

Drip Fertigation in Okra

Why Fertigation?

1. To maximize production and income

a. Consistent higher yield and top quality produce

2. To maximize fertilizer use efficiency

a. Applies nutrients accurately and uniformly
b. Adapts the amounts and concentrations to plant needs & climate
c. Increases the availability and uptake of nutrients
d. Reduces nutrient losses from leaching, volatilization, fixation etc.

3. To minimize production cost

a. Save fertilizer, chemicals, traffic, labour & energy expenses

4. To maximize soil productivity

5. To decrease the environment pollution

Advantages of Fertigation

1. Improves yield and quality
2. Improving Nutrient Use Efficiency

- Reduced time fluctuation in nutrient concentrations in soil in the course of growing season
- Better distribution and higher uniformity of plant nutrients throughout the entire root zone or soil profile
- Better and immediate penetration in to the soil
- Easy adaptation of the amounts and concentrations of specific nutrients to crop requirements, stages & climatic conditions
- Frequent applications in small doses not only increases availability but also reduces nutrient losses from soil surface and Leaching
- Careful regulation and monitoring the supply of nutrients
- Fertigation adapts to automation easily, increasing accuracy
- Possibility of saving (by ¼) in fertilizer in some crops

3. No need for special farm machinery avoiding soil compaction
4. Fertigation maintains proper nutrient level in root zone thus enabling farming in marginal soils having low CEC & low fertility status
5. Controlled fertigation (time & depth penetration) avoids groundwater contamination
6. Operation is fast and convenient
7. Saves time, labour and energy
8. Dry crop foliage retards development of plant pathogens
9. Full control over the process allows application of micronutrients thus avoiding need for separate foliar application
10. Unaffected by wind and causes no runoff

Which fertilizer is suitable for Fertigation?

1. High nutrient content in a form readily available to plants
2. Fully water soluble at field temperature conditions
3. Fast dissolution in irrigation water
4. Fine grade, flowable
5. No clogging of filters and emmiters
   - Low content of insoluble (< 0.02%)
   - Minimum content of conditioning agents
6. Compatible with other fertilizers
7. Minimal interaction with irrigation water
8. No drastic changes of water pH (3.5 < Ph > 9.0)
9. Low corrosivity for control head and system.

List of Fertilizer Suitable for Fertigation

S.N.	N	P	K	Micro nutrients
1.	Urea	MAP	Potassium chloride	Zn EDTA
2.	Ammonium nitrate	MKP	Potassium nitrate	Ca EDTA
3.	Ammonium sulphate	Phosphoric acid	Potassium sulphate	Fe EDTA
4.	Calcium nitrate		MKP	Fe DTPA
5.	Magnesium nitrate		Potassium thiosulphate	
6.	Potassium nitrate			
7.	MAP			

Limitations & Precautions of Fertigation

1. Fertilizer suitability: Only completely water soluble fertilizers Interaction of injected chemicals with irrigation water resulting in formation of precipitates which clog the emitters
2. Incorrect application may cause damage to crop, leaching of nutrients and contamination of groundwater
3. Knowledge of fertilizer compatibility while mixing is necessary
4. Correct operation of irrigation system is required
5. Corrosion of irrigation & injection system components
6. Toxicity of water when water source is linked to potable water supply

Myths concerning the use of Fertigation

- It is cost intensive.
- High maintenance costs of drip fertigation system.
- Only specialty fertilizers could be used in fertigation.
- Fertilizers suitable for fertigation are costly and are not easily available.
- Fertigation can be done by only sophisticated equipment.
- Fertigation is suitable for only greenhouse crops.
- Additional electric power supply is a must for fertigation.



BIO-FERTILIZER:

FUTURE NEEDS OF INDIAN AGRICULTURE

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> "Biofertilizers are natural fertilizes which are living microbial inoculants of bacteria, algae, fungi alone or in combination and they augment the availability of nutrients to the plants. These are preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil."

Introduction

The excess uses of chemical fertilizers in agriculture are costly with adverse effects on physico-chemical properties of soils. Therefore, in the recent years several organic fertilizers have been introduced that act as natural stimulators for plant growth and development. Biofertilizers are natural fertilizes which are living microbial inoculants of bacteria, algae, fungi alone or in combination and they augment the availability of nutrients to the plants. These are preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. It is estimated that by 2020, to achieve the targeted production of 321 million tons of food grain, the requirement of nutrient will be 28.8 million tons, while their availability will be only 21.6 million tons being a deficit of about 7.2 million tons, thus depleting feedstock/fossil fuels (energy crisis) and increasing cost of fertilizers which would be unaffordable to small and marginal farmers, thus intensifying the depleting levels of soil fertility due to widening gap between nutrient removal and supplies. Therefore, aim of fertilizers use is

to supplement the nutrients already exist in the soil. Besides nutrient supplementation, bio-fertilizers have various other benefits for example control soil-borne diseases, improves soil health, soil properties and result in higher yield rates.

Needs of biofertilizers in agriculture

The long term use of bio-fertilizers proves to be economical, eco-friendly, more efficient, productive and accessible to marginal and small farmers over chemical fertilizers. The need for the use of biofertilizers thus arises primarily for two reasons. First, because increase in the use of fertilizers leads to increased crop productivity, second, because increased usage of chemical fertilizer leads to damage in soil texture and raises other environmental problems.

Classification of bio-fertilizers

Various microorganisms and their association with crop plants are being dried-up in the production of biofertilizers. They can be groups in different ways based on their nature and works.

Rhizobium

Rhizobium belongs to the family *Rhizobiaceae* and symbiotic association with bacteria of the genus *Rhizobium* is a soil habitat bacterium, which colonizes legume roots which fix atmospheric nitrogen in nature. *Rhizobium* bacteria live within the roots. Specific rhizobia for different legumes infect the root moving to the root cortex through an infection thread, which result in the formation of a tiny out growth known as "root nodule". The morphology and physiology of *Rhizobium* vary from free-living condition to the bacteroid of nodules. They have seven genera and are highly specific to form nodule in legumes, referred as cross inoculation group.

Cross inoculum groups of *Rhizobium*

***Rhizobium* spp.**	**Cross inoculation groups**	**Legumes**
R. Leguminosorum	Peas	Pea, vicia, Lathyrus, Lentil
R. Phaseoli	Beans	Phaseolus
R. Trifoli	Clover	Trifolium (red and white clovers)
R. Meliloti	Alfalfa	Alfalfa, Sweetclover, Trigonella
R. Lupine	Lupini	Lupinus, orinthopus
R. Japonicum	Soyabean	Soybean, Cowpea, Peanut
R. Spp.	Cowpea	Vigna, Arachia

Chickpea seeds before (left) and after (right) treatment with

Azotobacter

Azotobacter belongs to the family *Azotobacteriaceae*, which is a chemoautotrophic in nature, free living, gram's negative and non-symbiotic in nature and is recommended for application to non-legume crops. Various species of *Azotobacter*, *A. chroococcum* happens to be the dominant inhabitant in arable soils capable of fixing N_2 (2-15 mg N_2 fixed /g of carbon source) in culture media. The bacterium produces abundant slime which helps in soil aggregation. The numbers of *A. chroococcum* in Indian soils rarely exceeds 105/g soil due to lack of organic matter and the presence of antagonistic microorganisms in soil. By the application of *Azotobacter* to various crops, the amount of recommended doses of nitrogenous fertilizers can be reduced by 10-20%. This inoculation in useful for cereal crop like wheat, rice, sorghum and vegetables like onion, brinjal, tomato and non-leguminous crop plants, sunflower, mustard, tobacco, sugarcane and cotton etc.

Azospirillum

It is belongs to the family *spirillaceae*, chemoautotrophic and associative (*Microaerophiles*) symbiosis to live within the roots and nitrogen fixing soil bacterium colonizing the rhizosphere. *Azospirillum lipoferum* and *A. brasilense (Spirillum lipoferumin* earlier literature) are primary inhabitants of soil, the rhizosphere and intercellular spaces of root cortex of graminaceous plants. 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*. Yield increase were 15-30 %. By the application of this fertilizer nitrogen saving is 20-30 kg ha^{-1}.

Gluconacetobacter diazotrophicus

It is an endophytic N_2 fixer and form to occur on large numbers in roots, stem and leaf of sugarcane and other sugar rich crops. It was first isolated from sugarcane. Cavalcanti and Dobereiner (1988) reported this new endophytic N_2 fixer and recently called as from *G. diazotrophicus*. It can tolerate upto 30% sucrose concentration and pH upto 3.0. Optimum sucrose concentration is 10-15%. Produce surface yellow pellicle on semisolid medium. Optimum is 5.5 pH.

Blue Green Algae

BGA is also known as *Cyanobacteria* have been kept the pigment are Cyanophyta. BGA is phototrophic in nature. *Algae* are the eukaryotic thallophytes have chlorophyll a as their primary photosynthetic pigments. But they lack vascular tissue. Coralloid roots of cycas having symbiotic association with BGA. These biofertilizers are used for rice crop, it has not presently attracted the attention of rice growers all over India. The benefits due to algalization could be to the extent of 20-30 kg N ha^{-1} under ideal conditions but the labour oriented methodology for the preparation of BGA biofertilizer is in itself a limitation. BGA increased grain yield by 6-35%. Recommendation application of 10 kg ha^{-1} flakes of BGA. It is applied 10 days after the transplanting of rice crop.

Azolla

It botanical name is *Azolla pinnata*, It belongs to the family *Azollaceae*. *Azolla* is a free-floating water fern that floats in water and fixes atmospheric nitrogen in association with nitrogen fixing *blue green algae Anabaena azollae*. A *blue green algae* (BGA) *Anabaena azollae* living in the epidermal cavity of lower side of the leaf of *Azolla*. The symbiotic association of *Azolla pinnata* and *Anabaena azollae* is termed as *Azolla Anabaena*.This algae fixes atmospheric nitrogen for *Azolla* and exchange the plant provides shelter and food to the *algae*. *Azolla* either as an alternate nitrogen sources or as a supplement to commercial nitrogen fertilizers. *Azolla* is used as biofertilizer for wetland rice and it is known to contribute 40-60 kg N ha^{-1} per rice crop. *Azolla pinnata* is widely distributed in Indian agriculture.

Phosphate solubilizing microorganisms (PSM)

The first phosphate solubilizing microorganism (biofertilizers) phosphobacteria contained *Bacillus megatherium* was used in the 1930s on large scale in Eastern Europe. Various soil bacteria and fungi, notably species of *Pseudomonas, Bacillus, Aspergillusetc*. Secrete organic acids and lower the pH in their vicinity to bring about dissolution of bound phosphates in soil. Increased yields of wheat and potato were demonstrated due to inoculation of peat based cultures of *Bacillus polymyxa* and *Pseudomonas striata*.

AM fungi

These are obligates symbiotic and *endomycorrhizae* where the fungus develops intracellalarly in the root without forming Harting net. The transfer of nutrients mainly phosphorus from the soil 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. The commonest genus appears to be Glomus, which has various species distributed in soil. It is recommended for forest trees, forage grasses, maize, millets, sorghum and barely and also leguminous crops.

Plant growth promoting rhizobacteria (PGPR)

The term PGPR was given by Kloepper and term rhizosphere was coined by german scientist Hiltner (1904). There is a group of bacteria (*Rhizobacteria*) found in rhizosphere which promotes plant growth, due to which they are called as rhizosphere bacteria. Various 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 bio-stimulants and the phytohormones they produce include indole-acetic acid, cytokinins, gibberellins and inhibitors of ethylene production. PGPR modes include fixing nitrogen and increasing the availability of nutrients in the rhizosphere, positively influencing root growth and morphology and promoting other beneficial plant microbes symbioses.

Types of bio-fertilizers: Bio-fertilizers include the following types:

S.No.	Type of biofertilizers	Example
	Nitrogen fixing biofertilizers	
1.	Symbiotic	*Rhizobium, Frankia, Anabaena azollae*
2.	Free-living	*Azotobacter, Beijerinkia, Clostridium, Klebsiella, Anabaena, Nostoc*
3	Associative Symbiotic	*Azospirillum*
	P solubilizing biofertilizers	
4.	Bacteria	*Bacillus megaterium var. phosphaticum, Bacillus subtilis, Bacillus circulans, Pseudomonas striata*
5	Fungi	*Penicilliumsp, Aspergillus awamori*
	P mobilizing biofertilizers	
6.	Arbuscular mycorrhiza	*Glomus sp. Gigaspora sp. Sclerocysis sp.*
7.	Orchid myccorhiza	*Rhizoctonia solani*
8.	Ectomycorrhiza	*Loccaria sp., Pisolithus sp., Boletus sp., Amaniata sp.*
	Bio-fertilizers for micronutrients (Silicate and zinc Solubilizer)	
9.	Bacteria	*Bacillus sp.*
	Plant growth promoting rhizobacteria	
10.	Bacteria	*Pseudomonas spp. Pseudomonas fluorescens*

Methods of Application of bio-fertilizers:

- **Seedling root dunk or dip**: It method is applicable in used for transplanted crops like vegetables (cauliflower, broccoli, brinjal and tomato) and rice etc. Two packets of the inoculant are mixed in 40 litres of water. The root portion of the seedlings is dipped in the mixture for 5 to 10 minutes and then transplanted.
- **Seed Treatment**: Seed Treatment is a most common method adopted for all types of inoculants. The seed treatment is effective and economic. The Seed are uniformly treated with Jaggery of inoculant to make it sticky and then shade dried for 30 minutes. The shade dried seeds are to be sown within 24 hours. One packet of the inoculant (200 g) is sufficient to treat 10 kg of seeds. Seed Treated with *Rhizobium*, *Azotobacter*, *Azospirillum*, along with PSM can be done.
- **Soil Treatment**: The biofertilizers along with the compost, FYM and manure are mixed and kept for one night. These mixture is then spread or broadcasted on the soil where the seed have to be sown in the field.

Importance of bio-fertilizers in agriculture:

- They are eco- friendly and cost effective.
- Bio-fertilizers improve soil texture, structure and it increase crop yield by 20-30%.
- Replace chemical nitrogen and phosphorus by 25% in addition to stimulating of the plant growth.
- It can provide protection against drought and some soil borne diseases.
- They do not allow pathogens to development.
- Helps in fixing atmospheric nitrogen directly.
- Solubilise immobile phosphorus and make it available.
- Enhance root proliferation.

Limitation of bio-fertilizer

- The most important limitation of bio-fertilizer is their nutrient content when compared to inorganic fertilizers.
- This might result to deficiency symptoms in plants grown with the bio-fertilizer. However, this problem can be curbed by the addition of substances such as bone meal (rich in phosphorus), wood ash (rich in potassium) or other substances of natural origin such as phosphate rock to enrich the fertilizer.
- Also the use of nutrient rich wastes such as palm wastes (rich in potassium), wood ash (rich in potassium also) in making bio-fertilizer can help to remedy the problem.
- Stated that the addition of phosphorus to wastes makes the bio-fertilizer more balanced and reduces nitrogen losses.

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CULTIVATION PRACTICES AND PRODUCTION TECHNOLOGY OF ONION: A REMUNATIVE OPTION FOR FORMER'S

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"Certain agricultural commodities depends entirely on the market success of their indigenous products and a GI tags provides recognition and economics protection to the farmers. It boots sales and export of the products. Kashmiri saffron from Kashmir and black rice from Manipur got GI tag recently"

Introduction

Onion (*Allium cepa* L.) is most important bulbous vegetable crop. The important contents like allicin, allin and sulphites etc. are present in onion. These compounds are helps to fighting cancer, high blood cholesterol and sugar, liver problems and intestinal problems. It has diuratic and stimulant property. Onion is used for treating problems including loss of appetite, upset stomach, and gall bladder disorder, for treating heart and blood vessel problems including chest pain (angina) and high blood pressure and for "preventing hardening of the arteries" atherosclerosis. Maharashtra, Karnataka, Gujarat, Orissa, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Rajasthan and Bihar are the major onion producing states in India. Onion contain Moisture (86.8g), Carbohydrates (11.0g), Protein (1.2g), Fibre (0.6mg), Minerals (0.4g), Thiamine (0.08mg), Vitamin-C (111.0mg), Calcium (180mg), Phosphorus (50.0mg), Iron (7.0mg), Nicotinic acid (0.4mg)and Riboflavin (Vitamin B-2) (0.01mg) etc.

Varieties: The important varieties, source and their salient features are as follows:

S. N.	Variety	Features	Yield	Remarks
		Red Varieties		
1	**Hisar-2**	Bulbs bronze-red in colour Red and are top-sided flat globular, sweet but pungent. Matures in 165 days.	300 q/ha.	TSS- 11.5-13.9%
2	**Kalyanpur Red Round**	Bulbs coloured, globular in shape, moderately sweet and pungent. Matures in 130-150 days.	250-300 q/ha.	TSS- 13-14.9%
3	**Arka Pragati (Sel-11)**	Pink coloured globe-shaped bulbs of uniform size with thin neck, highly pungent. Mature in 140-145 days	200 q/ha	
4	**N-53**	Bulbs are globe shaped, medium sized, very attractive, purplish red and mature in 150-165 day.	250-300 q/ha.	
5	**Bangalore Rose**	Bulbs are small sized and uniform in colour and size.	150 q/ha	
6	**VL-3**	Bulbs are red medium sized, globular and pungent and mature in 145 days.	250 q/ha	
7	**Arka Niketan**	Bulbs globose with thin neck, attractive colour and mature in 145 days.	337 q/ha	Excellent keeping quality and can be grown in Rabi and Kharif.
8	**Agrifound Light Red**	Bulbs are light red and globular in shape. Mature in 160-165 days.	300-325 q/ha	good keeping quality
9	**Agrifound Dark Red**	Bulbs are dark red, globular in shape with tight skin. Matures in 150-160 days.	300-400q/ha	Suitable for Kharif and late Kharif
		White Varieties		
10	**N-257-9-1**	Bulbs globe-shaped, white.		Good Keeping quality and suitable for dehydration.
11	**Pusa White Round**	Bulbs are white and roundish-flat in shape	300 q/ha	Suitable for dehydration
12	**Pusa White Flat**	White bulbs, flattish and medium to large in size.		Suitable for dehydration
13	**Udaipur-102**	White, round to flat bulb and mature in 120 days.		
14	**Punjab White**	Bulbs are large, round with white neck.	250-300 q/ha	High TSS (15%) and is suitable for dehydration.
		Yellow Varieties		
15	**Arka Pitamber**	Yellow colour, globe shape, high TSS, firm bulbs, good keeping quality, free from splits.		
16	**Phule Swarna**	Less pungent, 11.5% TSS having 4-6 month storage life.	240 q/ha	Suitable for export.
17	**Early Grano**	Bulbs are globe shaped, 7-8 cm in diameter and less pungent.	300-350 q/ha	It has good keeping quality and free from bolting.

Climate and Soil

Onion is a cool season crop. However, it can be grown under a wide range of climatic conditions. lt grows well under mild climate without extreme heat or cold or excessive rainfall. The ideal temperature requirement of the onion crop is 12.8-21°C before bulbing and 15.5-25°C for bulb development. Onion can be grown on all types of soils. However, deep friable loam and alluvial soils are best for its successful production with optimum pH 5.8-6.5.

Field preparation

About 4-5 shallow ploughings are sufficient to make the soil loose, friable and porous. The last ploughing should be followed by planking to level the field.

Manures and fertilizers

Onion is a heavy feeder of nitrogen and potash and requires 120 kg Nitrogen, 50 kg Phosphorus, and 160 Kg potash, 15 kg Magnesium and 20 kg sulphur. Apply 20-25 tons of farmyard manure at the time of first ploughing so that it may get mixed thoroughly during subsequent ploughings.

Methods of planting

The following four methods of planting are followed depending on soil, topography, climatic conditions and economic aspects:

1. Raising seedlings and transplanting.
2. Planting bulbs directly in the field.
3. Broadcasting or drilling of seeds directly in the field.
4. Planting by sets

Nursery Preparation

Seed treatment: Seeds treatment with thiram+ Carbendazim (2:1) @ 3g/kg seed or trichoderma @4-6 g/kg seed should be done to prevent diseases and damping off.

Nursery Sowing

Draw lines in the bed (5-7cm apart), sow seeds and cover with FYM followed by light watering. In north India, during Kharif season, poly shade nets should be used to protect against incessant rains and during Rabi, nursery beds

should be properly mulched to improve germination and prevent damage due to dew and low temperature.

Transplanting method

This is the most common method practiced for irrigated crop as it results in high yield and large size bulbs. Seeds are first sown in well prepared nursery beds of 90-120 cm width, 7.5-10.0 cm height and convenient length. Ratio between nursery area and main field is about 1:20 (500m^2). Seed rate varies from 8 to 10 kg/ha. Seedlings of 15 cm height and 0.8 cm neck diameter are ideal for transplanting and this is achieved in 8-10 weeks. Seedlings are transplanted at 1 x 10 cm spacing to ensure uniform bulb development.

Planting of bulbs

Medium to small sized bulbs alone are used for planting since large sized bulbs result in early bolting and high cost. Medium sized bulbs obtained from a seedling planted June crop are used for planting in September-October after giving a month rest. Bulbs are dibbled at 15 cm apart on the side of 45 cm wide ridges or in beds or in furrows depending on soil or climate. 10-12 quintals of bulbs are required to plant one hectare.

Broadcasting or drilling method

Direct sowing by broadcasting or drilling at 30 cm apart is practiced in some areas to save labour for transplanting. Here seed requirement is as high as 25 kg/ha. Usually weeding is done at 10 days interval for the first 1-2 months. When bulbs are 6-8 weeks old, seedlings should be thinned to proper distance which usually synchronizes with gap filling.

Planting by sets

Sets are small size onions produced by allowing the seedlings to mature in the nursery bed as such instead of transplanting them as usual. These Small bulbs are used as sets. Onion sets are produced which are sown during February and sown directly during Aug.-Sept. month in the field.

Irrigation

Frequency of irrigation depends on soil and climatic conditions and stages of crop. It requires less water immediately after establishment of seedlings and

consumption goes on increasing with maximum requirement before maturity, around 3 months after transplanting, and thereafter it is reduced. So irrigate the crop at 13-15 days interval during early stage followed by subsequent irrigations at 7-10 days interval.

Weeding and inter-culture

During early stages of the crop, plants grow slowly and it is essential to remove weeds. Pre-plant incorporation of Basalin (2 kg a.i./ha) and Pendimethalin @ 3-4 ml/l along with one hand weeding at 45 days after transplanting is recommended to control weeds. Generally two hoeing are essential for making soil loose and to cover bulbs.

Harvesting

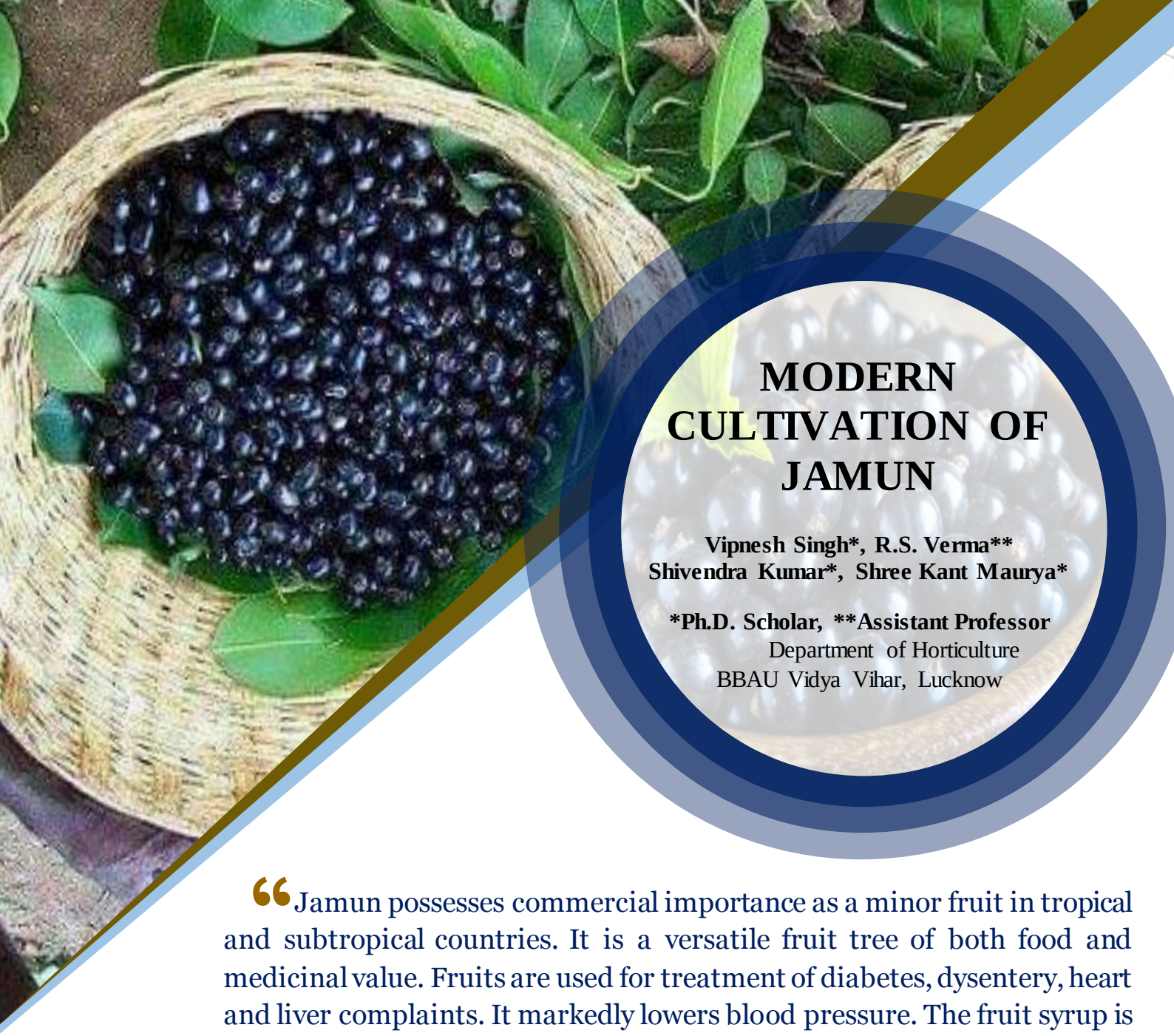
Onion is ready for harvest in 5-6 months after transplanting depending on variety. Bulb harvesting should be started when 50-75% neck fall occurs but this phenomenon occurs only during Rabi whereas in Kharif season, based on the visual inspection only, bulb harvesting is done. Harvesting is done by pulling out plants when tops are drooping but still green. During hot days when soil is hard, bulbs are pulled out with a hand-hoe.

Yield

In Kharif season, an average yields of 20-25 t/ha can be achieved whereas in Rabi season 30-35 t/ha is possible. Yield of kharif crop is comparatively low.

Physiological disorders

Disorders	Causes	Management
Poor seed germination	Old seed stock lost viability very soon in ordinary storage condition.	Cold storage condition somewhat extends the seed viability. Soak the seeds in water and sodium phosphate solution for 2-6 hours followed by drying.
Bolting	Extreme fluctuations in temperature, late transplanting of seedlings, poor supply of nitrogen in nursery and field.	Timely transplanting should be done. Transplant healthy and 8 week old seedlings and supply recommended dose of nitrogen
Splitting and doubling of bulbs	Generally it is caused by several factors like wider spacing, over-fertilization, uneven watering, temperature fluctuations, and planting too deep	Plant onion at recommended spacing, avoid over-fertilization, uneven irrigation and mechanical injury during intercultural operations.
Sprouting of bulbs	Due to excessive soil moisture at maturity and supply of nitrogen.	Optimum irrigation and nitrogen should be given. Spray Chlorpropham or Isopropyl N-3-Chlorophenyl) Carbamate (CIPC) @ 2% at 75 days after transplanting.
Poor bulb storage	Onion is difficult to store for a long duration at room temperature, especially in tropical and subtropical condition, due to sprouting, bulb rot and shrinkage.	Adjustment of planting time so that harvesting can be done in dry period and at appropriate stage of maturity. Only well-cured, thin-necked bulbs should be selected for storage



MODERN CULTIVATION OF JAMUN

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"Jamun possesses commercial importance as a minor fruit in tropical and subtropical countries. It is a versatile fruit tree of both food and medicinal value. Fruits are used for treatment of diabetes, dysentery, heart and liver complaints. It markedly lowers blood pressure. The fruit syrup is useful for curing diarrhea"

Introduction

The underutilized fruits have been long sustained due to their importance for their nutritional value and as a source of rural and tribal household income. Jamun (*Syzygium cumini* (L.) is one of such underutilized fruit species of great importance in India. Because of its hardy nature and multifarious uses, it has great potential for commercial exploitation in wastelands and dry-land horticulture.

Jamun possesses commercial importance as a minor fruit in tropical and subtropical countries. It is a versatile fruit tree of both food and medicinal value. The fruits are collected from the forest, roadside avenue plantation and from the few orchards and sold as fresh fruit for table purpose.

Composition and uses

Jamun fruits have considerable nutritive value. They are rich in iron content. Fruits are relished by people for their taste and pleasant flavour and are used for dessert purpose. Shaking fruits with salt before eating is a common practice. High tannin content is mainly responsible for astringency and purplish colour is due to anthocyanin pigments. Products made out of jamun fruits are beverages, jam, jelly, squash, wine and pickles. Vinegar is also prepared out of slightly unripe fruits and is used for its carminative, diuretic and digestive properties.

Fruits are used for treatment of diabetes, dysentery, heart and liver complaints. It markedly lowers blood pressure. The fruit syrup is useful for curing diarrhea. The juice of the jamun fruit is extremely soothing and has a cooling effect. It helps in the proper functioning of the digestive system. Mix of jamun juice and mango juice is an advisable drink for diabetic patients.

Seed powder is used in treatment of diabetes, which helps to reduce urine sugar very quickly and permanently. Seeds contain an alkaloid jambosin and a glycoside tambolin or antimellin, which reduce or stop the diastatic conversion of starch into sugars. Jamun leaves have medicinal value and are being used for correcting stomach disorders. Timber is resistant to fungal infection and insect attack and is used for making railway sleepers.

Nutritive value of jamun

The ripe jamun had 76 per cent edible portion. TSS and sugars followed an increasing trend, while tannin content followed a decreasing trend during growth and development. Jamun fruit edible portion 75%, calcium 0.02%, moisture 81.2%, iron 0.1%, fat 0.5%, phosphorus 0.01%, protein 0.7%, nicotinic acid 0.20 mg/100g, mineral matter 0.4%, thiamine 0.03 mg/100 g, fiber 0.9%, riboflavin 0.01 mg/100 g, total tannins 386-428 mg/100g, niacin 0.2 mg/100g, carbohydrates 14-19%, folic acid 3.0 mg/100 g, calorific value 83/100 g and ascorbic acid 18 mg/100 g.

Climate and soil

Jamun is a hardy fruit crop; it can be grown under adverse soil and climatic conditions. For better production well drained, fertile, deep, loam soil is the most ideal. It does not like very heavy and light sandy soils.

Young plants must be protected from frost because they are susceptible to frost. It thrives well under both tropical and subtropical climate. It requires dry weather at the time of flowering and fruit setting.

Varieties

This native fruit has not been given the due attention since the time immemorial to be grown as commercial crop in organized way in orchard. Therefore, well established varieties are not available. At present we have several area specific selections identified by farmers or local people based on fruit shape; size, and taste, fruiting and fruit maturity time.

Variety	Features
Ra-Jamun	It produces big sized, oblong fruits, deep purple or bluish-black in colour at full ripe stage. The pulp of the ripe fruit is purple pink and the fruit is juicy and sweet. The stone is small in size. The variety ripens in the month of June- July.
Paras	It has having large- sized fruits grown in Gujarat.
Narendra Jamun 6	
Rajendra Jamun 1	
CISH J-42	Seedless type
CISH J-37	
Konkan Bahadoli	
Goma Priyanka	

Propagation

The jamun can be propagated by both seed and vegetative mean grafting and budding. Due to existence of polyembryony, it comes true to parent through seed. Moreover, seedling trees start bearing only after 9 to 10 years. Therefor to avoid late bearing and to

maintain and preserve the genetic uniformity vegetative propagation should be preferred over seeds propagation. Budding is practiced on one year old seedling stocks, having 10 to 14 mm thickness. The best time for budding is July to August in low rainfall areas. Shield, patch and forkert methods of budding have proved very successful.

Planting

Jamun is an evergreen tree and can be planted both in spring i.e. February - March and the monsoon season i.e. July-August is the best. The later season is considered better as the trees planted in February- March have to pass through a very hot and dry period in May and June soon after planting and generally suffer from mortalities from the unfavourable weather conditions. Prior to planting, the field is properly cleared and ploughed. Pits of 1 x 1 x 1 m size are dug at the distance of 10 m both ways. Usually, work of digging of pits is completed before the onset of monsoon. The pits are filled with mixture of 75% top soil and 25% well rotten FYM or compost.

Nutrient management

Jamun is avery hardy crop and can stand good deal of neglect and thrive well without manuring and fertilizer application. However, better performance, regular manuring is recommended for this tree. Withholding irrigation, ringing of bark of branches and root pruning are employed to increase flowering in jamun trees.

S.N.	Nutrient	Amount/tree
1	FYM	10-20kg (Pre bearing tree) 50-60kg (Bearing tree)
2	N	500g
3	P_2O_5	600g
4	K_2O	300g

Water management

The well-developed deep tap root system of jamun is able to extract water from the deeper layers of soil that allows the plant to thrive well under rain-fed condition. However, commercial jamun orchardist is advised to give 8-10 irrigation per year during pre-bearing stage of plant for better plant establishment and vegetative growth, and 4-5

irrigation per year to bearing tree during fruit development to get more production per unit.

Training and pruning

Training of young plants is essential to provide better frame work. Keep the main stem or trunk clean up to a height of 60-90cm from the ground level by removing the basal branches and sprouts. Sprouts rising from the rootstock portion should be timely removed. During later part of plant growth jamun plants do not require any pruning except removing infected, weak, dry and crisscross branches/ twigs.

Flowering and fruiting

Under hot and arid conditions, jamun panicale emerge was initial during February and ended by late April. The flowering in jamun starts in the first week of March and continues up to the middle of April. The trees are in full bloom in the second week of April. The inflorescence in jamun is generally borne in the axils of leaves on branchlet. The pollination is done by honeybees, house flies and wind.

Harvesting and yield

The fruit ripens in the month of June-July. The main characteristic of ripe fruit at full size is deep purple or black colour. The fruit should be picked immediately when it is ripe, because it can not be retained on the tree in ripe stage. The ripe fruits are hand-picked singly by climbing the tree with bags slung on the shoulder. Care should be taken to avoid all possible damage to fruits.

The average yield of fruits from a full grown seedling tree is about 80 to 100 kg and from a grafted one 60 to 70 kg per annum.

Post-harvest management

Jamun fruits are highly perishable and cannot be stored for more than one or two days under ambient conditions. Storage life of fruits can be extended up to three weeks by storing pre-cooled fruits in perforated polythene bags at 8-10°C temperature and 85-90% relative humidity. After harvest fruits are usually packed in bamboo baskets for transportation to local markets. Grading is confined to removal of bruised and damaged fruits before sending to markets.

Insect pest and control measures

1. **Leaf eating caterpillar:** They eat the tender leaves and young growing points. One spray of Dimethoate 30 EC (0.05%), Malathion (0.1%).

2. **Bark eating caterpillar:** They eat live bark tissue. Keep orchard sanitation, injecting petrol in the hole and plugging with mud, foliar spray with Dimethoate (0.05%).

3. **Jamun leaf minor:** Leaves Clipping and burning of affected leaves followed by spraying of Dimethoate 30 EC (1.2ml/l), Chlorpyriphos 20 EC (2ml/l) or Endosulfan 35 EC (2ml/l).

Physiological disorder

Flower and fruit drop Flowers and fruits. Spraying GA_3 (60ppm) twice, one at full bloom and other 15days after fruit set.

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Scientific Cultivation of Early Vegetable Pea

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"Pea is used as a fresh or processed vegetable. Immature green pods are picked and immature large seeds are used as uncooked or cooked vegetable, sauted / fried or cooked in a curry along with potato, tomato or some other vegetables. Pea is also used for dehydration (or sun-dried), canning and freezing, nowadays frozen peas are commonly available in the market."

Pea (*Pisum sativum* L.) is a commonly grown leguminous vegetable in the world. It is a cool season crop of temperate and subtropical regions. It can be grown also in mild climate of the tropics. In India pea is extensively cultivated in Uttar Pradesh, Bihar and Madhya Pradesh. It is also grown in Haryana, Punjab, parts of Rajasthan, Himachal Pradesh, Jammu and Kashmir, West Bengal, Orissa, Maharashtra and Karnataka. The important producers of pea in the world are USA, China. France, U.K., Holland, Hungary, Russia, Egypt and Australia. Pea is a nutritious vegetable rich in protein, amino acids, carbohydrate and sugar.

Uses

Pea is used as a fresh or processed vegetable. Immature green pods are picked and immature large seeds are used as uncooked or cooked vegetable, sauted / fried or cooked in a curry along with potato, tomato or some other vegetables. Pea is also used for dehydration (or sun-dried), canning and freezing, nowadays frozen peas are commonly available in the market.

Varieties

Early Groups: In this group, the first flowering takes place in about 25-40 days after sowing. These varieties become ready for first picking in about 55-70 days after seed sowing: und two to three pickings at an interval of 10-15 days can be obtained.

Kashi Nandini (VRP-5) - Plants are erect, dark green foliage with 7-8 pods per plant. Plant height are about 40-45em. Pods are long, attractive, well filled with high shelling percentage and better quality. It is tolerant to leaf miner and pod borer. It gives an average yield of 65 q/ha.

Kashi Uday (VRP-6) - Foliage is dark green, short internodes and bears 8-10 pods/plant. Plants grow up to 55cm. Pods are long, attractive and well filled with bold seed. Crop duration is about 80 days. It gives an average yield of 100 q/ha. State Varietal release committee has identified this variety for cultivation in UP.

Kashi Mukti (VRP-22): Plants have short internodes and medium height (50 cm). Pods are about 10 cm long, attractive and filled with 9-10 bold and soft seeds. It is resistant lo powdery mildew under field conditions. Its average yield is about 140-160 q/ha.

Asauji - It is dwarf, early and smooth seeded (dry seeds are smooth) cultivar. It flowers in 30- 35 days at 6-7th node. The pods become ready for harvesting in about 60 days. The pod produced singly, about 8cm long, curved, dark green, 7 seeds/pod, and appear cylindrical round when fully developed. Average pod yield is 40-50 q/ha.

Hara Bona - Flowering starts 21 days after sowing and first harvesting takes place in about 50 days after sowing. Pods are dark green with 5-6 seeds/pod. Mature dry seeds are dimpled and green in colour.

Arkel - Plants are dwarf, first flower appears in about 30-35 days after sowing and takes 60-65 days to first picking. Pods are well filled, sickle shaped and attractive dark green with 7-8 green ovules per pod. It gives an average yield of 80-100 q/ha. Seeds are wrinkled at maturity.

Azad Pea-3 - Plants are medium tall, dark green in colour. First flower appears in about 40 days after seed sowing. Pods are well filled with bold green and attractive seeds. First picking is done in about 70 days after sowing. Green pod yield is 120-125 q/ha. Matured seeds are wrinkled.

Ageta (E-6) - Plants are small, erect and green in colour. It is suitable for early sowing. First flower appears in about 28 days after seed sowing and it takes about 8 weeks for first picking. Usually, two pickings of green pods are done. Average green pod yield is about 40-50 q/ha. Pods are well filled with 6-7 seeds. On seed maturity, seeds become dimpled.

Early Badger - It is dwarf and gets ready for first picking in 60 to 65 days after sowing. The average yield is 40 q/ha.

Meteor - It takes 60-65 days after seed sowing for first picking. The average yield is 40 q/ha. Immature green as well as dried seeds are smooth.

Little Marvel - It flowers in 40 days. Pods contain 5-6 seeds, and seeds are very sweet.

PM-2 - It flowers in about 52 days after sowing. It escapes from powdery mildew. Yield of green pods are about 60-65 q/ha.

VL Ageti Matar-7 - It is one of the earliest varieties of pea. Plants are dwarf; seeds are bold, sweet and pod contains 5-6 seeds. It yields about 40 q/ha.

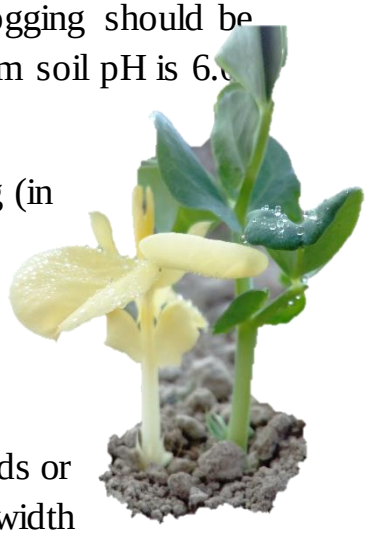
Early December (JM-4) - Plants are 55-60cm tall and pods are 7cm long. Average yield is about 50-60 q/ha. Seeds are wrinkled and big in size.

Harbhajan (EC-33866) - It is suitable for dry areas of North India. Plants are dwarf; pods are green and seeds are small, round and dimpled.

Production technology

Climate: Garden pea is a cool season crop. Its optimum temperature requirement is 13-18°C. The plant growth stops at 29-30°C. The round seeded varieties are more tolerant to higher temperature than the wrinkled seeded.

Soil: Pea can be grown on light sandy soil, silt loam or clay soil. Light soil is better for growing early varieties. The soil should be well-drained and water logging should be avoided. Soil with excess moisture is harmful to the plant. The optimum soil pH is 6.0-7.5.



Sowing: Pea is a direct-seeded crop. Seeds are sown by hand dibbling (in small areas) and drilling with desi plough or by tractor drawn seed drills. Seeds are sown at a depth of 25-3.0 cm. The planting distance is 30 cm apart rows and 7.5-10 cm. between plants. Some farmers broadcast the seeds of pea but it is better to sow them in rows.

Ridge bed: Planting is done either in flat field / plots or on raised beds or ridges. Seed can be sown on both sides of the raised bed of 120-150cm width with furrows for irrigation on either side.

Seed rate: The seed rate is about 100-120 kg per hectare for early varieties. Before sowing the seeds should be treated with Thiram (2g.) + Bavistin (1g.) per kg seed to

protect against fungal diseases. Pea seed are inoculated with Rhizobium culture in 10 per cent sugar or gur solution when sown in a new field.

Sowing time: The early round-seeded varieties can be sown in September while Arkel is best sown in the first fortnight of October.

Manures and Fertilizers: Pea does not require much nitrogen as it is a leguminous crop. About 20 tonnes of compost or FYM are applied at the time of field preparation before sowing along with 20-25 kg N, 40 kg P and 50 kg K per hectare. The fertilizer should be drilled in bands, about 2-3 cm. deeper than the depth of seeds sown, avoiding contact of the fertilizer with seeds which may result in poor germination of seeds. About 10 kg N per hectare may be applied as topdressing at the time of flowering.

Irrigation: The field is lightly irrigated about 2-3 days before seed sowing. Seeds are sown in the field when the soil has just sufficient moisture for seed germination. The field should not be irrigated after seed sowing otherwise it may affect the germination of seeds. The first irrigation is given after 15 days of seed germination and later at an interval of 10-15 days depending on the weather. Pea crop does not require much irrigation. Its optimum water requirement is 75-150 mm of water. Too frequent and heavy watering should be avoided as it is harmful to the pea crop.

Inter culture: Light hoeing and weeding are necessary during early stages of plant growth otherwise weeds may smother the crop. Generally hand weeding or mechanical weeding is practiced.

Weed control: Keep the field free from weeds upto 35-40 days after sowing by giving two hand weeding at 20 and 45 days after sowing. The weeds can also be controlled by herbicides like Pendimethilin at the rate of 12kg a i /ha as pre-emergence spray.

Staking: Pea plants are not staked by the farmers. However, plants can be staked in kitchen garden or in small plots. Mulching with grass has been found to be useful in pea.

Plant protection measures

Insect pests

Pod borer (*Heliothes* sp.): The young caterpillars start to feed on the surface of the pods, bore into them and feed on the seeds. They make the pods unfit for consumption.

Control: Spray Malathion (0.1%) or Carbaryl (0.2%) at regular intervals.

Stem fly: (*Ophiomyia phaseoli*): Fully grown larvae attack on the stem just above the ground level. The infected stem swells, cracks and turn brownish. The insect attack on the early sown crop.

Control

1. Treat the seed with Bavistin @I g/kg before sowing.
2. Sowing should be done in the second fortnight of october to avoid the attack.
3. Apply 8 kg Phorate 10 G or 25 kg Carbofuran 3 G per hectare in the furrows at sowing.
4. Spray Dimethoate (0.03%)

Diseases

Fungal Diseases

Powdery mildew (*Erysiphe polygoni*): White floury patches covering the large areas appear on the stems, branches, leaves, tendrils and pods.

Control:

1. Grow resistant varieties like JP-83, PM-2. JP-4, IRS-14.

2. Spray the crop with Dinocarp (Karathane) (0.2%) at weekly intervals.

Fusarium wilt and near wilt: They are caused by two distinct races of *Fusarium oxysporum* f. pisi. Wilt spread through affected soil. The affected plants wilt and shrivel. In near wilt the vascular bundles become brick red rather than orange brown coloured as in wilt. The discolouration is extended to the growing point. The near wilt has higher optimum temperature requirement in the soil than wilt and more harmful in warm season on the late sown crop and late maturing varieties.

Control

1. Grow tolerant/resistant varieties like Alaska, Rachna, etc.
2. Adjust the sowing time.
3. Treat the seed with Captan or Thiram @ 2 g/kg.
4. Drench the soil with Bavistin (0.2%).

Harvesting Green pods of pea are picked by hand at weekly intervals, either in early morning late afternoon. The early varieties are harvested after 50-60 days of sowing.

Yield: The average yield of green pods in early varieties is less than mid-season and late maturing varieties. The green pod yield in early varieties is about 3-5 tonnes per hectare.

Storage: Green pods can be stored at 0°C and 90 per cent relative humidity for one to two weeks

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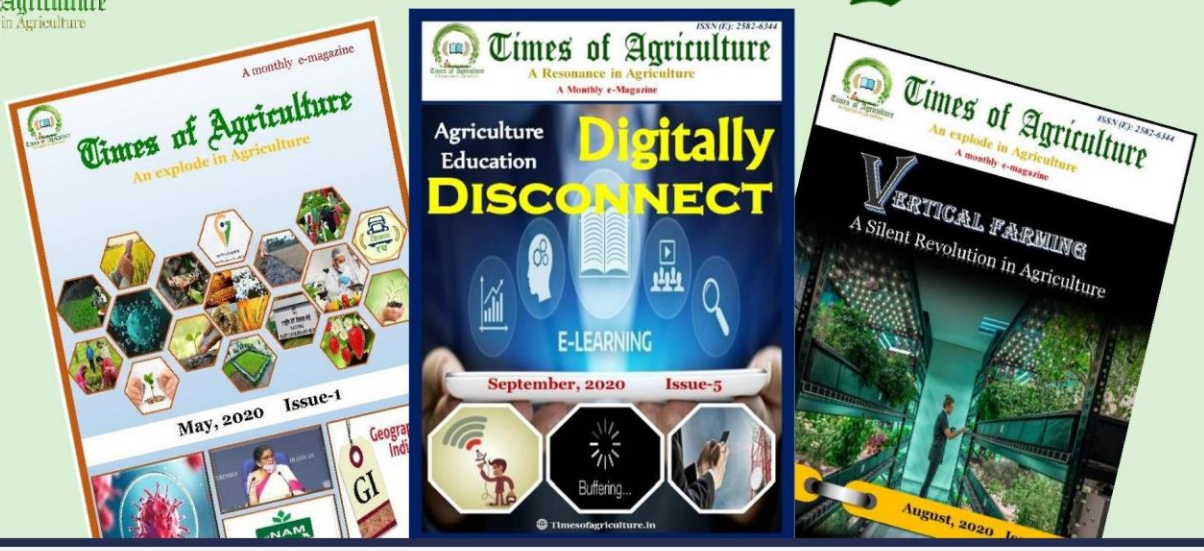

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