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# Times of Agriculture

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STARTUP INDIA

**SEED**



**FUND SCHEME**





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# CONTENT



## STARTUP INDIA SEED FUND SCHEME

### Cover Story

### Startup India Seed Fund Scheme (SISFS)

S.No.	Article No.	Title	Page No.
1.	-	<b>Agriculture Updates</b>	7-16
2.	1373	<b>Startup India Seed Fund Scheme (SISFS)</b> <i>Cover Story</i>	17-22
3.	1374	Grooming the Multi-disciplinary Status: A Fortuitous Opportunities for Indian Agri-versities under NEP-2020 <i>Dr. Shashi K. Sharma</i>	23-24
4.	1375	Rice varietal cafeteria, an innovative tool for technology transfer through varietal showcase and participatory selection <i>Dr. Kuntal Das and Dr. Swati Nayak</i>	25-26
5.	1376	Agromet advisory services: Boon to the farmers of Hoshangabad district- A case study <i>Dr. Anoop Kumar Rathore et al.</i>	27-28
6.	1377	Uptake and translocation of nanoparticles and quantification of enhanced nano-nutrient content in edible parts <i>Dr. Srikanth G. A et al.</i>	29-32
7.	1378	Entrepreneurship development in diversified jute products <i>Zeba Jamal and Nisha Arya</i>	33-34
8.	1379	Rural marketing techniques for success in rural India <i>Sandeep Gautam and Rohit Kumar</i>	35-36
9.	1380	Urban horticulture: In developing sustainable landscape architecture <i>G. Pradeep Kumar et al.</i>	37-38
10.	1381	Reconnecting farmers to nature: Need of the hour <i>Lalita Garg and Kamal Kumar</i>	39-40
11.	1382	Training Needs of vegetable processors for upgrading value chain development <i>Shruti and Madan Singh</i>	41-43
12.	1383	Indian Agriculture in the age of information and communication technology <i>Zahoor Ahmad Shah and Dr. Arif Hussain Bhat</i>	44
13.	1384	Importance of artificial intelligence in agriculture <i>Nikhil Parihar</i>	45-46



14.	1385	Soil testing: A vital tool in agriculture <i>Ravindra Sachan</i>	47-48
15.	1386	Soil health card: An overview <i>Ajendra Kumar and Ranjeet Kumar</i>	49-50
16.	1387	Chlorophyll meter (SPAD): A Site-Specific Nitrogen Management tool for the Wheat ( <i>Triticum aestivum</i> L.) crop <i>Ved Prakash</i>	51
17.	1388	Nutritional care in cancers <i>Akanksha Singh and Nalini Trivedi</i>	52-54
18.	1389	Significance of dietary fiber in human health <i>Gupta Priyanka and Paul Virginia</i>	55-56
19.	1390	Enormous role of lipid in maintaining good health <i>Jaiswal Stuti and Paul Virginia</i>	57
20.	1391	Finger millet: food security, nutrition, value added products, and its major diseases <i>Ajay Mangain and Dr. Laxmi Rawat</i>	58-59
21.	1392	Correlation of folic acid on women's health <i>Mishra Jaya and Paul Virginia</i>	60-61
22.	1393	Medicinal importance of marigold <i>Sagar Yadav and Achala</i>	62-63
23.	1394	Quercetin: Beneficial or dangerous ? <i>Ayushi Tiwari</i>	64
24.	1395	Vitamin C: A powerful antioxidant <i>Rahman Naba and Paul Virginia</i>	65-66
25.	1396	Role of vitamin D in human health <i>Pal Sangeeta and Paul Virginia</i>	67-68
26.	1397	Antibiotic resistance in food animals <i>Sheikh Shubeena</i>	69-70
27.	1398	A quick overview of India's poultry industry <i>Harshit Mishra and Dr. Supriya</i>	71-73
28.	1399	Breeding for quality traits in rapeseed- mustard <i>Raju Ram Choudhary</i>	74-75
29.	1400	Socio-economics of livestock diseases in India <i>Kamal Kumar and Lalita Garg</i>	76
30.	1401	Flower seed production a profitable approach <i>Heera Lal Atal and Manisha Mahanta</i>	77-78
31.	1402	The incidence of spotted pod borer: A pigeopea <i>Dwarka et al.</i>	79
32.	1403	An introduction of rice disease: Blast crop <i>Suresh Kumar</i>	80-81
33.	1404	Integrated pest management in brinjal <i>Aaradhna and Mukesh Kumar Singh</i>	82-83
34.	1405	Effective biocontrol of fall armyworm, <i>spodoptera frugiperda</i> by entomopatho-genic nematodes <i>Deepak Kumar et al.</i>	84
35.	1406	Automated system for plant disease diagnosis by using image processing <i>K. Vignesh</i>	85-86
36.	1407	Curry leaves ( <i>Murraya koenigii</i> ): a versatile multi-potential medicinal plant <i>Dr. Pankaj Kumar Ray</i>	87-88
37.	1408	Chemistry of plant DNA isolation <i>Himanshi Saraswat</i>	89-91
38.	1409	Synthetic theory of natural selection <i>Senthilkumar V.</i>	92-93
39.	1410	Properties of qualitative and quantitative traits <i>Kartik Tomar</i>	94
40.	1411	Ubiquitous nature of edible mushrooms <i>Brindhadevi S.</i>	95-96
41.	1412	Status and scope for maize in India <i>Kiran et al.</i>	97-98

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**Agriculture**

**Updates**

# Uttam Beej Portal



Chief Minister of Haryana, **Manohar Lal Khattar** has launched the '**Uttam Beej Portal**' which will benefit the farmers of Haryana by providing quality seeds with transparency. This seed portal has been linked with **Meri Fasal Mera Byora Portal** and **Family Identity Card ID**.

Meri Fasal Mera Byora Portal offers particulars to all these farmers who've land or who've given their land on contract and should promote their crop. Farmers will now get good **high-quality seeds**, which can improve their manufacturing and revenue. Along with authorities businesses, non-public visa businesses will even should register.



# Nutrition Smart Village



As part of **Azadi Ka Amrit Mahotsav** to commemorate the 75<sup>th</sup> year of Independence of India a programme on “**Nutrition Smart Village**” will be initiated to strengthen the **Poshan Abhiyan**.

This new initiative aims to reach out to **75 villages** across India through the network of All India Coordinated Research Project on Women in Agriculture (**AICRP-WIA**) which is in operation at **13 centres in 12 States of India**.

Main objectives of the initiative are **promoting nutritional awareness, education and behavioural change** in rural areas involving farm women and school children, harnessing traditional knowledge through the local recipe to overcome malnutrition and implementing nutrition-sensitive agriculture through homestead agriculture and Nutri-garden.



# HDFC bank integrates with e-NAM



**HDFC Bank**, stated that it has integrated with the Government of India's National Agriculture Market (**e-NAM**) to allow **digital collection** and **distribution of funds** to different e-NAM beneficiaries.

e-NAM is an online trading platform that facilitates the online transaction of agricultural commodities for farmers, traders, FPOs, and other stakeholders. It was **launched in 2016** with **Small Farmers Agri–Business Consortium (SFAC)**.

Under this engagement, HDFC Bank has worked with the SFAC to further increase the convenience of conducting business on the e-NAM platform by delivering the following collection mechanisms via integration with e-NAM.



# First ever bamboo made cricket bat, stumps



**Bamboo and Cane Development Institute (BCDI)** of Tripura along with the North East Centre of Technology Application and Reach (NECTAR) claimed to have developed the **country's first-ever bamboo made cricket bat** maintaining all the standard protocols used for manufacturing cricket bats. These bats could be used in all forms of cricket. The most preferred wood for the production of cricket bats is willow.

For the development of the bats, the hard Boom (local name) bamboo has been utilized. **“Kanakaich** (a local kind of bamboo)” has also been used to build bamboo wickets, which are almost completely solid.

To create this product, we made use of our exclusive bamboo blue board technology.



# First digital food museum



Union Minister, Piyush Goyal virtually launched **India's first Digital Food Museum in Thanjavur, Tamil Nadu**. It is a **1,860-sqft museum** co-developed by the Food Corporation of India (FCI) and Visvesvaraya Industrial and Technological Museums, Bengaluru (Karnataka) with an estimated outlay of Rs 1.1 crore.

The museum is the first one-of-its-kind effort to depict India's food story from the beginning to India becoming the largest food grain exporter in the country.

The measures of the government will make the country top the list of largest agricultural exporters in the world.



# Country's first fisheries business incubator launched



The first-of-its-kind, dedicated **fisheries business incubator** has been inaugurated in **Gurugram of Haryana** to nurture fisheries start-ups under real market-led conditions. The incubator is known as **LINAC- NCDC Fisheries Business Incubation Centre (LIFIC)**. It was inaugurated by the Union Minister of Fisheries, Animal Husbandry and Dairying, Shri Parshottam Rupala.

The centre has been established at a cost of **Rs. 3.23 crore** under the central flagship Pradhan Mantri Matsya Sampada Yojana (PMMSY).

The first batch of **ten incubators** from four states (Bihar, Himachal Pradesh, Gujarat and Maharashtra) have already been identified.



# Andhra Pradesh bags best marine state award



**Andhra Pradesh** has been named the **best marine state** in the country by the Department of Fisheries. The Department of Fisheries under the Ministry of Fisheries, Animal Husbandry and Dairying awarded best performing States for 2021-22 on the occasion of the **‘World Fisheries Day**, to recognise their accomplishments in the field and their contribution to the growth of the sector. The awards were announced by the Union Minister for Fisheries, Animal Husbandry and Dairying, **Parshottam Rupala** in Bhubaneswar.

**Marine states:** Andhra Pradesh

**Inland states:** Telangana

**Hilly and North East states:** Tripura



# Fund allotment for MGNREGA



The Finance Ministry has allocated additional funds of **₹10,000 crore** as an interim measure for the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) scheme after it ran out of funds allocated in the budget, according to the Ministry of Rural Development (MoRD). More funds may be forthcoming based on the “assessment of demand,” added the Ministry.

Further allocation may be made upon assessment of demand during the revised estimate stage,” said an MoRD statement issued.

These revised estimates will be included in supplementary budget demands made to Parliament when the winter session opens



# Balaghat distt. got first place in fisheries development



**Balaghat** district of **Madhya Pradesh** has got the **first place** in the country for excellent work in the **field of fisheries development**.

Balaghat district was given the **first prize on World Fisheries Day (21 November)** in **Bhubaneswar**.

Rs.3 lakh and Memento was given by the Government of India as a reward. Director Fisheries **Bharat Singh** and Deputy Director Fisheries Industry **Balaghat Shashi Prabha** received this award.

Bharat Singh informed that **Balaghat district** has received the Best Inland State award for doing excellent work for RAS, Biofloc, Cage and economic progress of women and children.





STARTUP INDIA

SEED FUND **SCHEME**

# STARTUP INDIA SEED FUND SCHEME



*The Hon'ble Prime Minister of India announced the plan in his speech during the grand plenary session of Prarambh: Startup International Indian Summit on January 16, 2021. The plan was announced on 1, Jan, 2021 after the approval of the EFC and the Hon'ble Minister of Finance. The seed fund will be disbursed to eligible startups through eligible business incubators present across the country.*

## OVERVIEW

Ease of availability of capital is essential for entrepreneurs in the early stages of growing their business. Funding for angel investors and venture capitalists for start-ups is only available after submission of a proof of concept. Likewise, banks offer loans only to asset-backed applicants. There is a need to provide seed funding to start-ups that have an innovative idea to prove the concept. DPIIT created a Startup India Seed Fund (SISFS) with an expenditure of INR 945 crore to provide financial assistance to startups for proof of concept, prototype development, product testing, market entry and marketing. It will support around 3,600 entrepreneurs through 300 incubators over the next four years.

## SISF SCHEME OBJECTIVES

- ✚ India's startup ecosystem suffers from insufficient capital at the early stage of development and “proof of concept”. The capital required at this stage is often a critical situation for startups with good business ideas.
- ✚ Many innovative business ideas fail to take off due to the lack of the critical capital required at an early stage for proof of concept, prototype development, product testing, marketing and commercialization.
- ✚ A seed fund will be provided to such promising cases to have a multiplier effect in validating business ideas for many startups, leading to job creation.



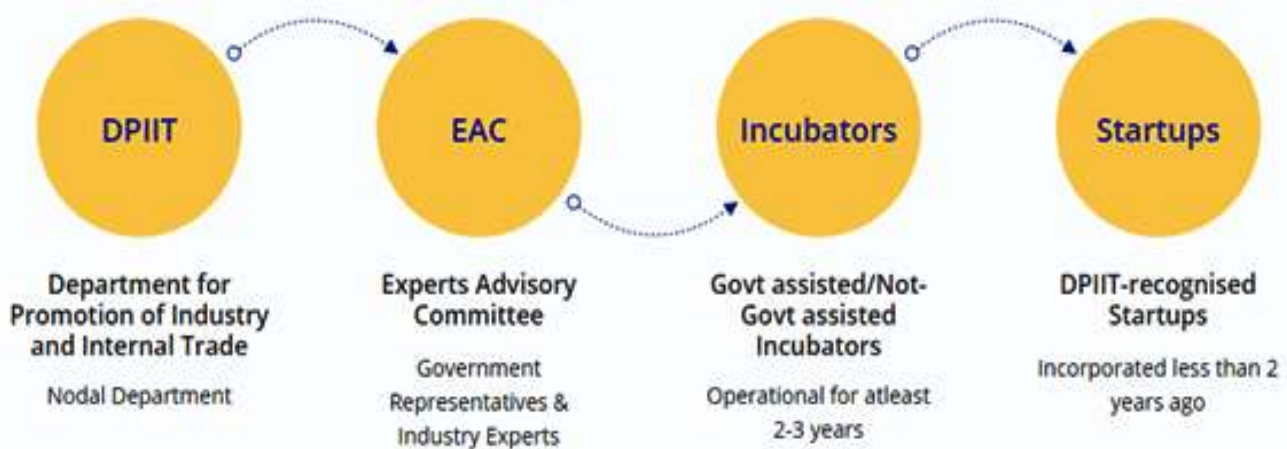


## EXPERT ADVISORY COMMITTEE

- ✦ An Expert Advisory Committee (EAC) has been set up by the Department for Promotion of Industry and Internal Trade (DPIIT) which is responsible for the overall implementation and monitoring of the seed fund plan in India.
- ✦ The EAC will assess and select incubators to allocate seed funds, monitor progress, etc.
- ✦ It will oversee the efficient use of funds to achieve the objectives of the India Startup Fund Scheme.

### How Startup India Seed Fund Will Operate

The Seed Fund will be disbursed to eligible startups through eligible incubators across India





# Eligibility Criteria

## **ELIGIBILITY CRITERIA**

- ❖ A start-up company, recognized by DPIIT, incorporated less than two years ago at the time of the application.
- ❖ The startup must have a business idea to develop a product or service that matches the market, viable marketing and scale.
- ❖ The startup must use the technology in its main product or service, business model, distribution model or methodology to solve the problem it is tackling.
- ❖ Preference will be given to startups that create innovative solutions in sectors such as social impact, waste management, water management, financial inclusion, education, agriculture, food processing, biotechnology, health, energy, mobility, defense, aerospace, rail, oil and gas and textiles, etc.
- ❖ The startup must not have received more than Rs. 10,00,000 in cash assistance under a central government program or otherwise.
- ❖ The contribution of Indian promoters to the startup must be at least 51 percent at the time of application to the incubator of the program, in accordance with the Companies Act 2013 and SEBI Regulation (ICDR), 2018.
- ❖ The start-up applicant can benefit from the initial support in the form of a grant and transferable debt / bonds according to the guidelines of the plan.



# STARTUP INCUBATOR



## INCUBATORS

1. The incubator must be a legal person:
  - An association registered under the Association Registration Act of 1860, or
  - A credit registered under the Indian Trusts Act of 1882, or
  - A limited liability company registered under the Companies Act 1956 or the Companies Act 2013, or
  - A regular body created by a law issued by the legislator.
2. The incubator must be in operation for at least two years from the date of application for the program.
3. The incubator must have facilities for at least 25 people.
4. The incubator must have at least 5 startups physically incubated on the date of application.
5. The incubator must have a full-time managing director, with experience in business development and entrepreneurship, supported by a competent team responsible for supporting startups in the testing and validation of ideas, as well as in the financial, legal and financial Human Resources Functions.
6. The incubator should not disburse seed funds to incubators using funds from a private third party entity.
7. In case the incubator does not receive assistance from the government or the central or governmental governments
  - The incubator must be ready to run for at least three years.
  - You must have at least 10 independent startups physically in the incubator on the application date.
  - Audited annual reports must be submitted for the last two years.
8. Any additional criteria that the EAC may decide.





## FUNDING

- ✚ A credit of Rs 945 crores will be distributed over the next four years to provide seed funding to eligible startups through qualified business incubators across India.
- ✚ The program is expected to support some 3,600 startups through 300 incubators.
- ✚ The online portal created by Department for Promotion of International and Internal Trade (DPIIT) for the program will allow incubators to apply for funds under the program. DPIIT has created an Expert Advisory Committee (EAC) to manage and oversee the Startup India Seed Fund program.
- ✚ Grants of up to Rs 5 million will be awarded to eligible incubators selected by the EAC.
- ✚ Selected incubators will be provided a grants of up to Rs. 20,00,000 for proof of concept, prototype development or product testing for startups.
- ✚ In addition, investments of up to Rs. 50,00,000 will be made available to start-ups for market sentry, marketing or expansion through convertible bonds or debt-related instruments.

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# Grooming the Multi-disciplinary Status: A Fortuitous Opportunities for Indian Agri-versities under NEP-2020

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After independence, Indian Agriculture has risen from scratch to an economy of more than \$ 500 billion and has come up as a key contributor to the economic development of the country. Though there are a number of drivers which have contributed to this growth, the role of Agricultural Higher Education is the major one. In 1947, under the leadership of S. Radhakrishnan, a commission for higher education was formed that emphasized the need for agricultural education, research and extension. Indian agricultural higher education system was then modelled on the US Land Grant University's pattern with the establishment of the first such university at Pant Nagar in 1962 with a land grant of 16000 acres from then Uttar Pradesh government. Today, the 'ICAR-Agricultural University System' has a network of more than 100 higher education institutions having a focus on learning through hands-on practice and field experience training. This education system has produced the human resource which has helped the country to move from a state of 'ship-to-mouth' to a nation with 'right-to-food'. Today, this system of education is having several domain-specific universities in horticulture, veterinary, fisheries, forestry etc. which are contributing effectively to nation-building.

Despite the tremendous achievements in the production of

various crops, present-day agriculture is facing a number of problems. First and foremost is the farmers' distress. During the race for attaining self-sufficiency in crop production, we have lagged somewhere to secure the economy of farmer households. In order to address the issues of agriculture and farmers' welfare seriously, the Govt. of India has decided to restructure agricultural higher education under the New Education Policy- 2020. Substantial changes have been planned in the



pedagogy and curriculum of agricultural education. It has been envisioned that all higher education institutions shall aim to become multidisciplinary for raising India as a global study destination for providing premium education at affordable costs and to restore its role as a 'Vishwa Guru'.

It is quite likely that agricultural universities will offer the flexibility to choose courses from a wider array of subjects pertaining to agriculture, science, arts, engineering, technology, law etc. without any formal restrictions. More liberal multidisciplinary undergraduate education with multiple exits, e-content development, integration of values and ethics, criterion-referenced testing, etc., are planned to be given central space.

In the near future, machines will define the fate of agriculture

under different agro-ecological settings. The multidisciplinary collaborative efforts will therefore be of great help for discovering solutions for the new agricultural challenges we face. The substantive interaction between different disciplines will provide ample opportunities for the exchange of ideas across the disciplines. For example, most of the agricultural and horticultural operations are still manual works and labour dependent. After water, skilled labour at affordable wages will be the next biggest crisis for Indian Agriculture. Despite the worry about food shortages in the coming years, many farmers will be worried about labour shortages. Just as the motorized harvesters transformed the economics of agriculture farms, a new wave of AI-based mechanization and automation will be required for handling various farm operations. As the picking of apples is different from that of strawberries, there are a number of farm management issues that will require a high level of technological intervention. Therefore, there will be a need for finding new ways for improving farm efficiency. The agriculture of the new age will require equipment based on small smart machines that can do the right thing, in right place, at right time in the right way. The approach of treating crops and soil selectively according to their needs by small autonomous machines is the next step required in the development of high precision farming. Automatic sensing and control for each task have to be made feasible, hence, enhanced interaction between agriculturists, plant physiologists, biochemists, engineers and mathematicians will be required for developing high-end human resources in agricultural production, marketing and processing technology. Numerous farm level digital technologies like AI &



Robotics, remote sensing and GIS, machine learning & data mining etc. are required to be planned for facilitating all the aspects of distant and practical learning. For better appreciation of the needs of the industry and for technological advancement of the farming community, fellowships and exchange programs have to be strengthened between industries and universities for direct learning and generation of the human resource of higher industrial requirements.

Under NEP-2020, all prestigious institutions like IISc, IISERs, IITs, IIMs etc. are planned to become multidisciplinary hence multi-institutional collaborations will be highly applicable for publicly funded R&D establishments. It will mobilize the motivation for collaboration and cooperation for otherwise disparate organizations to attain a common end that is unattainable via internal R&D. It will open vast collaboration opportunities for the agricultural institutions for yielding high-end research. Apart from it, selected universities from among the top 100 universities in the world are expected to be facilitated to operate in India; agri-versities can take full advantage of these opportunities to gain access to the resources and capabilities of other institutions so as to develop and sustain the comparative edge. The sharing of resources with others will reduce the uncertainty and will definitely help in cost saving at all the participating institutions.

Continuous measurement and analysis of the needs and aspirations of the people are essential for retaining the relevance of science for mankind welfare. Specifically, social sciences of agricultural economics, agricultural extension,

agricultural statistics, food and nutrition and home sciences help organize research and education around societal problems in scientific disciplines by improving focus, design, implementation, evaluation and demonstration of evidence of impact. Today, out of a hundred school pass-outs, only one student has access to agricultural education. For enhancing the reach of agricultural education to deserving rural populations, agri-versities will have to transform their network of regional research stations into institutions of agricultural education together with their research focus. Collaboration with rural and tribal communities for the effective operation of the constituent sub-institutions may be thought of for eliminating the socio-cultural differences prevailing under different agro-ecological settings. Further, the recent agricultural reforms envisage the proliferation of agricultural cooperatives, companies and corporations. It is oblivious that there will be an increased conflict between the farmers and other working groups. The technical workforce, which is supposed to support the farmers in their proximity; thus presumed to have knowledge of farmers' rights, pricing, tender process, tax and financing, crop seed business, importing crop seeds and planting material, commercial crop production and distribution, plant variety right protection, GM Crops, GM foods, importing animals, gene patents, product liability and intellectual property rights. The integration with the law teaching institutions is also therefore imperative under the coming farming context.

For restoration of the title of 'Vishwa Guru', India is required to target global agricultural issues in its

curriculum. Today, widespread hunger and under nutrition are once again drawing the world's attention. One out of every six people is at risk of not having enough to eat. And, the hungry families which tend to spend more than half of their income on food, remain extremely vulnerable to food price increases. For this reason, Indian agricultural education has also to be multifaceted and multi-disciplinary. It needs reinforcement of the students with the local, national, international problem-solving ability with multidisciplinary tools. The scientific and technical knowledge will have no significance unless the students are competent enough to trace the socio-political causes associated with the problem of hunger and poverty of the people.

It is obvious; the initiatives proposed under NEP 2020 can be fructified into reality only with the will and commitment of the higher education institutions. For rapid transformation of the existing set-up, agricultural higher education institutions have to devise a second set of recommendations at the university level which will require the formulation of new apparatuses to compete with the best of the world. These recommendations have to be process-oriented. The large scale confluence of different disciplines of social sciences, material sciences, engineering and mathematics is therefore needed in agricultural education for spawning new technologies and uprooting the problems of farmers' distress, poverty and hunger from the face of the planet, forever.

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# RICE VARIETAL CAFETERIA, AN INNOVATIVE TOOL FOR TECHNOLOGY TRANSFER THROUGH VARIETAL SHOWCASE AND PARTICIPATORY SELECTION



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**R**ole of improved crop varieties for increased productivity is well recognized since the era of green revolution. Acceptance of these varieties along with better agro-techniques happened through advocacy of different extension and training programmes. However, the large-scale adoption and operative visibility remain an existing gap in many parts of India especially in Eastern part for Rice crop. One factor of this slow adoption rate is that farmers do not directly visualize the significant advantages and benefits over existing one which corresponds to 'seeing is believing', leading to secure livelihood and enhanced profitability. Apart from that, a variety needs a robust positioning in the seed chain, which to be driven by farmer's acceptance as well as by other key influencers from market and policy domain. Since the farmer's perception, preference remains diverse based on their ecosystem, gender, socio economic background, therefore a participatory evaluation is necessary to capture varietal

performance in an equitable and inclusive manner. Thus, for disseminating the significance of new technology as improved varieties with best bet crop management practices among the farming community a concept of 'Rice Varietal Cafeteria' (RVC) is idealized and implemented through International Rice Research Institute, South Asia Regional Centre (IRRI-SARC) based at Varanasi in 2021 in Eastern Indian States.

## The Concept

RVC is a market inclusive, client-oriented platform, which showcase improved rice varieties of diverse features and connects different stakeholders in the seed value chain and support large scale promotion and up-scaling of preferred varieties. This is a scientifically valid trial which encourages learning and extensive knowledge sharing and thus proves as an 'Evidence Hub' of multiple diverse varieties.

## Functional Spread

Under AGGRi Alliance (Accelerated Genetic Gain for Rice) project funded by Bill and Melinda Gates Foundation, a total of 12 RVC has been established in key locations of Bihar, Odisha, Eastern UP, and Chhattisgarh. The RVC is placed within Krishi Vigyan Kendra (KVK) of ICAR and with competent NGO in well managed farm.

## Objectives

- To accelerate the acceptance and adoption of the new improved rice varieties with Abiotic and biotic stress tolerance, Multi Stress

Tolerance, Bio-Fortified (nutria-rich), Premium Quality Rice varieties.

- To engage private and public seed sector players, and their market channels like distributors, dealers, millers, FPOs, extension agents in participatory evaluation of different varieties.
- To strengthen learning and adoption by systematic evaluation both with qualitative and quantitative data.
- To create mass awareness and sensitization about new improved rice varieties
- To promote the seed and varietal replacement for improved productivity of rice in the region

## The Layout

The trial is established in 3 replicated plots in one field. Generally, 30-35 rice varieties are included in a trial which are majorly clustered into 3 maturity groups e.g. early (115-125 days), medium (125-135 days) and late (140 days & above). Staggered sowing pattern is followed to synchronize the flowering and maturity of the different varieties, where the late varieties are sown first followed by medium and last the early ones, keeping 15 days interval in between each group sowing. Optimum crop management practices are followed in the whole trial throughout the crop life cycle with close monitoring from IRRI scientific team. From IRRI-SARC, Dr. Kuntal Das: Senior Specialist Seed System and product Management; Sarvesh Shukla: Officer; Rabindra Moharana: Field technician and respective data enumerators are actively involved to implement RVC across geographies which are in few instances are labelled with geo-tags, specifying



each plot, variety and the entire layout, so that any visitor can identify the variety easily and observe.



**Fig 1:** Aerial view of Rice varietal Cafeteria (vegetative stage) at IRRI-SARC in Kharif'2021 laid with 36 varieties in 2 replications.

### Varietal EXPO

Once the trial reached to the harvesting stage, an EXPO is organized on a suitable date by inviting and ensuring participation of all key stakeholder engaging farmers (minimum 50) local distributors, dealers, millers, higher officials of Department of Agriculture (DoA), scientist from KVK, Universities, subject matter expert etc. The whole event is conducted in co-ordination with IRRI with the aim on farmer orientation training and participatory varietal evaluation.



**Fig 2:** Aerial view of Rice varietal Cafeteria (at harvest stage) at IRRI-SARC in kharif'2021 laid with 36 varieties in 2 replications.

### Systematic Evaluation

Two types of evaluation models are employed, a) Participatory (Qualitative) evaluation and b) Trait data (Quantitative) evaluation. In participatory evaluation the score-card is used to record basic varietal traits/ features in 1-5 scale (1 worst-5 best). The trait data score-card is used to record various varietal characteristics (e.g., plant height, grain type, yield, disease/ pest tolerance and etc.). Based on these evaluations a matrix is prepared to conclude on best performing as well as preferred varieties. Meticulous analysis of the data also indicates the reason to choose a specific variety by gender group (male and female), socio economic (marginal, land-lord) and functional background (farmer, distributor, retailer, policymaker, scientist etc.).

Holding the evaluation score cards, each participant closely observes each variety and mark the scores based on their observations. The score cards are later submitted the IRRI officials for further data analysis procedures. The consolidated results are shared with DoAs, Agriculture Universities and especially to state seed certification agencies for further endorsement and linkages in seed chain.



**Fig 3:** Participants observing the Rice varieties and scoring as per performance in Rice rvest stage) at IRRI-SARC in kharif'2021 laid with 36 varieties in 2 replications.

### The Impact

Rice Varietal Cafeteria provide an opportunity to farmers and wide stakeholders in selecting the variety based on their own judgment. The findings show that the client-

based RVC is an effective method for disseminating high-yielding varieties with improved climate resilience technologies by creating awareness among rice farmers. It was found to be very persuasive in changing the attitude, skills, and knowledge of farming communities.

But the benefits go beyond



that. The multidimensional approach of the RVC provide the opportunity for participatory learning and network building where various stakeholders interact, discuss, give feedback, and decide on their varietal preferences and choices. It also helps establish linkages between formal and informal seed systems as well as private and public seed sectors and stabilizes seed supply chain management by creating and managing varietal demand and supply. In addition, the evidence-based trait data from RVC provide very helpful information to breeders and researchers which further support in varietal development through improvement programs. The selected varieties are infused in seed chain to speed up the adoption among farmers. By adopting the most suitable varieties based on the ecological requirement, rice farmers also stand to gain higher yields and income. Findings from rice varietal cafeteria ensure insightful guidance for policymakers to advocate for seed and varietal replacement. Therefore, extension agencies and agriculture departments need to play a proactive role in providing technical support to rice varietal cafeterias and incorporate this method in their mainstream outreach programs for sustainable food production with increased productivity in the state.

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# Agromet Advisory Services: **BOON TO THE FARMERS OF HOSHANGABAD DISTRICT: A CASE STUDY**



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**A**griculture in India depends mainly on weather and climate conditions. Weather through various atmospheric factors plays a significant role in reaping good agricultural output. Activities in agriculture and allied sectors are highly influenced by weather phenomena. Crop yields, quality, protein content and other factors can be dramatically affected by the weather. Daily operational decisions such as field preparation, sowing, application of nutrients, crop protection measures and harvesting of crop depend on weather condition. Agromet advisory services (AAS) are vital tool which provide the valuable information about weather forecast information and crop specific advisories. The major objective of agromet advisory services is to help the farmers in capitalizing benevolent weather conditions in order to optimize the resource use and to minimize the loss due to harsh/aberrant weather conditions. AAS play critical role in agriculture under changing climatic condition. AAS benefits every farmer by minimizing the crop loss due to fluctuating weather condition in recent days. Weather forecast helps to

increase agricultural production, reduce losses, reduce cost of inputs, improve quality of yield, increase efficiency in the use of water, labour and energy and reduce pollution with judicious use of agricultural chemicals. The weather forecast based agro-advisory bulletin contains weather forecast information for the next five days and crop specific management strategies which is based on weather forecast, and giving warning to the farmers well in advance, regarding rainfall variation, its amount and other weather variables including pest/disease problems. Thus, farmers can decide on crop management options, application of nutrients and strategies to overcome other problems.

A young farmer named Mr. Yash Patel who lives in a small village in Hoshangabad district adopts rice-wheat cropping system in 7.0 acres of land. Hoshangabad district of Madhya Pradesh is the leading district in terms of production of summer moong crop in the country during the year 2021 with the total production of 3.10 lakh metric ton. Moong was grown in more than 2.08 lakh hectare area in the Hoshangabad district during summer 2021. After inspiration from fellow farmers, he planned to go for third crop i.e. summer moong in his field. He collected the required information from his fellow farmers. The farmer started cultivating summer moong in 7 acres of land. Initially he realized approximately 35 quintal of moong yield from 7 acres of land area. However, farmer couldn't realize much of yield due to heavy rainfall during maturity stage in the first week of June 2020. This was due to sowing of moong after the first week of April. There was also avoidance of control measures at critical stage of disease and pest infestation. This is due to lack of right crop advisories at right



time. The actual yield realized by farmer for 7 acres of land was 21.7 quintal with cost incurred was about Rs. 83370. The gross and net return realized was Rs. 21855/acre and Rs. 9945/acre, respectively (Table 1).

## **Impact of agro-met advisory service**

Farmer heard about the AAS issued by Zonal Agricultural Research Station (ZARS), Powarkheda, Hoshangabad through GKMS Scheme and he came to know the service through his farmer friends and get registered with his mobile number to receive AAS bulletin biweekly. The farmer took keen interest about the service and regularly access agro-met advisories



from the centre. He was informed in advance about the expected change in weather condition through agromet advisory service and also advised on how to adjust the agricultural operation in the field. Powarkheda center advised the optimum sowing window for rice-wheat-moong cropping system (RWMCS) to farmers to achieve profitable yield. We suggested to adjust the sowing window of rice in the last week of June which led to adjust the sowing window for wheat crop upto 15<sup>th</sup> November and moongbean upto first week of March. Young farmer Mr. Yash Patel adopted the same sowing window as suggested through AAS. Young farmer Mr. Yash Patel said that “By the time we realize that the crop is attacked by disease and insect, it is too late”. But, now I am receiving SMS about agro-met services well in advance and come to know about the change in weather condition and through service I also come to know what to do for arising problems. That

helped us a lot, said by Mr. Patel. Because of AAS service, the same farmer realized around 5.12 q/acre of yield in next season and gross returns of Rs. 36844/acre with cost of cultivation of about Rs. 11100/acre and net income realized were about Rs. 25744/acre. The benefit and cost ratio arrived for AAS and non-AAS situation was 3.32 and 1.83, respectively (Table 1). According to him AAS service is one of the best service readily available to farmers in event of uncertain weather conditions. He himself took initiative in his village and advised all his fellow farmers to adopt service. Consequently, almost 50 farmers in the village registered their mobile number for accessing the agro-met advisory service. The GKMS centre, ZARS Powarkheda provide all the relevant weather information (rainfall, temperature, relative humidity and wind velocity etc.) twice in week to all registered farmers well in advance in free of cost. Based

on the advisory, farmers prepare their field activities accordingly and protect from loss occurred or minimize the loss at maximum extent.

It was realized that agro-met advisory service issued by GKMS centre based on current and forecasted weather across the country is valuable and advanced agro-based technology readily available with farmers in the light of climate change situation. Dissemination of weather based information well in advance is advantageous for farmers to protect their crop from adverse weather condition. Further, it helps to minimize their loss through adjusting their farm activities according to agro-met advisory service received in advance. Due to judicious and timely utilization of inputs, cost of production for the AAS farmers reduced. Therefore increased farm output level and reduced cost of cultivation led to increased returns.

**Table 1: Cost and return of summer moong cultivation with and without agro-met advisory service in farmer field of Hoshangabad District**

Variable	Without agro-met advisory service (Year 2020)	With agro-met advisory service (Year 2021)
Yield (q/acre)	3.1	5.12
Price (Rs/q)	7050	7196
Cost of cultivation (Rs./acre)	11910	11100
Gross return (Rs./acre)	21855	36844
Net return (Rs./acre)	9945	25744
B:C ratio	1.83	3.32

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# UPTAKE AND TRANSLOCATION OF NANOPARTICLES AND QUANTIFICATION OF ENHANCED NANO-NUTRIENT CONTENT IN EDIBLE PARTS



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Nanotechnology has shown promising potential tools and strategies at the nanometer scale to improve food production and meet the future demands of agricultural and food security. However, considering nanotechnology's potential benefits to date, their applicability has not yet reached up to field conditions. Increasing concerns regarding absorption, translocation, bioavailability, toxicity of nanoparticles, and impropriety of the regulatory framework restrict the complete acceptance and inclination of the agricultural sector to implement nanotechnologies. The biological function of nanoparticles depends on their physicochemical properties, the method of application, and concentration. The effects of the various types of nanoparticles (NPs) on plants were determined to increase seed germination and biomass or grain yield. The NPs also increased

the plant's resistance to various biotic and abiotic stresses. The plant's biological functions depend on the events that occur at the molecular level. However, little progress has been made at the molecular level influenced by nanoparticles, which is an important step in evaluating potential mechanisms and plants' effects. Therefore, it is important to understand plants' underlying mechanism and response towards nanoparticles, and the gene expression changes through molecular approaches. The associations of nanomaterials with plant cells, the process of internalization, and the distribution of biomolecules using nanoparticles as a carrier are studied but not well understood. The transmission of biomolecules, such as nucleic acids, is a major obstacle due to cell walls, limiting the application of nanomaterials in crop enhancement mediated by genetic engineering. Recently, the use of different nanomaterials for nucleic acid delivery in plant cells has been published. Here, we aim to update researchers on the absorption and translocation of nanoparticles and elaborate on the importance of nanoparticles in agriculture and crop stress tolerance.

## Introduction

Significant technical advancements and innovations have been made in recent years in agriculture to meet the growing challenges of sustainable agricultural production and food security. The world needs to generate 50% more food by 2050 to meet the needs of 9 billion people. This goal can only be accomplished by technical interventions to increase productivity, as land and water

resources are constrained. Arable land shortage, irrigation, and reliance on conventional crops are the key concerns that have drawn the researchers' attention to using various methods. It is not surprising that attempts have been made to improve the agricultural sector using nanotechnology and nanomaterials because of nanomaterials' obvious special and incredible properties. In particular, the use of different kinds of nanomaterials consists of metal oxides, silicates, ceramics, magnetic materials, semiconductors of quantum dots (QD), polymers, lipids, dendrimers, and emulsions. The goals are to minimize the quantity of applied plant protection products (PPP), alleviate nutrient losses during fertilization, and maximize revenue in the agriculture sector through better nutrient management. Many factors depend on the increased use of nanoparticles (NPs) in agriculture, including well-known effects, potential toxicity, monitored fate, and overdose levels. NPs can communicate with their environment, and plants are a key component of all ecosystems. Therefore, it can be concluded that NPs can communicate with plants and that these interactions, such as their intake and their accumulation in plant biomass, will affect their environmental fate and transport. Nanomaterials can penetrate live plant tissues, but their aggregation in the ecosystem and their effectiveness as smart delivery systems in living plants have implications. It is important to understand whether plants can consume intact NPs and transport them to other plant tissues. NPs can enter plant tissue from either the root tissues or the above-ground tissues (e.g., cuticles, stomata, hydathodes, and trichome) as well as through root junction and wound regions.

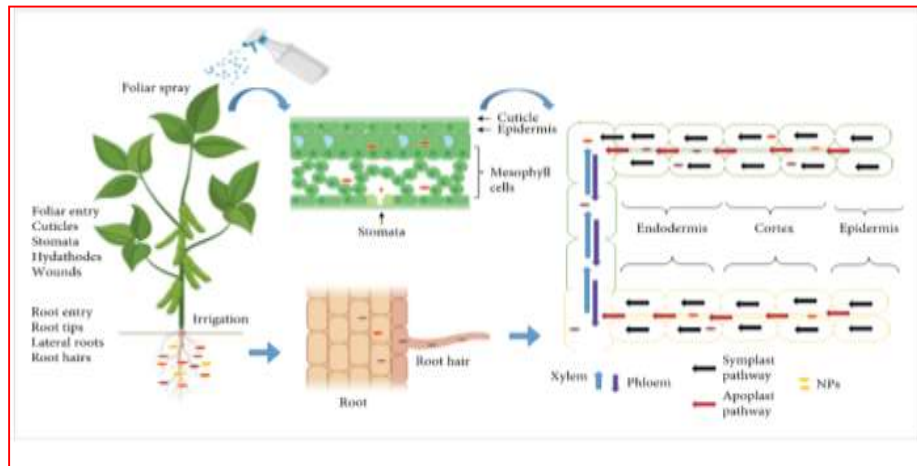
## ABSORPTION AND TRANSLOCATION OF NANOPARTICLE

### Mechanisms of Nanoparticle Uptake by Plants

In the soil, the NPs undergo a series of bio/geotransformations,



which determine the bioavailability and toxicity of NPs. The NPs translocate to aerial portions after interacting with plant roots and accumulate in cellular or subcellular organelles. Adsorption of NPs from the soil by plant roots can be described as the first step in bioaccumulation. Several researchers analyzed numerous NPs and proposed that plant accumulation occurred by root adsorption accompanied by dissemination through plant tissues by certain modifications, such as crystal phase dissolution, biotransformation, and bioaccumulation. The NP's size is directly connected to the absorption of the NPs because it is a crucial parameter that enables its entrance through cell wall pores or plant stomata. Besides, size determines their subsequent transport processes into cells (i.e., plasmodesmata) or organelles of plant cells, affecting their accumulation, toxicity, and kinetics of transport into plant cells. The surface area, agglomeration, and reactivity on the cell surface or within plant structures are correlated with the NP shape. To determine the specific zone of interaction between plant cell structures and NPs, the NP surface is calculated by its area and morphology, which constitute essential parameters. Due to the obvious negative charge of the cell wall, the attachment of the NPs to the surface of the plant cell relies directly on the charge of the NPs. Following the charge and particle size, the hydrophobicity present on the plant surface played a crucial role in the uptake and translocation process. In addition, the basic structure of nanomaterials is complementary to the evaluation of their effect on NP absorption, translocation, and aggregation in the plant. The above facts demonstrate the need to standardize laboratory experiments to assess NPs in plant tissues at various levels to determine the exact effect of NPs supported by their physical-chemical properties. Therefore, to understand and elucidate the absorption, translocation, and



**Fig 01:** Schematic presentation of nanoparticle uptake through different routes and their translocation pathways in different plants' parts.

accumulation processes, a detailed study on the nature of the NPs is needed. To determine their movement and localization to various structures and cell organelles within the plant, monitoring and tracking NPs are important.

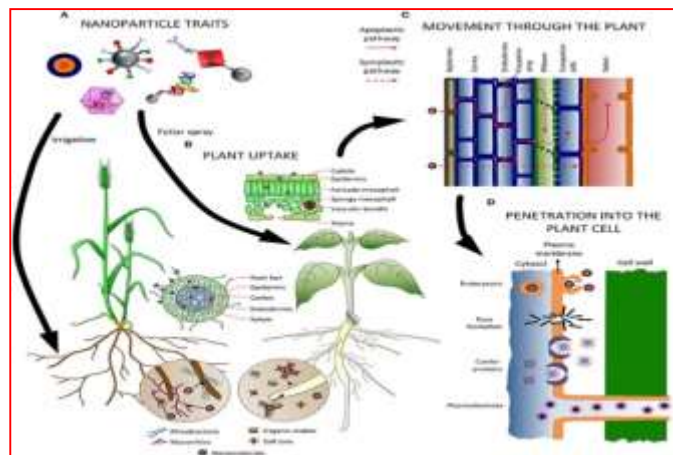
The unprecedented capability to control and characterize materials on the nanometer scale has led to the rapid expansion of nanostructured materials. The expansion of nanotechnology, resulting into myriads of consumer and industrial products, causes a concern among the scientific community regarding risk associated with the release of nanomaterials in the environment. Bioavailability of excess nanomaterials ultimately threatens ecosystem and human health. Over the past few years, the field of nanotoxicology dealing with adverse effects and the probable risk associated with particulate structures <100 nm in size has

emerged from the recognized understanding of toxic effects of fibrous and non-fibrous particles and their interactions with plants.

The present review summarizes uptake, translocation and accumulation of nanomaterials and their recognized ways of phytotoxicity on morpho-



**Quantification of enhanced nano-nutrient content in edible parts**



**The anthropogenic release of nanoparticles (NPs)**



anatomical, physiological, biochemical and molecular traits of plants. Besides this, the present review also examines the intrinsic detoxification mechanisms in plants in light of nanomaterial accumulation within plant cells or parts.

The anthropogenic release of nanoparticles (NPs) to the environment poses a potential hazard to human health and life. The interplay between NPs and biological processes is receiving increasing attention. Plants expose huge interfaces to the air and soil environment. Thus, NPs are adsorbed to the plant surfaces, taken up through nano- or micrometer-scale openings of plants and are translocated within the plant body. Persistent NPs associated with plants enter the human food chain. In this Opinion, we document the occurrence and character of NPs in the environment and evaluate the need for future research on toxicological effects. Plant nanotoxicology is introduced as a discipline that explores the effects and toxicity mechanisms of NPs in plants, including transport, surface interactions and material-specific responses.

### **Mechanism of Nanoparticle Translocation in Plants**

Studies attempted to establish the mechanisms involved in plant structures or cell organelles in the absorption, translocation, and accumulation of various NPs. The translocation and accumulation of NPs in the plant depend on the plant cells' physiology and structure, the nanomaterial interaction with the soil, and the nature and stability of the NPs. The cell wall of plants serves as a specific barrier that regulates the entrance of NPs into the cell and determines the ability to solubilize and allow the passage of NPs according to their nature. The majority of studies report that the size of the cell wall's pore is the key constraint on the entrance of NPs into the plant cell. The size of NPs is 40-

50 nm to penetrate the cell from the plant surface. The nature of the NPs is a second restriction factor impacting their penetration through the cell wall and cell membrane or promoting attachment to the radical surface or radical exudates. The positive charging of NPs can improve their adhesion to the cell wall. Besides, morphology and NP coating can play a significant role in their behavior on the rhizosphere and their action on plants.

### **MECHANISMS OF NANOPARTICLE AND PLANT INTERACTION**

#### **Effects of Nanoparticles on Plants**

The NPs enter the plant system by several routes, mainly through roots and leaves. NPs interact with plants at cellular and subcellular levels after entry, promoting changes in morphological and physiological states. These interactions may be positive or negative, depending on the nature of the NPs and the plant species. The chemical nature, reactivity, size, and specifically concentration of NPs in or on the plant could determine NPs' effects on plant systems. The researchers used various NP application methods, such as soil application, foliar spray, or seed treatment, to examine the impact of nanoparticles on seed germination or in plant growth. Available evidence has shown that different NPs can promote seed germination and plant growth and development at concentrations below certain limits. These studies were mostly performed under artificial treatment conditions such as plate growth medium and hydrophobic or pot conditions. To understand the impact of nanoparticles on plant growth, we discuss nanoparticle's positive impact on plant seed germination and plant growth and the positive effects of NPs to improve plant stress tolerance.

#### **Seed Germination**

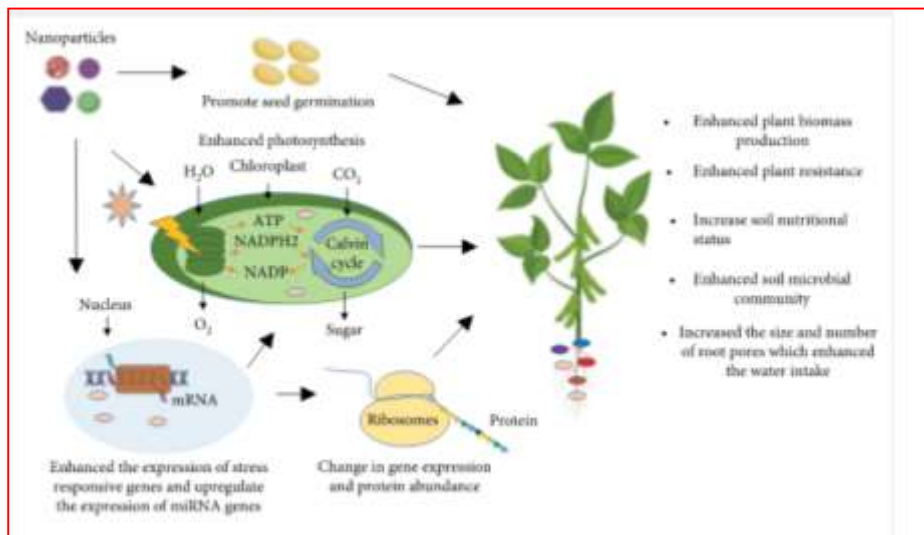
Germination of seeds provides a basis for the productivity, growth, and development of plants. A natural

method of germination takes time, and the yield obtained is not very high indeed. But high germination has been accomplished in the case of treated seeds, making nanotechnology a potent technique for improving both germination and yield. To monitor the ability of nanoparticles to enhance germination, numerous researches have been done. The mechanism underlying the process by which NP treatments increase seed germination rates is still unclear. The NP treatments improve seed absorption and water retention; it may be attributed to increasing seed germination. The tomato seeds were inoculated to media with carbon nanotubes (CNTs); after 2-day incubations, the seeds' moisture content was treated with CNTs containing 19% more than untreated seeds. These findings suggested that the CNTs promote the uptake and retention of water. The mechanism is not fully understood; maybe the CNTs create microspores, and water permeation channels into the seed coats. It is assumed that CNTs regulate the aquaporins (AQPs) in the seed coats. The AQPs are membrane proteins and act as a water channel in the cell membrane.

#### **Conclusion**

In recent years, nanotechnology research has suggested the development of NPs as a powerful technique to reduce existing problems resulting from conventional fertilizers in traditional agricultural systems. The results relating to nutritional elements containing NPs (i.e., Fe, Cu, Se, and Co) have shown substantial scientific evidence of their efficacy in improving the micronutrients of the plant, which has been reflected by improved growth parameters and significant improvements at the physiological level (i.e., chlorophyll and carotenoids, photosynthetic activity, metabolic pathways, and





become a valuable feature that facilitates the future use of NPs. However, critical studies carried out under controlled conditions are desperately required to determine the role of NPs in and out of the plant and their effects on the environment. The basic dosage of NPs, exposure duration, translocation and accumulation, and mechanism of action on plants are important for an application strategy to be developed. In addition, the secondary effects and accumulation of soil, air, water, and biotic organisms in the ecosystem are critical in deciding the exact impacts of NPs and their effects on the ecosystem.

**Fig 2** Positive effects of nanoparticles on plant growth and development. The optimum concentration of nanoparticles causes an alteration in different physiological processes to increase seed germination and photosynthesis of the plants. Further, the nanoparticles alter the gene expression of different genes and miRNAs that have a positive impact on stress tolerance and plant biomass.

transpiration rate). A major obstacle is the precise dosage and activity of NPs on the surface of plant targets, so

minimizing the leakage of chemical products extracted from bulk materials (i.e., mineral fertilizers) has

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# ENTREPRENEURSHIP DEVELOPMENT IN DIVERSIFIED JUTE PRODUCTS



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Jute seems to be a very promising fibre in the years to come. It has the capability to be made into a wide range of innovative articles. Thus, making it adaptable into small scale enterprise by rural people and making a good livelihood out of it. This article discusses the various possible ventures that can be taken up in development of diversified products from jute.

## Introduction

Entrepreneurship is the dynamic process of developing something new with value by devoting the required time and effort, taking up financial risks and relishing the monetary rewards associated with it. This product may or may not be new, but the entrepreneur has infused its value. He/she has done it by using the skills and resources effectively and efficiently.

An entrepreneur is a person who is responsible for an entrepreneurship venture. Even though it is widely believed that entrepreneurs are born with the necessary skills; however, it is not entirely true, anyone can learn how to become one by undergoing an entrepreneurship development process.

## Small scale enterprises

Small Scale Enterprises manufactures, offers service, and produces goods with minimal manpower and fewer machines, i.e., they offer services on a small scale. Usually, these industries make a one-

time investment of less than Rs.10 crore on equipment and plant.

Like many other fortune companies or larger enterprises, small scale enterprises/ industries create numerous employment opportunities. Hence, it plays a vital role in the nation's economy. These micro-enterprises take support from government tax policies and other business functionalities. Some examples of the small-scale industries are paper, toothpicks, pens, bakeries, candles, native or local chocolates, water bottles, toys, beauty parlours, photography, leather belts, bags, and a lot more. One such promising small-scale industry which shall flourish in near future is jute and its innovative handicraft products.

## DIVERSIFIED JUTE PRODUCTS

### Bags

Shopping Bags are made from hessian or sacking cloths with handles, straps, chains in different shapes and dimensions. They are used specially for marketing. They are bleached and decorated with different artistic designs. Promotional bags are generally sample bags to promote items for sale. Polylined / Poly laminated bags are hessian or sacking bags with a coated polythene film.



### Jute Ornaments

Eco-friendly and unconventional ornaments made of jute makes a great fashion statement. Dangers, tops, rings, chokers, light necklaces, bangles and bracelets are available in colours ranging from the original fabric shade to dyed and treated chilli red, tanga orange, aquamarine blue, jet black and tree-bark brown to match every outfit.



One will love jute jewellery as it fits any budget and looks cool. Instead of spending money on expensive jewellery if one spend the same amount on jute ornaments, one can acquire a variety of them and look different and trendy every day. Even the big pieces are so lightweight that one can wear them for long hours. The durability and maintenance free property of jute makes it a favourite of many. It lasts long, the colour doesn't fade.

### Jute Lampshades

Nowadays, jute fabric is increasingly used to make lovely things (clothing, rugs, and upholstery) as well as practical ones. And it turns out to be suitable for lampshades too.



As well as being strong and durable, jute low thermal conductivity and anti-static properties – all very handy for creating gorgeous lampshades. More importantly, it's also colour and light-fast, which means that one can really play around with colour combinations – mixing and matching complementary or contrasting colours for the outside of the shade and the inner linings, helping to create a lovely glow and warmth.

### Jute Candle-holders and Plant-holders

Jute twines and strings are used in combination of macramé technique for creation of beautiful candle holders and plant holders. This technique is not very complicated and can be easily learnt by illiterate rural women. These beautiful functional items are not only in demand in Indian market but also is



welcomed overseas. Hence, a small scale enterprise related to this will make profit in leaps and bounds.

### **Jute Furniture**

Its sturdiness, not to mention its stylishness, makes jute ideal for furniture with a natural vibe. Intricately braiding it into poufs creates contemporary and reliable seating. Using creativity, a lot of beautiful designs can be created. Jute furniture is also in huge demand and setting up a small-scale business will prove to be a profitable venture.



### **Jute Footwears**

Jute Footwear offers cozy comfort to the feet. It is 100% natural that is biodegradable and eco-friendly. A wide range of jute footwear is available in attractive designs and color combinations that make it an ideal fashion accessory. Jute Sandals have original jute on upper side and a rubber base that prevents consistent wear and tear. Mostly, the sides have velvet fabric that is pasted to offer comfort while making the sandals more attractive.



The sole of the sandals are made from leather or some other material that provide strength to the structure. Some sandals have braided jute straps to get the trendy look. Herein, the straps are embellished with flowery patterns and glass beads. Sandals made from jute are available in tanned brown color to natural brown.

### **Conclusion**

Jute handicraft items are gaining huge recognition, with the passage of time. Therefore, investing in jute handicrafts through small-scale enterprise will help rural people rise in fame and monetary terms as well. Jute is definitely going to be known as the future fibre.

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# RURAL MARKETING TECHNIQUES FOR SUCCESS IN RURAL INDIA



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In this highly industrialized era, the Indian economy is dominated by the rural sector. As a result, most marketers in India aim to reach out to the rural market and consumers. Rural India is one of the most important and large markets in the world, and it is rapidly changing. The rural market in India is not a self-contained entity; it is heavily influenced by the country's social and behavioral elements. The rural market comprises all marketing efforts aimed at satisfying rural consumers, including demand, product planning, distribution, and the complete marketing process. Rural marketing is also considerably easier than it was for the pioneers, thanks to significant improvements in transportation and communication over the last decade. Marketers can contact the rural market and consumers in a variety of methods.

## What is Rural Marketing Techniques?

Rural marketing is the process of pricing, developing, advertising, and distributing rural-specific goods and services in order to suit the requirements and wants of rural customers while also achieving organizational goals.

## Types of Rural Marketing

These are types of rural marketing-

- Periodic Markets
- Mobile Traders
- Permanent Retail Shops

## Periodic Markets

One of the most essential aspects of rural marketing in India is the periodic market. Despite urbanization and the expansion of retail outlets, rural people's rural economic and social life Rely on periodic marketplaces. Fairs and weekly markets are two institutions that do periodic marketing work.

## Mobile Traders

Mobile traders are another significant agency that caters to the limited needs of rural consumers such as vegetables, fruits, clothing, utensils, cosmetics, spices, and hygiene. Mobile traders travel from one location to the next, from one home to the next, selling items that rural residents frequently require.

## Permanent Retail Shops

With the Amplify in the populace of villages, Enhancement in their income, demand for goods, and each day improvement of everlasting retail shops take place. Traditional fairs, weekly markets, ought to now not fulfill the situation, which led to the upward jab and improvement of everlasting stores.

## Marketing Techniques in Rural Areas

Complex planning and positive rural advertising techniques will assist your company to flourish in rural areas. From hoarding to mobile, many techniques are handy in the rural market. In the beneath section, we referred to top rural advertising

methods that assist entrepreneurs attain rural market in India.

## 1. Rural Market Segmentation

The first and most essential method of rural advertising is the appropriate segmentation of the rural market. A conceivable rural market is segmented into wonderful sub-markets of shoppers. Market segmenta-tion is an approach of acquiring a most market response from confined sources via recognizing variations in the response traits of extraordinary market segment. To get started, the corporation can do the following

- Focus on selected markets
- Concentrate on selected makes
- Focus on selected villages

## 2. Competitive Strategy

Marketers searching to enter the rural market can study their strategy on the conceptual framework of Michael Porter's Five Forces spell for strategy development. Competitive method for rural market-

- Supplier,
- costumer power,
- potential entrants,
- alternative products,
- competitor.

## 3. Product Strategy

Product strategy in rural advertising is an imperative step for accurate marketing. So, for this, take a look at out the factors stated below:

- understand product value
- packing
- branding
- logos & symbol

## 4. Pricing Strategy

Companies ought to rate their product competitively and grant most price for cash spent in their rural areas. Indian groups can do this by way of growing an aggressive price structure. Redesigning of products for the rural market ought to be accomplished to keep a low value of products. Pricing strategy for rural market:

- cost-based pricing,



- value-based pricing,
- demand-based pricing,
- Competition-based pricing.

### 5. Advertisement via Hoardings & Wall Paintings

Advertisement thru hoarding is pretty an ancient and tremendous way of branding. In this process, the marketer or adviser put hoardings on the aspect of the road. Apart from hoarding, wall portray is most positive in rural areas for branding. The rural region prefers to stay in simplicity and standard values.

- Hoarding,
- Wall painting

### 6. Mobile VAN

Videos and audios create a extra impactful impact for anything. Similarly, these mediums create exceptionally affected impressions of manufacturers in rural areas. So, for rural marketing, mobile VAN (cellular trucks) have to be a precise choice. Mobile VAN advertisement in rural market:

- posters
- megaphone
- pamphlets

### 7. Kiosk Setup

When branders prefer one-on-one interplay with rural people, then kiosk setup is one the pleasant methods or rural advertising strategies. For this, you have to set up the kiosk in the famous areas of the village like a publish office, the marketplace, close to a school, etc.

- Mic
- Tent
- Abandoned place

### 8. Shop Branding

Shop branding is every other quality approach to make your manufacturer famous amongst rural people. In this process, you have to promote your manufacturer in and round the village shop, which will create instant response between the rural consumers.

## OPPORTUNITIES IN RURAL MARKETING

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### The use of the internet and mobile phones has increased

Currently, over 227 million individuals in rural areas utilize the Internet, compared to approximately

205 million in urban areas. However, in the next years, this figure is expected to rise by a significant amount.

### Opportunities for Employment are Expanding

Due to government initiatives over the years, rural development has resulted in financial development in rural regions. It has also boosted work prospects for rural populations, resulting in a rise in income.

### Increase the rate of literacy

Rural folks are more aware of education in this new age. They recognize the value of education and strive to promote it. Older individuals are more aware of the importance of education as a result of them. The literacy rate in rural India was 71 percent in 2015.

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# URBAN HORTICULTURE: IN DEVELOPING SUSTAINABLE LANDSCAPE ARCHITECTURE



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Plants are central to a functioning global ecosystem because they oxygenate atmosphere and reduce the pollutants. The ecological restoration in both developed and developing countries is a primary strategy for mitigating the impact of climate change. Sustainable landscape architecture is a category of sustainable design concerned with the planting and design of the built and natural environments. Environmentally sustainable design is also known as environmentally conscious design and eco design. It's the philosophy of designing physical objects, the built environment and services to comply with the principles of ecological sustainability. The intention of sustainable design is to avoid negative environmental effect completely by skilful and sensitive design. Manifestation of sustainable design requires renewable resources and innovation to impact the

environment minimally and connect people with the natural environment

### **Importance**

Horticulture practices and products can provide beauty and tranquillity through the involvement of people with both public and private gardens. The presence of gardens and active involvement in gardening is also being shown to provide important therapy for handicapped and disabled people. Horticulture can provide many benefits that counter the negative aspects that are arising in modern, industrialised societies where nature is increasingly being disrupted. Horticulture can guide modern humankind to progress from the unnatural to the natural domain in earliest, convenient and most effective way and in a relatively short period of time.

### **Landscape architecture role**

Landscape architecture can be defined as the art of designing outdoor and indoor environments or varying size including aspects of environment, Art, Engineering architecture and sociology.

### **Importance of landscape architecture**

The following are some major reasons why we have to go for sustainable landscape architecture.

- ❖ Helps combat toxically and other environmental aspects.
- ❖ Offers customizable and sustainable development avenues.
- ❖ Storm water management practice.
- ❖ For innovative trouble shooting and natural environments.
- ❖ Optimizing weather control.
- ❖ Outdoor public recreation.
- ❖ Psycho-social benefits for humans.
- ❖ Therapeutic find products.

### **Examples of countries which are developed the sustainable architecture design**

Frederick low Olmsted in 19<sup>th</sup> century acted as pioneer American landscape architecture. He used landscape design to transform societal dynamics his works are still in projects like New York City's central park, Boston's emerald communal passageways through the city. In the era of climate change buildings with green credentials as environmental impact leads decisions around design, construction and operation.

### **Examples for sustainable architecture design building are**

Pixel building (Melbourne, Australia) which is opened a decade ago. It's the first carbon neutral office building, generating all its own power and water onsite. One central park (Sydney, Australia) it's a park at the ground floor of building which continuous up the structure, as vegetation of 250 species of Australian plants and flowers opened in 2014.

### **Vancouver convention centre west (Vancouver, Canada)**

It opened in 2009, it's the first building of having double LEED (Leadership in energy and Environmental design) platinum designation. Four hives of European honey bees have been installed to pollinate roots plants and grasses which in turn help reduce heat build-up in summer and retain it in winter and roofs slopping shape also assists with water drainage and distribution of seeds.

### **Bosco Verticale (Milan, Italy)**

In 2014 construction was completed, they have designed these with plenty of spaces to accommodate large, full-grown trees, and a variety of ground cover plants and shrubs. It's the one of the most intensive living green facades ever realized.





**Vancouver convention centre west  
(Vancouver, Canada)**



**Bosco Verticale (Milan, Italy)**



**Parka royal collection Pickering (Singapore)**



**Robin tower Singapore**

### **Parka royal collection Pickering (Singapore), 2013**

The design is inspired by terraformed rice paddies and numerous sky gardens have been inserted along the buildings façade. It has luxuriant greenery, including palm trees, to public areas and guest room balconies, these provide a natural cooling effect.

### **Robin tower Singapore, 2019**

It's a design loaded with podiums and tracks for trees and other plants, the design also maximizes the amount of available natural light coming in which artificial lighting costs. The public can visit an enclosed garden on the roof and an open-air garden on the top of the retail spaces in the buildings.

### **Conclusion**

It is concluded that in the developing and under developing countries we must give importance to this type of construction building designs which are eco-friendly and sustainable. This will help our mankind for developing maintain sustainability.

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# RECONNECTING FARMERS TO NATURE: NEED OF THE HOUR



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In a country like India who has 86 percent of the farmers as marginal farmers. The neoliberalization of the Indian economy led to a deep agrarian crisis that is making small scale farming an unviable vocation. Indian farmers increasingly find themselves in a vicious cycle of debt, because of the high production costs, high-interest rates for credit, the volatile market prices of crops, the rising costs of fossil fuel based inputs, and private seeds. More than a quarter of a million farmers have committed suicide in India in the last two decades. Various studies have linked farmer's suicides to debt. Debt is a problem for farmers of all sizes in India. Under such conditions, 'zero budget' farming promises to end a reliance on loans and drastically cut production costs, ending the debt cycle for desperate farmers.

## Zero Budget Natural Farming

Zero-Budget Natural Farming (ZBNF) is a holistic alternative to the present paradigm of high-cost chemical inputs-based agriculture. The brainchild of Subhash Palekar is a kind of practice that believes in the

natural growth of crops without adding any foreign element. It is very effective in addressing the uncertainties of climate change. Apart

from retaining soil fertility, ZBNF also helps in lowering the cost input, thus increasing the income of farmers. The requirement of monetary investment is almost nil and chemicals are replaced with biological products like cow dung, cow urine, jaggery, and pulses flour for crop protection. ZBNF principles are in harmony with the principles of Agroecology. Agroecology emphasizes minimizing external, artificial inputs by using resources available in the local ecosystem so as to make farming sustainable and environment-friendly.

## Key principles of zero budget natural farming

1. **No till farming**— plowing the soil alters the natural environment of the soil and promotes the growth of weeds.

*"Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor".*

Theodore Schultz

2. **No weeding by tillage or herbicides**— weeds are not eliminated but can be suppressed by spreading straw over freshly sown land and growing ground cover.

3. **No chemical fertilizers** – this is because adding chemical fertilizers help in the growth of the plant but not of the soil, which continues to deteriorate.

4. **No dependence on chemical pesticides**— nature's own balancing act prevents any one species from gaining the upper hand.

## Multipronged benefits of ZBNF

1. **Sustainability:** As there is no deterioration in the soil health, the soil would remain fertile for years, unlike conventional farming where chemicals are rendering the soil sick. The ZBNF is a contribution towards the UN Sustainable Development Goals, focusing on 'No Poverty', 'Clean Water and Sanitation', 'Responsible Consumption and Production', and 'Life on Land'. The main focus in this type of farming is also on the soil health and humus content of the soil.

2. **Climate resilience:** In natural farming, climate protection is ensured by not using any foreign material in the soil. Biofertilizers and biopesticides which are used in ZBNF also made from cow dung, cow urine, jaggery, chilly and all these components are environmentally safe.

3. **Breed conservation:** As Mr. Palekar explained that only cow dung of our local cow is effective not of Jersey or Holstein. We can mix half cow dung and half the dung of bullock or buffalo, but not of Jersey or Holstein at any cost. So, for ZBNF rearing of the indigenous breed of cow is necessary for urine and dung production, in this manner conservation of indigenous breed, would also be encouraged.

4. **Health:** Agriculture products which are produced by ZBNF are also free from any kind of chemical residues, pesticides, and insecticides. Thus nutrition quality of the products is also high, ensuring the good health of the consumers or ensures no bad effects on the health of the consumers.

## Lesson from Andhra Pradesh

The Government of Andhra Pradesh has launched a scale-out plan to transition 6 million farms/farmers



to 100% chemical-free agriculture by 2024. Andhra's ZBNF program aims to cover all 80 lakh hectares of cultivable land in the state by 2024. It was launched in June 2018, following a three-year pilot project spread across 700 villages. Andhra's program aims to improve soil health, environment and biodiversity while augmenting food security and farm livelihood, including landless agricultural workers. As both a social and environmental program, it aims to ensure that farming, particularly smallholder farming, is economically viable by enhancing farm biodiversity and ecosystem services. It reduces farmers' costs by eliminating external

inputs and using in-situ resources to rejuvenate soils, whilst simultaneously increasing incomes, and restoring ecosystem health through diverse, multi-layered cropping systems. In a scenario when the country is battling with the issues like high population growth, food security, agriculture distress, health-conscious population, sustainability, climate resilient agriculture, doubling farmers' income and farmers' suicides at that time zero budget natural farming can be a boon for the country. Multipronged benefits of

zero budget natural farming would be helpful for the farmers, governments and other stakeholders who have a concern for sustainable, climate resilient and inclusive agricultural growth. United Nations Environment Programme, hailed ZBNF "a better deal for farmers, consumers, and the planet".

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# TRAINING NEEDS OF VEGETABLE PROCESSORS FOR UPGRADING VALUE CHAIN DEVELOPMENT



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**A**mong vegetables, the potato, tomato and mushroom were selected for identifying the training needs as it has huge potential of processing into various value added products. The study was conducted to identify the training needs of tomato processors, potato processors and mushroom processors from Dhar (MP), Meerut (UP) and Sonapat (Haryana) respectively for value chain development. From each commodity, 15 processors were selected purposively. The tomato

processors were mainly making tomato sauce, the potato processors were engaged in making chips, *namkeen*, *papad*, *laccha* etc. whereas, mushroom processors were found canned mushroom making. For identifying the training needs the scaled developed by Shruti in 2019 was used. The scale was developed in four dimensions namely marketing, technical, information and social responsibility.

## 1. Marketing Training Needs

Within marketing dimension, four sub-dimensions i.e. Product, Price, Place and Promotion (4Ps) were identified. The Table 1 illustrates that the most preferred area of training need for tomato processors were

- Identifying the types of value added product from tomato (12.6)
- identifying the potential customers as well as point and volume of sale (10.93),

- deciding nutritional value of products and using natural ingredients (10.53) and
- pricing of products and fixing discounts on it.

However, for potato processors, online marketing (11.13) and selection of agricultural commodities (11.07) were observed to be preferred area. The reason for 'selection of agricultural commodities' as preferred area of training need due to irregular and high cost of suitable variety of potato in Meerut. In case of mushroom processors, the preferred area was noticed for types of value added product (13.3) that can be possible, as presently, the processors were restricted to canned mushroom only instead of various potential for value addition in mushroom. Within sub-dimension, among all the three processors the promotion was found to be most preferred area of training need due to trend of online marketing in present scenario and promotional strategies i.e. free sample, coupon, contests, incentives, loyalty programmes.

**Table 1. Preferred area of training need in market dimension among vegetable processors to upgrade value chain as per Friedman test**

S. No	Statements	Tomato X <sup>2</sup> 70.89 (14)p<0.05	Potato X <sup>2</sup> 85.72 (14)p<0.05	Mushroom X <sup>2</sup> 112.7 (14)p<0.05
<b>A</b>	<b>Marketing Dimension</b>			
<b>I.</b>	<b>Product</b>	<b>3.5</b>	<b>3.64</b>	<b>3.46</b>
1.	Selection of agricultural commodities	8.2	11.7	1.76
2.	Designing or planning of types of value added products that can be developed	12.6	7.4	13.3
3.	No need of training to determining features of value added product i.e. size, quality, appearance etc.*	6	7.03	8.53
4.	Technology used in processing and packaging value added products	4.13	8.5	7.1
5.	Determining branding of value added products	8.9	5.33	7.06
6.	Deciding nutritional value of products and using natural ingredients	10.53	5.46	8.46
<b>II.</b>	<b>Pricing</b>	<b>3.78</b>	<b>3.25</b>	<b>3.68</b>
7.	No need for training to estimate cost of value added products*	4.16	3.26	3.73
8.	Pricing of products and fixing discounts on it	10.33	7.067	7.4
9.	Identifying price differences among target customer groups	6.56	6.4	10.83



10.	Determining the competition for the products	6.7	9.33	11.96
<b>III.</b>	<b>Place</b>	<b>4.15</b>	<b>3.8</b>	<b>3.24</b>
11.	No need of training to identify enterprise opportunities and its premises*	8.7	5.3	4.4
12.	No need of training to identify distribution of product through direct selling or intermediaries involvement*	8.96	10.6	6.1
13.	No need of training to determine potential customers as well as point and volume of sale*	10.93	9	9.76
<b>IV.</b>	<b>Promotion</b>	<b>4.26</b>	<b>4.63</b>	<b>4.1</b>
14.	Strategies for promotion i.e. free sample, coupon, contests, incentives, loyalty programmes	7.3	9	9.76
15.	No need of training for online purchasing facility of value added products*	5.93	11.13	9.8

## 2. Technical Training Needs

Under technical dimension, the sub-dimensions were inputs, infrastructure, finance, legal and managerial. The Table 2 represents

that in case of tomato and mushroom processors, the preferred areas of training need were developing innovative value added product or services (12.43 and 12.76) followed by modern processing technology

(11.03). For potato processors, food quality and safety standards (11.8) followed by determining sources, price trends, demand and supply of potato (10.46) were preferred area.

**Table 2. Preferred area of training need in technical dimension among vegetable processors to upgrade value chain as per Friedman test**

B	Technical Dimension	Tomato X <sup>2</sup> 75.28 (13)p<0.05	Potato X <sup>2</sup> 55.65 (13)p<0.05	Mushroom X <sup>2</sup> 143.51 (13)p<0.05
<b>I</b>	<b>Inputs</b>	<b>3.8</b>	<b>4.11</b>	<b>3.73</b>
1	Determining sources, price trends, demand and supply of critical raw materials	4.9	10.46	1.86
2	No need of awareness about international/national standards, regulations and laws of agricultural technology*	6.83	6.23	9.3
3	No need of training to use appropriate and modern technology for processing*	11.03	8.2	11.16
4	No need of training for developing innovative value added products or services*	12.43	7.4	12.76
<b>II</b>	<b>Infrastructure</b>	<b>4.46</b>	<b>3.76</b>	<b>2.36</b>
5	No need of training to determine cost effectiveness of storage capacity*	5.73	8.86	4.23
6	No need of training for estimating cost effectiveness of cold chain facility*	4.6	5.03	4.5
<b>III</b>	<b>Finance</b>	<b>3.86</b>	<b>3.57</b>	<b>3.35</b>
7	Effective financial planning including balance sheet, profit and loss statements etc.	10.76	7.13	9.76
8	Forecasting the need for additional capital for agri-enterprise	5.36	5.2	9.06
9	No need of training to identify the credits availability, sources, types and rules as well as procedures to avail it*	7.06	5.5	3.33
<b>IV</b>	<b>Legal</b>	<b>3</b>	<b>4.26</b>	<b>3.02</b>
10	Registration of agri-enterprise	5.2	8.9	3.43
11	No need of training to obtained appropriate licenses*	7.06	6.56	6.8
12	Knowing different food quality and safety standards	9.06	11.8	8.43
<b>V</b>	<b>Managerial</b>	<b>3.2</b>	<b>3.8</b>	<b>4.26</b>
13	Need of training for enhancing decisions making skills	6.96	7.9	9.06
14	Need for exposure for networking skills	7.93	5.73	11.16



### 3. Information Training Need

Within information dimension, the Table 3 clearly indicates that tomato and mushroom processors

required information regarding enterprise expansion and diversification (5.46 & 5.73) whereas potato processors needed information

regarding marketing information (5.13).

**Table-3: Preferred area of training need in information dimension among vegetable processors to upgrade value chain as per Friedman test**

B	Information	Tomato X <sup>2</sup> 38.73 (5)p<0.05	Potato X <sup>2</sup> 39.45 (5)p<0.05	Mushroom X <sup>2</sup> 11.07 (5)p<0.05
1	Information and support for agri-start-up, its expansion and diversification	5.46	4.63	5.73
2	Marketing information about prices, flow of products, food processing units etc.	3.3	5.13	4.23
3	Need of information regarding new technology from governments etc.	4.5	2.06	3.86
4	No need of information regarding post-harvest management of agricultural produce*	2.16	3.7	2.46
5	No need of training for searching and utilising data from patent information, innovation information and other sources of knowledge*	2.76	2.83	3.2
6	Understanding of the different ethical issues that exists in relation to enterprise and its utilisation	2.8	2.63	1.5

### 4. Social responsibility Training need

In case of social responsibility, Table 4 illustrates that tomato processor preferred training need for

reducing deleterious effect of value added products on human health (4.36) whereas, potato processor preferred training regarding compliance with government rules,

procedures and legal requirements (4.33). The mushroom processor wanted training for effective utilization of fund and resources (4.1).

**Table 4 Preferred area of training need in social responsibility dimension among vegetable processors to upgrade value chain as per Friedman test**

D	Social Responsibility	Tomato X <sup>2</sup> 30.96 (4)p<0.05	Potato X <sup>2</sup> 18.22 (4)p<0.05	Mushroom X <sup>2</sup> 23.76 (4)p<0.05
1	No need of training to provide conducive working environment for work culture*	1.9	2.33	1.96
2	Effective utilization of funds and resources	2.9	3.16	4.1
3	No need of training for prevention of environmental pollution*	2.2	2.43	2.83
4	No need of training to reducing deleterious effects of industrial products on human health*	4.36	2.73	3.83
5	To comply with government rules, procedures and legal requirements	3.63	4.33	2.26

### Conclusion

The most common dimension for training needs among these three processors namely tomato, potato and mushroom was found marketing. All

the processors showed their interest for marketing dimension as training need because of their need to diversify their value added products, identifying the potential customers as well as point and volume of sale and

learn online marketing and other promotional strategies.

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# INDIAN AGRICULTURE in the age of Information and Communication Technology



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In India majority of the people are directly or indirectly associated with the agricultural sector. More than fifty percent of its rural household are still primarily dependent on agriculture and its allied sectors for their livelihood. Agriculture is considered as one of the effective factors in economic development of the country. Nature has gifted vast agro-climatic conditions to different regions of the country that enables it to produce varied type of crops. The role of the agriculture and its allied sectors in alleviating poverty and ensuring the sustainable development of the economy is well established. So in other words growth in agriculture is related to social, economic and educational development of the farmers.

Until recently, people associated with agriculture and allied sectors use traditional methods of cultivation

with the purpose only to feed their family.

However, with the increase in population of this vast country, the traditional

and unauthorized system of cultivation does not meet the demands of growing population, besides threatening social, economic and environmental sustainability. It is expected that India's population may reach to 1.7 billion by 2050, making it the most populated country in the world. To feed the ever increasing population, food production must increase by 70%. This percentage of increase in food production in a short span of time using old aged techniques is impossible unless innovative techniques and technologies are adopted at the farmer's field. As we are aware that innovative techniques and technologies are being developed/generated at different research stations, experimental institutes and farm science centers for the benefit of our farming community. This technology needs to be adopted by the farmers at their farms in order to increase both production as well as productivity of major crops grown in the country.

There is vast scope of using smart agricultural technologies and one such technology is the use of information and communication technologies (ICT's). ICT has largely revolutionized the agricultural sector in developed countries and significantly transformed the farming at different scale. The use of ICT's has

profoundly increased the efficiency, reduced input costs, enhanced social, economic and environmental sustainability and ensured food security of the growing population, besides the potential yields of major crops are secured by utilizing balanced agricultural inputs. Thanks to Smart Agricultural Technologies.

However, in Indian scenario having vast geographically area, the innovative techniques and technologies developed at different research institutes is impossible to disseminate to the farming community who are dispersed in difficult-to-reach places, besides having low ratio of public sector extension agents (An extension agent is one who is authorized to disseminate the information to the farmers and in India the extension agent to farmer ratio is 1:1162, against recommended ratio of 1:750). So there is huge scope of ICT in India to disseminate innovative agricultural technologies from lab-to-land. There are various ICT based applications through which important information can be disseminated and farming community can benefit by touching or clicking few buttons on their mobile phones and in no time agricultural experts can connect them and provide necessary information related to crop production. So need of the hour is to educate the Indian farmers about the latest technology involved in the cultivation of crops, and become self-resilient and ensuring food security to the growing population.

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# IMPORTANCE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE



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## Introduction

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. In this article, we will discuss how AI can change the agriculture landscape, the application of drone-based image processing techniques, precision farming landscape, the future of agriculture and the challenges ahead.

## Scope of AI in agriculture

Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular, is all set to become the most disruptive technology in agriculture services as it can understand, learn, and respond to different situations (based on learning) to increase efficiency.



Providing some of these solutions as a service like chatbot or other conversational platform to all the farmers will help them keep pace with technological advancements as well as apply the same in their daily farming to reap the benefits of this service.

Currently, Microsoft is working with 175 farmers in Andhra Pradesh, India to provide advisory services for sowing, land, fertilizer and so on. This initiative has already resulted in 30% higher yield per hectare on an average compared to last year. Given below are top three areas where the use of cognitive solutions can benefit agriculture.

## 1. Growth driven by IOT

Huge volumes of data get generated every day in both structured and unstructured format. These relate to data on historical weather pattern, soil reports, new research, rainfall, pest infestation, images from Drones and cameras and so on. Cognitive IOT solutions can sense all this data and provide strong insights to improve yield.

Proximity Sensing and Remote Sensing are two technologies which are primarily used for intelligent data fusion. One use case of this high-resolution data is Soil Testing. While remote sensing requires sensors to be built into airborne or satellite systems, proximity sensing requires sensors in contact with soil or at a very close range. This helps in soil characterization based on the soil below the surface in a particular place. Hardware solutions like Rowbot (pertaining to corns) are

already pairing data-collecting software with robotics to prepare the best fertilizer for growing f corns in addition to other activities to maximize output.

## 2. Image-based insight generation

Precision farming is one of the most discussed areas in farming today. Drone-based images can help in in-depth field analysis, crop monitoring, scanning of fields and so on. Computer vision technology, IOT and drone data can be combined to ensure rapid actions by farmers. Feeds from drone image data can generate alerts in real time to accelerate precision farming.

## 3. Identification of optimal mix for agronomic products

Based on multiple parameters like soil condition, weather forecast, type of seeds, infestation in a certain area and so on, cognitive solutions make recommendations to farmers on the best choice of crops and hybrid seeds. The recommendation can be further personalized based on the farm's requirement, local conditions, and data about successful farming in the past. External factors like marketplace trends, prices or consumer needs may also be factored into enable farmers take a well-informed decision.

## Importance of Drone

As per a recent PWC Study, the total addressable market for Drone-based solutions across the globe is \$127.3 billion and for agriculture it is at \$32.4 billion.

Drone-based solutions in agriculture have a lot of significance



in terms of managing adverse weather conditions, productivity gains, precision farming and yield management.

### **Yield Management using AI**

The emergence of new age technologies like Artificial Intelligence (AI), Cloud Machine Learning, Satellite Imagery and advanced analytics are creating an ecosystem for smart farming. Fusion of all this technology is enabling farmers achieve higher average yield

and better price control. Microsoft is currently working with farmers from Andhra Pradesh to provide advisory services using Cortana Intelligence Suite including Machine Learning and Power BI.

### **Challenges in AI Adoption in Agriculture**

Though Artificial Intelligence offers vast opportunities for application in agriculture, there still exists a lack of familiarity with high tech machine learning solutions in

farms across most parts of the world. Exposure of farming to external factors like weather conditions, soil conditions and presence of pests is quite a lot. So what might look like a good solution while planning during the start of harvesting, may not be an optimal one because of changes in external parameters.

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# SOIL TESTING: A VITAL TOOL IN AGRICULTURE



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**A**griculture is the mainstay of the economy of our country and only the sustainable agriculture is likely to provide long term food production, development and poverty alleviation. Modern civilization is facing a real threat from the rapid population outburst. Simultaneously the per capita land area or land: man ratio is decreasing dangerously which is one of the main reason for food insecurity in the near future. Since soil is the backbone of civilization and is the most precious and vital natural resource, but owing to the rapid industrialization, increasing population, and widespread use of chemical fertilizers and pesticides, the quality of soil can get deteriorated. And therefore the agricultural soil must be tested for its quality and fertility. 60% of crop yields depend on soil fertility? As a farmer, you can do this by performing soil tests on a regular basis. Want to know more about why testing soil is so important? Soil testing is a valuable tool for your farm as it determines the inputs required for efficient and economic production. Without soil testing, it is very difficult to ensure the right application of fertilizers for the crop and get the optimum yield.

## What is Soil Testing?

Soil testing is a rapid chemical analysis to access available nutrient status of the soil and includes interpretation, evaluation and

fertilizer recommendation based on the result of chemical analysis and other considerations. This is an important diagnostic tool for determining the nutrient for plants.

## Objectives of Soil Testing

- ✓ To evaluate the fertility and nutrient status of soil for providing an index of nutrient availability or supply in a given soil.
- ✓ Assessment of the type and degree of soil-related problems like salinity, Sodicity, acidity and suggesting appropriate reclamation/amelioration measures.
- ✓ Classification of soil into different fertility groups for preparing soil fertility maps of a given area.
- ✓ To avoid excess use of fertilizer and to ensure environmental safety.
- ✓ Time to time evaluation of the inherent soil fertility status is essential for arriving at the crop and site-specific balanced fertilization program to sustain productivity.
- ✓ Evaluation of the suitability of the soil for the crop.

## Sampling Tools

1. **Soil Tube Auger:** For soft and moist soils.
2. **Screw Auger:** For hard and dry soils
3. **Post-hole Auger:** For excessively wet or waterlogged soils.
4. Khurpi
5. Kassi / Phawda (Spade)
6. **Core Sampler :** For collection of undisturbed soil cores
7. Sampling Bags

## Procedure of Sampling

- ✓ Divide the field into different homogenous units based on the visual observation and farmer's experience.
- ✓ Remove the surface litter at the sampling spot.

- ✓ Drive the auger to a plough depth of 15 cm and draw the soil sample.
- ✓ Collect at least 10 - 15 samples from each sampling unit and place in a bucket or tray.
- ✓ If the auger is not available, make a 'V' shaped cut to a depth of 15 cm in the sampling spot using a spade and place in a clean container.
- ✓ Mix the samples thoroughly & remove materials like roots, stones, & gravels.
- ✓ Reduce the bulk to about 500 g by quartering process.
- ✓ Collect the sample in a clean cloth or polythene bag.
- ✓ Label the samples properly for identification. A label of thick paper with identification mark and other details should be put inside the sample bag.

## Processing of Soil Samples for Analysis

Processing of soil samples involves several procedures in sequence as follows:

**Drying:** The soil sample should be dried in shade at room temperature.

**Grinding:** Crush the soil clods lightly with the help of wooden pestle and mortar.

**Sieving:** Pass the entire quantity through a 2 mm stainless steel sieve. For specific type of analysis (organic carbon) grind the soil further and pass it through the 0.2 to 0.5 mm sieves.

## Precautions in Sampling and Processing

- ✓ The sample must be representative of the area it belongs to.
- ✓ Avoid all possible contaminants from chemicals, fertilizers or manure during sampling, packaging, transport and processing.
- ✓ Use stainless steel augers for sampling, instead of rusted khurpi or Kassi.



- ✓ Do not use bags previously used for storing fertilizers or any chemical.
- ✓ Store soil samples in clean cloth or polythene bags.
- ✓ Use glass or polythene jars for storage of soil samples for a longer duration.
- ✓ Recently manured or fertilized field should not be sampled.
- ✓ Proper labelling of the sample is very important, and to be done on the spot.

#### **Why should Farmers get their Soil Tested?**

- ✓ It informs the farmer of the current health of the farm's soil and how to improve it.
- ✓ Soil test leads to minimization of fertilizer expenditure.
- ✓ Soil testing results in limited over-fertilization.
- ✓ Farmers can easily avoid soil degradation.

- ✓ Farmers with fertile soils can contribute to feeding the world's growing population.

#### **Environmental benefits of soil testing**

Soil sampling can also help the environment. Regular usage can wear out the land on which you grow your crops. The biggest impact soil testing has on environmental benefits mean:

- More efficient use of plant nutrients means fewer losses from leaching or runoff into waterways.
- Poorly nourished crops leave less plant residue to hold soil in place. Plant residue helps build soil and saves it from wind and water erosion.
- Providing the right levels of nutrients helps increase yields and may help reduce the need for

intensively farming marginal land.

#### **Conclusion**

Thus, testing becomes a crucial aspect of agricultural success. It boosts yields, prevents erosion, and saves both farmers' and nature's resources. Soil tests become a win-win solution as soil health is not only a healthy environment but also healthy mankind, following the famous quote "we are what we eat", and perhaps, what we breathe. Soil testing is the first step in soil management. The activity gives farmers valuable information that helps them improve the soil's health; healthy soils eventually imply healthy crops.

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# SOIL HEALTH CARD: AN OVERVIEW



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The Ministry of Agriculture and Farmers' Welfare introduced the scheme on December 5, 2015. Soil Health Card (SHC) is a printed report which contains nutrient status of soil with respect to 12 nutrients: pH, Electrical Conductivity (EC), Organic Carbon (OC), Nitrogen (N), Phosphorus (P), Potassium (K), Sulphur (S), Zinc (Zn), Boron (B), Iron (Fe), Manganese (Mn) and Copper (Cu) of farm holdings. SHC is provided to all farmers in the country at an interval of 3 years to enable the farmers to apply recommended doses of nutrients based on soil test values to realize improved and sustainable soil health and fertility, low costs and higher profits. Farmers can track their soil samples and also obtain their Soil Health Card report. It is a field-specific detailed report of soil fertility status and other important soil parameters that affect crop productivity.

## OBJECTIVES

- To improve soil quality and profitability of farmers.
- Employment generation for rural youth.
- To update information on soil analysis.
- To provide soil testing facilities to farmers at their doorstep.

## METHODOLOGY

- The cropped area was divided into grids of 10 ha for rainfed and 2.5 ha for irrigated and taken only

SOIL HEALTH CARD		Name of Laboratory	SOIL TEST RESULTS			
Farmer's Details						
Name		S. No.	Parameter	Test Value	Unit	Rating
Address		1	pH			
Village		2	EC			
Sub-District		3	Organic Carbon (OC)			
District		4	Available Nitrogen (N)			
PIN		5	Available Phosphorus (P)			
Aadhaar Number		6	Available Potassium (K)			
Mobile Number		7	Available Sulphur (S)			
Soil Sample Details		8	Available Zinc (Zn)			
Soil Sample Number		9	Available Boron (B)			
Sample Collected on		10	Available Iron (Fe)			
Survey No.		11	Available Manganese (Mn)			
Khasra No. / Dag No.		12	Available Copper (Cu)			
Farm Size						
Geo Position (GPS)	Latitude:	Longitude:				
Irrigated / Rainfed						

Sl. No.	Parameter	Recommendations for Soil Applications
1	Sulphur (S)	
2	Zinc (Zn)	
3	Boron (B)	
4	Iron (Fe)	
5	Manganese (Mn)	
6	Copper (Cu)	
General Recommendations		
1	Organic Manure	
2	Biofertiliser	
3	Lime / Gypsum	

Sl. No.	Crop & Variety	Reference Yield	Fertilizer Combination-1 for NPK	Fertilizer Combination-2 for NPK
1	Faddy (Dhaan)			
2				
3				
4				
5				
6				

- one soil sample from each grid and test results will be distributed to all the farmers whose area was falling under the grid.
- Soil samples are processed through standard procedures and analyzed for various parameters namely pH, electrical conductivity (EC), Organic Carbon (OC), available N, P, K, S and micronutrients (Zn, Cu, Fe, Mn & B). The State Government will collect samples through the staff of their Department of Agriculture or through the staff of an outsourced agency.
- The State Government may also involve the students of local Agriculture/Science Colleges.
- Soil Samples are collected generally two times in a year, after harvesting of Rabi and Kharif Crop respectively or when there is no standing crop in the field.

## PROGRESS REPORT

- Under the Phase-I (2015-17) of the scheme, 10.74 crore cards were distributed.
- Phase-II (2017-19), 11.69 crore cards have been distributed.
- A pilot project, 'Development of Model Villages' is also being implemented by the Ministry of

Agriculture and Farmers' Welfare in the financial year 2019-20.

- It is to be noted that, this project is different from the Saansad Adarsh Gram Yojana (SAGY) which was launched in October 2014 with the goal of developing the socio-economic and physical infrastructure of villages.
- Development of Model Villages Under this project, a Model Village is selected for aggregation of soil samples and analysis of each agricultural holding.
- The programme promotes farm holding based soil sample collection and testing with farmers' participation.
- The Soil Health Card Scheme along with other projects (National Mission for Sustainable Agriculture) for soil health management has created jobs for the agrarian youth.
- Under these, village youth and farmers up to 40 years of age are eligible to set up Soil Health Laboratories and undertake testing. 75% of laboratory costs are proposed to be funded by the Central and State Governments. The same provision applies to Self Help Groups, Farmers'



Cooperative Societies, Farmers Groups and Agricultural Producing Organizations.

### **BENEFITS**

- SHC helps farmers to improve soil health and ultimately increase productivity.
- After getting SHC farmers have reduced N, P and K use, especially nitrogen use has and increased micronutrients use which helped them to increase the fertility.
- It has helped farmers to diversify towards less input-intensive crops from more input intensive crops like paddy and cotton.
- It has also helped farmers to find input substitutions. It has helped in the formulation of specific schemes like subsidized micronutrients from government.

### **DRAWBACKS**

- Many farmers are unable to understand the content, hence

unable to follow the recommended practices.

- Number of soil samples per unit area are not based on soil variability.
- Lack of Coordination among agricultural extension officers and farmers
- Microbial activity, moisture retention activity are essential but missing in SHC.
- The soil health card is more focused on chemical nutrient indicators; among physical and biological properties only soil color is included.
- Some important indicators (i) cropping history, (ii) water resources (soil moisture), (iii) slope of soil, (iv) depth of soil, (v) color of soil, (vi) soil texture (bulk density) and (vii) Microbiological activity etc are not included.
- Inadequate soil testing infrastructure.

### **FUTURE STRATEGIES**

- There is a need for demonstration of benefits of SHC on an experimental basis in each block by adopting a comprehensive approach (systematic and scientific analysis of soil and water) and adoption of recommended doses.
- A specialized body is needed both at central as well as at state level for the management of soils. They should be given responsibility of monitoring the quality of service by various agencies. This also provides continuity of the work by the department.
- SHC distribution and awareness campaigns needs to be arranged before sowing season, so that farmers will practice recommended crop choice and fertilizers.

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# Chlorophyll meter (SPAD): A Site-Specific Nitrogen Management tool for the Wheat (*Triticum aestivum* L.) crop



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The SPAD meter works by emitting two incidences of light, one at a wavelength of 660 nm (red) and one at 940 nm (infrared). Leaf chlorophyll absorbs red light but not infrared, the difference in absorption is measured by the meter and termed Optical Density Difference (ODD). Therefore, the unit of measurement is ODD, a ratio that is provided by the meter. The value does not give an actual chlorophyll or nitrate count rather than saying the meter value can be interpreted as, a ratio of reflection vs. absorption. Additionally, plants cease to create chlorophyll once a certain threshold has been reached. Thus, the meter cannot indicate an abundance of nitrate, only a possible deficiency. In terms of estimating nitrate content, the measured value is most useful when compared to a well fertilized control set.

Nitrogen (N) is the most important nutrient for wheat but it is the most limiting element in almost all soils. Optimal N supply matching with the actual crop demand is thus vital for improving crop growth and maximizing production. Among the various strategies available for N management, chlorophyll meter for real-time N management in wheat is a simple, easy and non-destructive option. SPAD (soil plant analysis development) meter is a crop-need-based N management in wheat, rice, and maize. It measures leaf colour intensity that is related to leaf N status. SPAD meter is an ideal tool to optimize N use in wheat at high yield levels, irrespective of the source of N

applied, viz. organic manure, biologically fixed N, or chemical fertilizers. Thus, it is an eco-friendly tool in the rice wheat and maize cropping system environment.

Purpose of using SPAD meter is to apply adequate amount of nitrogen and avoid application of fertilizer more than required. Use of SPAD helps to determine nitrogen demand of the crop and guide right time of fertilizer nitrogen application to prevent unwanted nitrogen losses and their deleterious impacts on the ecosystem, like insect-pest attack due to excessive growth of higher N application. It is diagnostic tool for monitoring the relative greenness of a wheat leaf as an indicator of the plant N status.

Advantages of using SPAD meter is faster than tissue testing for N. Samples can be taken often and can be repeated if results are doubtful. Chlorophyll can be measured at any time to help determine the crop N status. The chlorophyll meter allows “guideline” of N management to field conditions and reduces risk of under- or over fertilizing the wheat crop. However, this is a tool to counterpart, not replace, other aspects of sound management. If a producer is already aware of the amount of N needed for his soil type, under his management conditions, and in normal weather conditions, then the use of the chlorophyll meter will probably result in little or no change in the N recommended. The chlorophyll meter will be most helpful when a producer is unfamiliar with the situation or when conditions are unusual (manure use, excessive rains, high N carryover, etc.). The chlorophyll meter would also help people who are not highly trained to make N recommendations. It is important for More Crop yield, time saving, avoid disease, reduction of GHG emission, crop N status and potentially increase N use efficiency.

Site-specific nitrogen management (SSNM) enables wheat farmers to optimally supply their crops with essential nutrients. The SSNM approach aims to apply nutrients at optimal rates and times to achieve high yield and high efficiency of nutrient use by the Rice crop, leading to high cash value of the harvest per unit of fertilizer invested. With the SSNM approach, N-fertilizer recommendations for rice can be developed by: -

- Estimating the total N-fertilizer required for wheat crop in a winter season.
- Formulating a dynamic N management to distribute N-fertilizer to best measured the crop's need for N. How to use the SPAD meter take the first SPAD reading at 20 days after sowing (DAS). For line sowing and broadcasting of wheat crop.
- Randomly select 10 healthy plants in your field where plant distribution is uniform.
- Select the topmost, fully expanded, and healthy leaf of each of the 10 plants. Take SPAD meter readings by placing the middle part of the leaf in SPAD between two light emitting diode and press to closed and measured N status in leaf. The SPAD readings at same time of the day between 8:00 AM and 10:00 AM. from first up to the last reading.
- Take at least 10 leaves reading and average these reading if reading goes to below threshold value in wheat crop, apply 20-30 kg N/ha during optimum moisture.
- Repeat SPAD readings every ten days until the first flowering. Different sets of 10 leaves can be used for each weekly reading. Limitations of SPAD meter several factors influence SPAD readings: Varietal group, Plant or tiller density, Variability in solar radiation between seasons and Status of nutrients other than N in soil and plant.

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# NUTRITIONAL CARE IN CANCERS



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## Introduction

The word “Cancer” comes from the latin for Crab. It refers to any malignant growth or tumor caused by abnormal and uncontrolled cell division. When a cell is set loose from normal control, it becomes what is known as transformed. Basically, the cell no longer looks like its neighbors in terms of its shape, size and its internal components. This transformed property is conferred upon all of the daughter cells. That is, all subsequent cells that arise from that initially transformed uncontrolled manner. This is the transmissible nature of cancer- once one cell becomes cancerous; all cells that arise from this abnormal cell also take on this characteristic.

## Cancer is a tumor or new growth which has a high growth factor

The new growth may be benign or malignant. A malignant growth can kill a patient, if left untreated. A malignant growth can kill a patient, if left untreated. A malignant tumor can invade the surrounding tissue and release cells that can be carried to other parts of the body and set spreads to the surrounding tissues. A benign growth is non-malignant.

## Development of Cancer:

The cancer development is a process involving initiation, promotion and progression. The first step is initiation when the exposure to a

carcinogen allows the carcinogen to enter the cell. This carcinogen then alters the cellular DNA (deoxyribonucleic acid). The second step is promotion when there is enhancement of cancer development and the cell begins to multiply uncontrolled. The third step is progression when a tumor formation takes place. It may spread to other tissues or organs. Thus the cells released and carried to other parts of the body are called as metastasis.

## Etiological Risk factors in Cancer

In general, the basic cause of cancers is the loss of control over normal reproduction of cells. These are various factors which contribute to this loss of cell control. These include genetic factors, environmental factors, dietary factors, carcinogens, radiation, oncogenic viruses, and others including stress factors.

**1. Genetic factors:** Person with a family history of cancer have a greater risk of developing cancers than a person without such a genetic pre-disposing factor.

**2. Environmental factors:** Smoking, water pollution, air-pollution and sunlight exposure are some environmental factors which are known to cause cancer.

**3. Dietary factors:** Dietary constituents can also be carcinogenic but to what extent diet will contribute to the development of cancer is not known. Researches indicate that the incidence of cancers especially stomach cancers is high in parts of the world where people eat a lot of heavily smoked, pickled or salt cured foods that produce carcinogenic nitrosamines. Alcohol has also been associated with a high incidence of some cancers especially cancers of the throat and mouth. Beverages such as beer may contain nitrosamines and alcohol. Other beverages such as brandy and wine may contain the carcinogen urethane, which is produced during fermentation. Many epidemiological studies have shown that there is an association between the high intake

of calories by humans and increased risk for endometrial and gall bladder cancer. Some researchers have shown a possible association between the high intakes of total protein or animal protein and the risk of breast and colon cancers.

A high intake of fat in humans has been linked to increased risk for breast and colon cancers. Some studies also indicate that trans-fatty acids are more carcinogenic than cis-fatty acids.

## 4. Non-dietary factors

A large number of agents cause genetic damage and induce neoplastic transformation of cells. These include:

### i) Chemical Carcinogens

Chemicals have been shown to be carcinogenic. Some are naturally occurring components of plants and microbial organisms. Some are synthetic products created by industry. Some of the major chemical carcinogens are alkylating agents and aromatic amines. Aflatoxin B1, Beta nits, nitrosamines and amides, vinyl chloride, nickel, chromium, fungicide and insecticide are also some of the chemical carcinogens. Tobacco, smoking and drug abuse are also cancer causing.

### ii) Radiant energy

Radiant energy can be in the form of the ultraviolet rays of sunlight or as ionizing electromagnetic and particulate radiation. These can transform all cell type in-vitro and induce neoplasm in vivo in human as well as experimental animals. Various epidemiological studies have shown that ultraviolet rays from sunlight induce an increased incidence of squamous cell carcinoma (skin) and melanocarcinoma of the skin.

### iii) Ionizing radiations

Electromagnetic (X-rays, gamma rays) and particulate ( $\alpha$ -particles,  $\beta$ -particles, protons, neutrons) radiations are all responsible for causing cancer. Even therapeutic radiation has been documented to be carcinogenic.



## Oncogenic viruses:

The viruses which interfere with the function of the regulatory genes are oncogenic viruses. Several studies indicate that these viruses are the second most important risk factor. A large number of RNA and DNA viruses have been proved to be oncogenic in animals.

## 5. Stress Factors:

Emotions play an important role in cancer causation stress has a profound impact on how our body's systems function. Apparent link between psychological stress and cancer could arise in several ways. For example, people under stress may develop certain behaviours, such as smoking, overeating, or drinking alcohol, which increase a person's risk for cancer.

## Metabolic Alterations during Cancer:

Patients with advanced cancer experience profound anorexia, early satiety, changes in structure/ function of organs/ gland/ body parts, many nutritional deficiencies and weight loss. Although the cause for these symptoms not known clearly but they are associated with metabolic status of the patient. These are alteration in the energy expenditure, carbohydrate, protein and fat metabolism, enzyme activities and endocrine functions, generally metabolic rate is increased. But there are variations among patients with gastrointestinal cancers. Some patients may be hyper metabolic, whereas patients with colon and rectal cancer do not show any difference. Therefore, it is evident that there can be variations among patients.

Generally, Cancer patients have been shown to have glucose intolerance. This is due to an increased insulin resistance and also reduced insulin secretion. Also, there is increased rate of production of endogenous glucose, in cancer patients. This increased production combined with other carbohydrate changes is associated with weight loss. An increased rate of Cori cycling has been reported to occur in cancer

patients. In this cori cycle, glucose released by peripheral tissues is metabolized to lactate, which is then resynthesized to glucose in liver. This process is energy consuming. Therefore, if the tumour cells release more lactate, more energy will be wasted on the resynthesis of glucose. Therefore, we can know that cori cycling could be one of the significant factors in the development of weight loss in cancer patients. And weight loss is of important and significant concern in cancer patients.. Various researches have reported that the major portion of weight loss in cancer patients is mainly due to body fat depletion. These include increased breakdown of fat (lipolysis) caused by decreased intake of food and release of lipolytic factors produced by the tumour itself. Loss of body fat occurs when both lipolysis and fatty acid oxidation are increased. The rate of fat oxidation is found to be greater than the rate of carbohydrate oxidation in cancer patients, who had lost weight significantly.

With regard to protein metabolism, the following changes are observed:

- ✚ The rate of whole body turnover increases.
- ✚ Breakdown rate muscle protein increase as the disease stage advances and it leads to weight loss.
- ✚ Negative nitrogen balance occurs inspite of sufficient intake.
- ✚ Skeletal muscle mass is reduced.
- ✚ Albumin is the main secretory protein of the liver. Depletion of albumin is common in cancer patients and it results in hypoalbuminemia.

Several clinical complications and severe metabolic changes can cause progressive weight loss, Protein energy malnutrition, anaemia and other abnormalities in carbohydrate, fat and protein metabolism. This syndrome is known as cancer cachexia. Apart from these changes fluid and electrolyte imbalance are seen in advanced cancer patients. Severe vomiting; diarrhoea and also observed. Many cancer patients have

diminished taste and appetite. This loss of taste and appetite in cancer patient are contributory factors for weight loss in them. Hyper calcemia (excessive calcium in blood) also a common complication in cancer. The symptoms range from mild to severe. They may include increased thirst and urination, stomach pain, nausea, muscle weaken, confusion, fatigue, anorexia, lethargy, confusion and stupor progressing to coma.

## Clinical Manifestations and Nutritional Problems Associated with Cancer:

Major clinical signs and symptoms associated with nutritional status of cancer patients include:

- ✚ Anorexia with progressive weight loss and undernutrition.
- ✚ Taste changes.
- ✚ Alterations in carbohydrate, protein and fat metabolism.
- ✚ Increased energy expenditure despite weight loss.
- ✚ Impaired food intake.
- ✚ Metabolic abnormalities induced by tumour or chronic blood loss.
- ✚ Electrolyte and fluid problems with persistent vomiting.

## Nutritional Requirement of Cancer Patients

### General guidelines:

In view of the pathophysiology, signs and symptoms as well as various forms of cancer on the health and nutritional status of the patient, the dietary management should aim at meeting the following objectives:

- To prevent further tissue catabolism.
- To meet the increased metabolic demands of the body.
- To provide relief from the symptoms.
- To prevent progression and promote recovery from Cancer Cachexia.

### 1. Energy

Cancer imposes increased energy demands because of the hyper metabolic state of the disease process



and increased energy requirement to spare protein for tissue healing and promote weight gain. Since many inhibitory factors are associated with food intake (cancer cachexia), it may not be possible to promote an intake beyond 2000 kcal/ day. However, by the help of appetite stimulants and/ or nutrition support systems (enteral tube feeding) malnourished patients can be motivated to consume around 30-35 kcal/ kg. body weight/ day (3000-4000 kcal/ day). A high energy diet is helpful in inhibiting the side effects of chemotherapy and cancer cachexia.

## 2. Protein

Metabolic stress of cancer as well as chemotherapy result in increased tissue catabolism. Anaemia and hypoalbuminemia are also very common. Tissue protein synthesis-which is a necessary component of healing and rehabilitation requires nitrogen and essential amino acids. Efficient protein utilization which depends upon protein: energy ratio help to promote tissue anabolism, prevent catabolism and help to build up body reserves. An adult patient with average nutritional status will require 80-100 g protein per day to meet maintenance needs and ensure anabolism. However, a malnourished patient must consume 100-150 g protein per day to replenish reserves and restore a positive nitrogen balance.

## 3. Fat

During cancer there is depletion of body fat because there is enhanced

mobilization of free fatty acids from adipose tissues. Around 15-20% of modified energy requirements should be provided from fat as they help in making the meals calorie dense and improve palatability. Emphasis should be given on the incorporation of emulsified fats and vegetable oils. Visible sources of animal fat like pure ghee and flesh food like red meat should be restricted in diet. A combination of vegetable oils (olive, coconut, safflower, sunflower etc.) and cream, butter etc. can help in improving taste and providing variety in terms of flavour in different meals.

## 4. Carbohydrate

Adequate amount of carbohydrate (60% of total energy) should be provided. If a very high-calorie diet is being given to the patients, then easy to digest carbohydrates (mono/ disaccharides and starches) should be incorporated so as to make meals small in volume and energy dense. Fibre intake should be curtailed if the patient is suffering from cancer of GIT or digestive disturbance. However, if the patient is experiencing hyperglycaemia, then foods which are rich in soluble fiber (pulses and legumes) would be helpful.

## 5. Vitamins and minerals

Particularly  $\beta$ -complex group of vitamins are essential to promote adequate metabolism of energy and protein. Fat soluble vitamins A and E and ascorbic acid should be provided liberally because they help in reducing the morbidity and mortality

due to cancer. Among the minerals, selenium and zinc are particularly important and hence their intake should be slightly increased by giving supplements.

## 6. Phytochemicals

Various phytochemicals like carotenoids, flavonoids, phenols, lycopene, plant sterols etc. play a very important role in disease prevention. Incorporation of good amount of fresh vegetables, fruits preferably with their edible peels, soybean and certain herbs and condiments such as turmeric are helpful in promoting the dietary intake of phytochemicals. The role of catechin gallate in green tea, curcumin in turmeric, genistein in soybean and folic acid in reducing the morbidity associated with cancer has been reported by various researchers.

## 7. Fluids

Adequate intake of fluid is essential to replace the losses due to gastrointestinal disturbance and certain infections and it will also help the kidney to dispose-off the metabolic breakdown products from toxic drugs used in the treatment. Adequate intake of fluids or beverages helps in providing relief from xerostomia (marked reduction in secretion of salivary glands) and other swallowing problems, diet should be planned in such a way that they include dishes rich in water along with a beverage. Generally dry meals are not preferred by most patients.

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# SIGNIFICANCE OF DIETARY FIBER IN HUMAN HEALTH



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improve the intestinal flora and provide energy and nutrition for probiotics proliferation. Recent studies have shown that dietary fiber helps to reduce postprandial blood glucose, insulin, and triglyceride concentrations and can lower blood cholesterol levels.

## Best Dietary Sources of Fibre

Foods high in soluble fibre:

- Oats, barley, oat bran, psyllium husk.
- Legumes – peas, beans, lentils.
- Fruits such as apple, orange and pear.
- Carrots.

## Foods high in insoluble fibre:

- Brown rice, whole wheat, wheat bran.
- Seeds and nuts.
- Many kinds of vegetables including green leafy vegetables, cabbage and tomato.

## Types of Dietary Fibre

Dietary fibre is often categorized according to its solubility into soluble or insoluble. Both types of fibre are found in different proportions in fibre-containing foods. Good sources of soluble fibre are oats, barley, fruit, vegetable and pulses (beans, lentils, chickpeas). Wholegrain cereals and wholemeal bread are rich sources of insoluble fibre.

## Health Benefits of Fiber

Adopting an adequate fibre diet can help to:

### Bowel Function

Dietary fibre, particularly insoluble fibre, helps prevent constipation by increasing stool weight and

decreasing gut transit time. This effect is enhanced if fibre intake is paralleled by an increase in water intake.

The short chain fatty acids, produced when fibre is fermented by gut bacteria, are an important source of energy for colon cells and might inhibit growth and proliferation of gut tumour cells.

By improving bowel function, dietary fibre can reduce the risk of diseases and disorders such as diverticular disease or haemorrhoids, and may also have a protective effect on colon cancer.

## Blood Glucose Levels

Soluble fibre, may slow digestion and absorption of carbohydrates and hence lower the rise in blood glucose that follows a meal (postprandial) and insulin response. This can help people with diabetes improve control their blood glucose levels.

## Blood Cholesterol

Results of epidemiological studies identify another role for dietary fibre in the prevention of coronary heart disease (CHD) that of improving blood lipid profiles. Clinical trials confirm the results of these epidemiological studies. Isolated viscous fibres such as pectin, rice bran or oat bran lower both total serum cholesterol and low density lipoprotein (LDL or bad) cholesterol levels. At the same time, research continues to show that diets high in a mix of dietary fibre also protect against CHD.

With the improvement of the standard of living, people's diet has become increasingly sophisticated. Many lifestyle diseases are caused by an imbalanced diet, such as diabetes, cardio-cerebrovascular disease, obesity, intestinal cancer, constipation, and other disorders that have serious adverse effects on the health of human beings. Therefore, functional foods that can adjust the body function and prevent lifestyle diseases of civilization have attracted more attention in recent years such as "Dietary fiber" which has outstanding health promotion functions.

Dietary fiber plays a very important role in regulation of human bodies. This material does not decompose in the human gut and affects the moisture absorption in the digestive system. It can increase the volume of food inside the intestines and stomach, increase satiety, and facilitate weight loss. Dietary fiber can promote gastrointestinal peristalsis to alleviate constipation and absorb the harmful materials in the gut, promoting their removal. Additionally, dietary fiber can



## Type 2 Diabetes

A high fiber diet cuts the risk of diabetes in half by reducing high spikes in blood sugar. The glycemic index of fiber-rich foods is low, because they cause only a small rise in the post-prandial (after feeding) blood sugar level, and thus a reduction in the need for insulin production. This spares the pancreatic cell reserve.

Fiber also increases the insulin sensitivity of the peripheral glucose-utilizing tissues, such as skeletal muscle, liver, and fatty tissue. Insulin promotes early uptake of glucose by the cells of these tissues and therefore leads to the normalization of the blood sugar soon after eating a meal.

## Metabolic Syndrome

High fiber diets could play a crucial role in lowering the risk of metabolic syndrome, which includes hyperinsulinemia, hyperglycemia, low HDL levels, obesity or overweight, and hypertension. Metabolic syndrome is a known high-risk factor for heart disease and diabetes.

## Obesity

An excessive BMI is associated with increased risk of type 2 diabetes, heart disease, cancers and osteoarthritis.

Its treatment is closely related to limiting energy intake. Dietary fiber plays a huge role in this aspect, because it produces a feeling of satiety and thus keeps the person feeling full for a longer time, thereby reducing overall calorie intake.

## Nutritional Benefits

Dietary fiber, in its natural state, is associated with many phytochemicals, such as plant polyphenols, isoflavones and flavonoids, lignans and carotenoids, as well as with vitamins and minerals, as for instance in the aleurone layer of wheat grains. This may explain why fruit, vegetables, whole grains and nuts have a beneficial effect on so many health conditions.

## How much fibre do we need?

### Recommended daily fibre intake for adults

- Men = 30g of fibre each day
- Women = 25g of fibre each day.

### Recommended daily fibre Intake for Children

- Children (4 to 8 years) = 18g
- Girls (9 to 13 years) = 20g
- Girls (14 to 18 years) = 22g
- Boys (9 to 13 years) = 24g
- Boys (14 to 18 years) = 28g.

## Some tips for increasing fiber intake:

- Eat whole fruits instead of drinking fruit juices.
- Replace white rice, bread, and pasta with brown rice and whole grain products.
- For breakfast, choose cereals that have a whole grain as their first ingredient.
- Snack on raw vegetables instead of chips, crackers, or chocolate bars.
- Substitute beans or legumes for meat two to three times per week in chili and soups.
- Switch to whole meal or multigrain breads and brown rice.
- Add an extra vegetable to every evening meal.
- Snack on fruit, dried fruit, nuts or whole meal crackers.

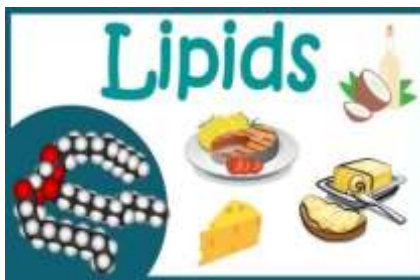
A daily intake of more than 30g can be easily achieved if you eat:

- Wholegrain cereal products.
- More fruit, vegetables and legumes.
- Nuts or seeds instead of low-fibre cakes and biscuits.

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# ENORMOUS ROLE OF LIPID IN MAINTAINING GOOD HEALTH



cannot make them, it needs to be supplied from food.

**(a) Omega 3 fatty acids** – these reduce inflammation and formation of blood clots thus protecting heart.

**Ex**– salmon, herring, sardines, walnuts, flaxseeds, chia seeds, canola oil.

**(b) Omega 6 fatty acids** – it plays an important role in controlling blood pressure and allergies. However, consuming higher amounts of Omega-6 fatty acids in comparison to Omega-3 fatty acids can be harmful for the body.

**Ex**; tofu, roasted soybeans, walnuts, vegetable oil (corn oil, sesame oil, sunflower oil)

## Excess of lipid; Dyslipidemia

Dyslipidemia refers to unhealthy levels of one or more kinds of lipid (fat) in your blood.

If you have dyslipidemia, it usually means your LDL levels or your triglycerides are too high. It can also mean your HDL levels are too low.

LDL cholesterol is considered the “bad” type of cholesterol. That’s because it can build up and form clumps or plaques in the walls of your arteries. Too much plaque in the arteries of your heart can cause a heart attack.

HDL is the “good” cholesterol because it helps remove LDL from your blood.

## Conclusion

It is very much important to eat fat in a right amount because it is an essential part of a healthy, balanced diet. Fat is a source of essential fatty acids, which the body cannot make itself. Fat helps the body absorb vitamin A, vitamin D and vitamin E, as they are fat soluble vitamins.

We must include monounsaturated and polyunsaturated fatty acids in our diet as they are good fats and thus good for our heart, cholesterol, and overall health while we must avoid eating trans fats as they clog arteries and thus increases the risk of cardiovascular disease.

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hunger and gives a feeling of satiety.

- **Palatability**– fats improves texture as well as flavor.

## Less healthy fats-

Saturated and trans fat are called as bad fats as they are potentially harmful for health. Most of these types of fats are solid at room temperature.

**Ex**; ghee, butter, palm oil etc.

**Saturated fat** – these are mostly found in animal fats, mostly in high fat meats and dairy products. Ex; beef, pork, butter, cocoa butter, whole milk.

**Trans fatty acids**– these are not present naturally in foods except in meat and dairy products. When cooking in the same oil again and again, leads to the development of trans fatty acids in the oil. This increase the chances of coronary heart diseases, diabetes and stroke as it raises LDL (Low density lipoprotein) i.e. bad cholesterol.

- The WHO has called for the elimination of industrially produced trans fatty acids from global food chain supply by 2023.
- From September 2007, it is mandatory that trans fat content to be listed on food labels that are manufactured in India.
- FSSAI suggested trans fat free logo by 2022.

**Good fats-** Monounsaturated and polyunsaturated fats are considered as heart healthy fats.

**Monounsaturated fat** – eating foods that contain monounsaturated fat can improve blood cholesterol level, and decreases risk of heart diseases.

**Ex**; olive oil, peanut oil, nuts, avocado (butter fruit)

**Polyunsaturated fat** – these are essential fats because our body

Lipids are commonly known as fats and oils and are integral part of our food. They occur in both plants and animals and are a concentrated source of energy. The word lipid is used when discussing metabolism of fats in the body while the term “fats” is used as the fatty component of foods and diets.

## Role of fat in body

- **Energy reserve** – It is the main form in which energy is stored in the body.
- **Insulator** – As fats get deposited under the skin that helps in trapping the heat and thus maintains body temperature.
- **Protection** – Fats get surrounded in certain vital organs, such as lungs and kidney and thus helps in holding them in position and protects from physical shock.

## Role of fat in diet

- **Source of energy** – on complete breakdown, 1 gram of fat gives 9kcal of energy.
- **Satiety value** – fats take long duration to get digested and remain in stomach for 3.5 hours after a meal. This helps to control



# FINGER MILLET: FOOD SECURITY, NUTRITION, VALUE ADDED PRODUCTS, AND ITS MAJOR DISEASES



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Millets are under-utilized small cereal crops that are consumed as staple food in developing countries of Asia and Africa. Among the variety of millets available worldwide, finger millet (*Eleusine corksana* L.) ragi or mandua is cultivated in small coarse grains. It is one of the most important millets widely grown in various regions of India and Africa. Cereals should be commercially produced to reduce hunger and poverty and maximize food and nutritional security. This crop is full of nutrients for health benefits. Millet grains contain a higher amount of protein, oil and minerals than rice, wheat, maize or jowar. Finger millet is unique among cereals such as barley, rye and oats with high nutrient content and has excellent qualities as a subsistence food crop. It is rich in dietary fiber (18%), calcium (0.34%), dietary fiber (18%), protein (6%–13%) minerals (2.5%–3.5%), and phenolics (0.3%–3%). In addition, it is also a rich source of thiamine, riboflavin, iron, methionine, isoleucine, leucine, phenylalanine and other essential amino acids. The abundance of these phytochemicals enhances the nutraceutical potential of finger

millet, making it a powerhouse of beneficial nutrients. Millet seed coat has a higher polyphenolic content than its whole flour extract, and these seed coat based polyphenols show higher antifungal and antibacterial activity than flour extract. In recent years, millet has attracted attention for improving food quality and exploring human health.

Finger millet is used in the preparation of various food items both in natural and malted form. The grains of this millet are converted into flour for the preparation of products such as porridge, puddings, pancakes, biscuits, bread, bread, noodles and other snacks. Apart from this, it is also used as a nutritious food for babies when malted and considered as a healthy food for diabetic patients.

## MAJOR DISEASES

### 1. BLAST – *Pyricularia grisea* Symptoms

Survives in crop residues and other grains. The initial inoculum comes from weeds or collateral hosts. It is spread by air borne conidia. Symptoms of blast can be seen on shoots, leaves, stem and finger depending on the stage of crop. Symptoms include elliptical or diamond-shaped lesions on leaves with gray centers, water-drenching and green halos around the lesions. The fungus, when infecting the stem, causes the nodal area to turn black. When the neck area is affected the tissues weaken and the head collapses.

### Mode of spread

Primary infection is through seed-borne inoculum and secondary transmission is through airborne conidia.

### Survival

Pathogen survives in infected plant debris and collateral hosts

## Management

1. Seed treatment with captan or thiram 4 g/kg of seed.
2. Spray with Iprobenphos or edifenphos @ 500 ml/ha or carbendazim @ 250 g/ha.



Leaf Blast



Neck Blast



### 2. *Cercospora* leaf spot- *C. eleusinis* Symptoms

Symptoms are usually observed on older leaves and then spread to younger leaves. Initial symptoms appear as reddish-brown spots with a yellowish halo. Later, many such spots fuse together to form large lesions that show a burnt appearance. During rains, the fungus sporulates and develops a grayish-white color in the center of the spot and then it looks like a brown spot.

### Mode of spread

Survive on crop residues, stray crops, collateral hosts and seeds. Spread by wind-borne spores: Gray leaf spots on tides appear as narrow oblong lesions delimited by veins. Long-term spot enlargement to



develop irregular spots. The lesions become brown with age.

#### Survival

The pathogen survives on crop residues, stray crops, collateral hosts and seeds.

#### Management

1. Seed treatment with captan or thiram 4 g/kg of seed
2. Spray with Iprobenphos or edifenphos @ 500 ml/ha or carbendazim @ 250 g/ha



**Cercospora Leaf Spot**

### 3. Seedling blight or leaf blight – *Helmithosporium nodulosum*

#### Symptoms

The pathogen affects both seedling and adult plants. Within a minute, young leaves are oval, light brown lesions and dark brown. Many such lesions combine to form large patches of infection on the leaf blade. Affected blades wither prematurely and shoots may die. Affected young leaves show microscopic, light brown oval spots. Mature plants develop oblong and dark brown spots. The spots on the leaf cover and buds are irregular. Infected spikes turn brown and are often overgrown with fungal sooty growths

#### Mode of spread and Survival

The pathogen is transmitted through infected seeds and airborne conidia and survives in infected seeds and the collateral host.

#### Management

- Removal of collateral host
- Seed treatment with captan or thiram at 4 g/kg of seed

- Spray with mancozeb @ 1.25 kg/ha

### 4. Wilt or foot rot– *Sclerotium rolfsii*

#### Symptoms

The fungus invades the basal stem part and leaf sheath. The infected area becomes soft and dark brown in colour. Later, small circular, dark-colored sclerotia form in the affected areas.

#### Mode of spread

The pathogen spreads through irrigation water and farm implements

#### Survival

The pathogen survives in the soil as soil borne *sclerotia*.

#### Management

- Crop rotation with non-host plant
- Spot drenching with copper oxy chloride @ 0.25 %

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# CORRELATION OF FOLIC ACID ON WOMEN'S HEALTH



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**W**e all know that Folic acid is a form of folate (B vitamin) that everyone needs. If you can get pregnant or are pregnant, folic acid is especially important. Folic acid protects unborn babies against serious birth defects. You can get folic acid from vitamins and fortified foods, such as breads, pastas and cereals. Folate is found naturally in foods such as leafy green vegetables, oranges, and beans.

Folic acid man made in the form of foliate (B vitamin) Folate is found naturally in certain fruits, vegetables, and nuts. Folic acid is found in vitamins and fortified foods. Folic acid and folate help the body make healthy new red blood cells. Red blood cells carry oxygen to all the parts of your body. If your body does not make enough red blood cells, you can develop anaemia. Anaemia happens when your blood cannot carry enough oxygen to your body, which makes you pale, tired, or weak. Also, if you do not get enough folic acid, you could develop a type of anaemia called folate-deficiency anaemia.

## **BENEFITS OF FOLIC ACID** **[VITAMIN B<sub>9</sub>]**

**Preventing birth defects:** Women who are trying to become pregnant or are currently pregnant are highly

encouraged to take in a minimum of .4 mg of folic acid on a daily basis. A folate deficiency has been shown to lead to birth defects, specifically neural tube de facts like anencephaly and spina bifida.

**Anemia:** Because one of the biggest functions of folic acid is to aid the body in producing and maintaining new cells, the formation of red blood cells is dependent on the proper levels of this vitamin.

**Thyroid health:** Studies have shown that low levels of folate can lead to hypothyroidism. It has also been shown that patients who are taking thyroid hormone replacement do not fully recover from hypothyroid



symptoms if they are deficient in folic acid.

**Heart disease and stroke:** Just as homocysteine plays a role in hypothyroidism, high levels of this amino acid are also linked to stroke and heart disease. Studies have shown that folic acid supplements can also significantly reduce the risk of high blood pressure.

**Kidney disease:** The majority of people who have serious kidney disease also have high homocysteine levels. Taking the right amount of folic acid can help prevent kidney issues and improve the outlook of those who are currently suffering from kidney dis ease.

**Vision and hearing:** There is some research that shows that supplementing with folic acid and other B vitamins such as B6 and B12 may reduce the risk of this vision loss. Older people who take folic acid supplements on a daily basis have a slower rate of hearing loss than those who don't.

**Depression:** Although more studies need to be done, there is limited research that implies that folic acid may help to improve symptoms in individuals who have been medically diagnosed with depression. These studies tested folic acid when taken in conjunction with antidepressants.

**Gum issues:** There is limited research that shows that folic acid may be beneficial for a number of gum problems. One study tested the effect of folic acid on gum problems that were caused by taking the prescription drug Phenytoin.

**Cancer:** The theory is that higher levels of the vitamin may help cells resist DNA changes that are linked with the development of different cancers. With breast cancer, some studies have shown that consuming folate, high amounts of vitamins B6 and B12, and high levels of methionine may lower the risk of getting it.

**Alzheimer's disease:** There is some evidence that older individuals who take in higher levels of folic acid have a lower risk of developing Alzheimer's. It has also been shown to decrease age-related decline in thinking skills and memory.

## **Recommended intake of folic acid**

The Office on Women's Health Trusted Source recommend that women who are or might become pregnant take 400–800 mcg of folic acid per day, and that people with spina bifida or a family history of neural tube irregularities take 4,000 mcg per day. Those who are breastfeeding should aim to take around 500 mcg per day.



The body absorbs folic acid from supplements and fortified foods better than the folate from naturally occurring foods.

The Office of Dietary Supplements Trusted Source recommend that people get the following Dietary folate equivalents (DFEs) from food or vitamin sources:

Age	Recommended amount
0–6 months	65 mcg DFE
7–12 months	80 mcg DFE
1–3 years	150 mcg DFE
4–8 years	200 mcg DFE
9–13 years	300 mcg DFE
14–18 years	400 mcg DFE
19+ years	400 mcg DFE

It is important to note that folic acid can interact with certain medications and may not be safe for everyone to take.

### Folate deficiency

Folate deficiency occurs when there is not enough folate present in the body. This can lead to a type of anemia called megaloblastic anemia. During pregnancy, folate deficiency increases the risk of congenital irregularities.

### Some symptoms of folate deficiency include:

- + Weakness,
- + fatigue,
- + trouble concentrating,
- + headache,
- + irritability,

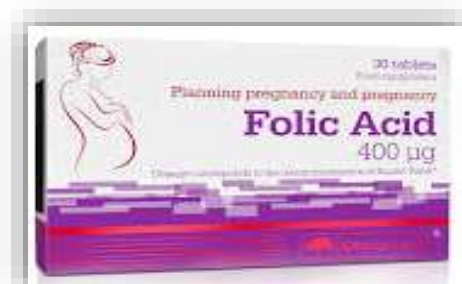
- + heart palpitations,
- + sores on the tongue and inside the mouth,
- + a change in color of the skin, hair, or fingernails and
- + irritability, headache, heart palpitations, and shortness of breath.

### Some groups at increased risk of folate deficiency include:

- + people with alcohol use disorder, pregnant women,
- + people of childbearing age,
- + people with conditions that affect nutrient absorption, including IBD and celiac disease and
- + people with MTHFR polymorphism.

### Toxicity

Since vitamin B<sub>9</sub> is water-soluble, it is excreted regularly from the body via urine which effectively lowers the risk of toxicity. The Recommended Dietary Intake of folate is 400 mcg. Pregnant women and those planning pregnancies are suggested to have 400 to 800 mcg of folate every day. But do keep in mind to get consulted with a doctor or health care personnel before taking Vitamin B<sub>9</sub> in supplement form as an over dosage or anything more than the prescribed amount can cause side effects like sleep disturbances, mental confusion, skin reactions, loss of appetite, nausea, seizures and gastrointestinal defects.



### Conclusions

Recommendations of The Expert Advisory Group on Folic Acid in prevention of neural tube defects has several aspects (1) reducing the risk of the first NTD occurrence by preconceptional vitamin supplementation of folic acid in the dose of 0.4 mg day, which would go on until the end of the 12th week (2) reducing the risk of NTD recurrence in offspring of men and women with spina-bifida or with obstetric history affected with NTD by preconceptional vitamin supplementation of folic acid in the dose of 4 mg daily during the first 12 weeks and (3) organizing educational programmes for medical staff as well as the whole population in order to popularize vitamin supplementation.

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# MEDICINAL IMPORTANCE OF MARIGOLD



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**M**arigold is botanically name as *Tagetes* sps. Which belong to the family *Compositae* (Asteraceae). Marigold is native to *Mexico* and naturalised elsewhere in the tropics and subtropics. The genus *Tagetes* have 33 species have been introduced into the Indian gardens viz. *Tagetes erecta* [African marigold (2n=24)] *Tagetes lucida*, *Tagetes minuta*, *Tagetes patula* [French marigold (2n=48)], *Tagetes tenuifolia*. The marigold are easy to grow and have longer blooming period with the beautiful flowers, it could grow whole the year.

Marigold in India extensively used to make garland, house decoration, temple decoration, for adoration of God, etc. There are many flowers that have just one meaning but marigold has a few different meaning depending on its colour.

Yellow	Orange – Red	Orange
Positive feeling, Happiness and Joy	Love, Passion and Romance	Positive energy and Strong emotions

There are some medicinal uses of different species of marigold:

- *Tagetes erecta* has been used for the treatment of a wide variety of diseases and ailments.

- The decoctions of the leaves of *Tagetes erecta* and *Tagetes patula* have been traditionally used as antimalarial.
- *Tagetes minuta* has been traditionally used for repelling mosquitoes and also possesses strong larvicidal effect.
- The roots and seeds of *Tagetes patula* are used as purgative.
- The juice from *Tagetes patula* contains iodine and is used on cut and wounds.
- The *Tagetes lucida* plant is used in food as an ingredient of soup in place of tarragon and its leaves and flower heads are used to perfume bathing water.
- The shoots of *Tagetes lucida* and *Tagetes filifolia* have been used for the preparation of native teas in Mexico.
- The *Tagetes* oil has been mainly used for the compounding of high grade perfumes.
- *Tagetes minuta* is considered as the best source of valuable essential oil.

## Some pharmacological property of marigold plant

- ❖ **Anti-bacterial property:** The antibacterial property of different solvents of *Tagetes erecta* flowers against:

Bacteria	Disease
<i>Alcaligenes faecalis</i>	Skin and soft tissue infection
<i>Bacillus cereus</i>	Gastrointestinal illness
<i>Campylobacter coli</i>	Diarrhoea
<i>Klebsiella pneumonia</i>	Pneumonia, meningitis
<i>Proteus vulgaris</i>	Respiratory tract infection
<i>Streptococcus mutans</i>	Dental caries
<i>Streptococcus pyogenes</i>	Skin infection

**Flavonoid- Patulitrin** is a potential element for its anti-bacterial property.

- ❖ Anti- inflammatory property
- ❖ Anti-oxidant property
- ❖ Hepatoprotective property
- ❖ Anti-cancer property
- ❖ Anti- diabetic property
- ❖ Anti- depressant property
- ❖ Wound healing property
- ❖ Mosquitocidal property
- ❖ Anti –fungal property -: Essential oil of leaves of *Tagetes erecta* exhibited complete inhibition of the growth of *Pythium aphanidermatum* (Damping off).

## Some medicinal use of marigold plant

- Heals skin wounds, burn and rashes.
- **Body toxins:** Marigold is helps in the body's detoxification process



by removing all toxic materials that have accumulated in the body.

- **Menstrual pain:** Marigold flowers offers benefits for the proper regulation of the process that occur in the female reproductive system. These flowers help in relieving menstrual pain and cramps.
- **Skin conditions:** Marigold is also been used in alleviating various skin conditions due to its anti-inflammatory properties. Marigold essential oil when applied on skin helps in reducing damage caused by U.V. radiation. It was found that marigold

methanol extract has high levels of polyphenols, which provide anti-aging effects to the skin.

- **Naturally repels insects:** Due to its strong smells, anti-oxidant content and volatile oils, these flowers can be used to naturally fend off mosquitoes, pests and other insects.

#### **Marigold plant keeps Nematodes away**

Marigold are known to control nematodes especially the root-knot nematodes (*Meloidogyne spp.*) and lesion nematodes (*Pratylenchus spp.*) infesting crop plant. Marigold can be

used as a cover crop or in a crop rotation as they produce a substance called “*Alpha-terthienyl*” which can aid in the reduction of root-knot nematodes, lesion nematodes and other disease promoting organisms such as fungi, bacteria, insects and some viruses. The nematicidal compound (*alpha-terthienyl*) is only released by active, living marigold roots. Marigold should be planted at least two months before the desired vegetable crop. Furthermore, it must be planted at the same site in which the vegetable crop will be planted.

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# QUERCETIN: BENEFICIAL OR DANGEROUS ?



Quercetin is a flavonoid and natural product which has anti-oxidant and anti-inflammatory effects.

## Possible health benefits of Quercetin:

1. Relieving allergy symptoms.
2. Preventing infections.
3. Lower high blood pressure.
4. Reduce the risk of heart disease.
5. Fighting free radicals.
6. Reduce the risk of cancer.

The US food and drug administration has issued warning letters to several manufacturers about the treat diseases of the quercetin product which they advertise on their labels and websites.

There has been a little safety issue of the quercetin product to the pregnant, breastfeeding women, children and also adolescents. Not only this but studies found out that there is a suspicion of a parallel effect on animals also.

In humans, particularly the estrogen dependent tumors.

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The amount of Quercetin consumed by human beings is approximately 3 to 38 mg. It is not only found in onions but also in many other vegetables like asparagus, red leaf lettuce and fruits like apple, cherries, berries in high amount, while tomatoes, peas, broccoli, and green peppers have lower levels.

Phenylalanine in plants, is transform into 4- coumaroyl- CoA known as general phenylpropanoid pathway. One molecule of 4- coumaroyl-CoA is added to three molecules of malonyl- CoA to form tetrahydroxychalcone.

The "*Quercetin*" name comes from the Latin word "*Quercetum*" which is a yellow coloured compound that liquefy in alcohol and lipids but is insoluble in cold water and very poorly soluble in hot water.

**Y**ellow colour of the outer skin of onion bulb is due to "Quercetin". Quercetin (3,3',4',5,7- pentahydroxyflavonoid) that means five hydroxyl groups placed at the 3-,3'-,4'-,5- and 7- positions is almost found in every fruit and vegetables.

It is a group of polyphenols, which has a bitter flavour and is used in almost all the beverages, dietary supplements and foods as an ingredient.



# VITAMIN C: A POWERFUL ANTIOXIDANT



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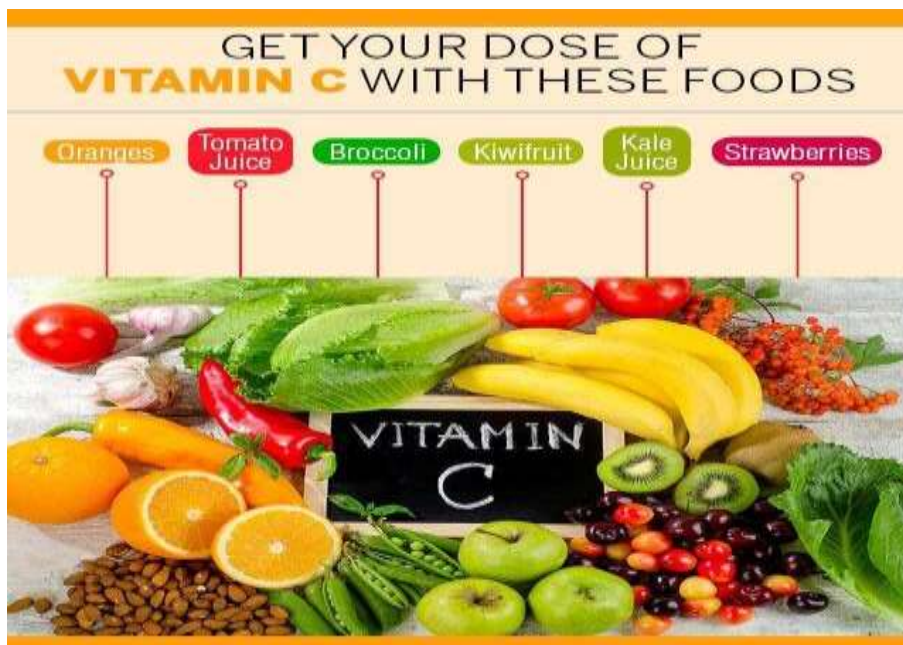
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Vitamin C also known as **Ascorbic acid** is a water soluble vitamin, which means it cannot be stored in the body and we must take it from dietary sources. It is a nutrient that the body needs in small amounts to functions and stay healthy.

Leftover amounts of the vitamin leave the body through the urine. Although the body keeps a small reserve of these vitamins, they have to be taken regularly to prevent a shortage in the body.

## Benefits of Vitamin C

- 1. Wound healing:** Vitamin C help fight infections, wound healing, and keep tissues healthy. It is an antioxidant that helps prevent cell damage caused by free radicals (highly reactive chemicals).
- 2. Protein synthesis:** Vitamin C is vital for normal synthesis of collagen. Collagen which is a fundamental component of connective tissues, is one of the important proteins whose formation is catalyzed by vitamin C. Vitamin C is thus vital to body growth and wound repair.
- 3. Antioxidant activity:** This vitamin is responsible for the non-enzymatic regeneration of other

antioxidant molecules, which take part in various physiological processes, such as alpha-tocopherol (vitamin E). Vitamin C is also known for its ability to protect glutathione from oxidation.

- 4. Iron absorption:** Vitamin C enhances the absorption of non-heme iron, which is the type present in plant foods, in intestine. It does this by reducing ferric iron to the ferrous state, (ferrous, Fe+2) which is better absorbed. Ascorbic acid supplementation is found to facilitate the dietary absorption of iron.
- 5. Immune regulation:** An important role in immune regulation. Vitamin C stimulates phagocytosis, as well as antibody formation.
- 6. Bile acid synthesis:** Vitamin C stimulates the initial step in cholesterol metabolism to bile acids via the 7-alpha-hydroxylase enzyme. This function may have importance in the formation of gallstones and the maintenance of normal blood cholesterol levels.
- 7. Prevent atherosclerosis:** Ascorbic acid is known to prevent the oxidation of LDL primarily by scavenging the free radicals and other reactive oxygen species in the aqueous milieu.

## Requirement

RDA 2020 of ascorbic acid (Vitamin C) for various physiological groups

Physiological Group	Body weight (Kg)	RDA (mg/day)
Adult Men	65	80
Adult Women	55	65
Pregnant	55+	65+15
Lactating	55+	65+50
Infants (0-6m)	5.8	20
Infants (6-12m)	8.5	27
Children (1-3y)	11.7	27
Children (4-6y)	18.3	32
Children (7-9y)	25.3	43

## Dietary sources

Good sources of ascorbic acid include **citrus fruits, tomatoes, berries, green vegetables, cantaloupe, green peppers and broccoli.** Potato is an important staple food in many countries that provide the required ascorbic acid cantaloupe even though its ascorbic acid concentration is low.

Food stuffs	Ascorbic acid (mg)
Citrus fruits	45-600
Tomatoes	20
Leafy vegetables	60-250
Roots and Tubers	10-40
Other vegetables	20-80
Nuts & oilseeds	0-7
Condiments & Spices	0-50



Ascorbic acid is sensitive to heat, light and oxygen and interacts with copper, iron and tin. During storage, losses have been found to vary (8-35%). It may also darken on exposure to light, moisture and heat. Cooking typically destroys ascorbic acid by accelerating the oxidation reaction.

#### **Toxicity**

High Vitamin C intakes have adverse effects after very large doses (greater than 3g/day). Possible adverse effects associated with very high

intakes have been reviewed and include: diarrhea and other gastrointestinal disturbances, increased oxalate excretion and kidney stone formation, increased uric acid excretion, increased iron absorption leading to iron overload, reduce vitamin B<sub>12</sub> and copper status, increased oxygen demand, and erosion of dental enamel.

GIT disturbances such as nausea, abdominal cramps, and diarrhoea are the most common adverse effects of high Vitamin C intake.

#### **CONCLUSION**

Vitamin C is known to have number of health benefits. It is an electron donor and therefore a reducing agent or antioxidant. Recent studies have shown potential health benefits of ascorbic acid in decreasing risk of cardiovascular accidents and asthma, cancer morbidity and mortality, prevention of cataract and its impact on common cold.

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# ROLE OF VITAMIN D IN HUMAN HEALTH



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Vitamin D is a fat-soluble vitamin that is important for strong bones, muscles, and general good health. There are two main forms of vitamin D, which are D<sub>2</sub>, otherwise known as ergocalciferol, and D<sub>3</sub>, which is also known as cholecalciferol. The majority of the vitamin D needed by the body is obtained from sun exposure, although some food products also contain vitamin D. Dietary supplements are also available to help increase intake of vitamin D. The vitamin D obtained from these sources is biologically inert and must undergo hydroxylation within the body in order to offer a functional use.

Your body produces vitamin D naturally when it's directly exposed to sunlight. You can also get it through certain foods and supplements to ensure adequate levels of the vitamin in your blood.

## Multiple roles of the vitamin D in body

Promoting healthy bones and teeth, Supporting immune, brain, and

nervous system health Regulating insulin levels and supporting diabetes management, Supporting lung function and cardiovascular health ,Influencing the expression of genes involved in cancer development

The major biological function of vitamin D is to maintain normal blood levels of calcium and phosphorus increase in the strength of the immune system. To date, more than 500 studies support the role of vitamin D in immune health.

Results from some studies report that vitamin D assists in the maintenance of joint and muscle comfort, as well as the maintenance of a healthy mood, and supports breast, colon, and prostate health. Many multivitamins formulated for women have increased amounts of vitamin D to at least 800 IU.

## BENEFITS OF VITAMIN D IN HUMAN HEALTH

### Healthy bones

Vitamin D plays a significant role Source in the regulation of calcium and maintenance of phosphorus levels in the blood. These factors are vital for maintaining healthy bones.

### Healthy infants

Vitamin D deficiency has links to high blood pressure in children. One 2018 study found a possible connection between low vitamin D

levels and stiffness in the arterial walls of children The American Academy of Allergy Asthma and Immunology (AAAAI) suggest that evidence points to a connection between low vitamin D exposure and an increased risk of allergic sensitization. An example of this is children who live closer to the equator and have lower rates of admission to hospital for allergies plus fewer prescriptions of epinephrine auto injectors. They are also less likely to have a peanut allergy.

### Healthy pregnancy

A 2019 review Source suggests that pregnant women who are deficient in vitamin D may have a greater risk of developing preeclampsia and giving birth preterm. Doctors also associate poor vitamin D status with gestational diabetes and bacterial vaginosis in pregnant women. It is also important to note that in a 2013 study Source, researchers associated high vitamin D levels during pregnancy with an increased risk of food allergy in the child during the first 2 years of life.

## RECOMMENDED DIETARY ALLOWANCES (RDAs) For VITAMIN D

Sensible sun exposure on bare skin for 5–10 minutes, 2–3 times per week, allows most people to produce sufficient vitamin D. However, vitamin D breaks down quite quickly,



Age	Male	Female	Pregnancy	Lactation
0-12 months*	10 mcg (400 IU)	10 mcg (400 IU)		
1-13 years	15 mcg (600 IU)	15 mcg (600 IU)		
14-18 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
19-50 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
51-70 years	15 mcg (600 IU)	15 mcg (600 IU)		
>70 years	20 mcg (800 IU)	20 mcg (800 IU)		

meaning that stores can run low, especially in winter.

### Sources of Vitamin D

Getting sufficient sunlight is the best way to help the body produce enough vitamin D. Plentiful food sources of vitamin D include:

- Fatty fish, such as salmon, mackerel, and tuna, Egg yolks, Cheese, Beef liver, Mushrooms, Fortified milk, Fortified cereals and juices

### DEFICIENCY OF VITAMIN D

Regular sickness or infection, Fatigue, Bone and back pain, Low mood. If Vitamin D deficiency continues for long periods, it may result in complications such as:

- Cardiovascular conditions
- Autoimmune problems

- Neurological diseases

### TOXICITY

Too much vitamin D can make the intestines absorb too much calcium. This may cause high levels of calcium in the blood. High blood calcium can lead to:

- Calcium deposits in soft tissues such as the heart and lungs.
- Confusion and disorientation.
- Damage to the kidneys.
- Kidney stones.
- Nausea, vomiting, constipation, poor appetite, weakness, and weight loss.

### CAUSES OF VITAMIN D

Having vitamin D deficiency is defined as having blood levels below 20 ng/mL. There is no single cause of

having this type of nutritional deficiency, but your overall risk may be linked to certain underlying conditions, as well as lifestyle factors. Here are some of the most common risk factors for vitamin D deficiency:

- Having dark skin.
- Being an older adult.
- Having overweight or obesity.
- Not eating much fish or dairy.
- Living far from the equator in areas where there is little sun year-round.

### CONCLUSION

Vitamin D is a very useful vitamin for the body. Our body makes it in sunlight. Apart from this, we also get it from food. Vitamin D strengthens the bones of our body and increases immunity. Its deficiency can lead to rickets and osteoporosis. Too much vitamin D can also harm the body delivers. Vitamin D decreases cell proliferation and increases cell differentiation, stops the growth of new blood vessels, and has significant anti-inflammatory effects. Many studies have suggested a link between low vitamin D levels and an increased risk of cancer, with the strongest evidence for colorectal cancer.

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# ANTIBIOTIC RESISTANCE IN FOOD ANIMALS



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**A**ntibiotics are biological substances that kill or prevent the development of microorganisms. Antibiotics have been widely used in contemporary medicine since their discovery eight decades ago, and they are exceedingly powerful against bacterial infections, which were formerly a significant source of morbidity and mortality. Antimicrobials are essential for the preservation of animal health, animal welfare, and food safety (FAO, 2016). In animals the antibiotics are mainly used for three purposes i.e., treatment, metaphylaxis and growth promoters. When the body gets exposed to the Antibiotics, the natural selection plays its role in development of the antibiotic resistance. Antimicrobial resistance (AMR) is widely accepted as a worldwide health issue, yet its scope remains unknown in many regions of the world. The invention of the antibiotics was a marvellous achievement in the field of medicine in order to save the millions of lives from various deadly bacterial diseases. The inventions that were once thought to be saving the world are now becoming the threat for the present and future generations. Rising income levels have resulted in an unprecedented increase in demand for animal protein. The demand of the animal proteins is increasing and to meet this surging demand the antimicrobials as growth promoters

are used in widespread manner that ultimately lead to the antimicrobial resistance. The difficulties associated with the nutritional shift to animal protein-based diets and the growth of antibiotic resistance are thus inextricably linked. Antimicrobial usage for animals is anticipated to increase by 99 percent in the BRICS nations by 2030, whereas human populations are only expected to increase by 13 percent over the same time period.

## Scenario of Antimicrobial resistance in India

Antimicrobials are often used in modern animal production procedures, potentially boosting selection pressure on microorganisms to become resistant. Despite the serious implications for antimicrobial resistance, there has been no quantitative assessment of cattle antibiotic usage worldwide. Antimicrobial use in animal production is expected to increase by two-thirds between 2010 and 2030, with one-third likely to involve antimicrobial usage (AMU) for disease prevention and growth promotion (or sub-therapeutic levels), particularly in pig and poultry production. Antimicrobial usage in food animals is estimated to account for 80% of the nation's yearly antimicrobial use in the United States (Food and Drug Administration, 2010). In recent years, India has emerged as a worldwide hotspot for antibiotic resistance (ABR), with increased rates of resistance to most antibiotics in common pathogens and an increasing number of treatment failures. India is one of the top consumers of agricultural antibiotics worldwide, accounting for 3 percent

of global consumption. India's increased use of antimicrobials, complimented with widespread "misuse" in health and agriculture sector has resulted in the spread of multidrug resistant organisms (MROs). India's battle with AMR made global headlines, when a novel multidrug-resistant strain was detected in a Swedish visitor afflicted with a common bacteria (*Klebsiella pneumonia*) in 2008. The bacteria was harbouring a drug resistant gene having ability to pass between a ranges of species and was named as "New Delhi Metallo-beta-lactamase-1" by the international scientific community. Despite repeated warnings from the WHO, it took nearly a decade for the problem of AMR to be openly addressed politically. Such concerns were soon followed by the first inter-ministerial background report on the matter titled, "Antimicrobial Resistance and its Containment in India". In India, antibiotic consumption in animals is not limited to treating infections. They are used widely in food animals as growth promoters and prophylactically to prevent expected infections. According to a MoHFW research, there are minimal restrictions in India prohibiting the use of antibiotics for non-therapeutic purposes, and even where there are rules, the onset of AMR from antibiotic abuse in the animal industry is likely to be an unmeasured burden. Antibiotics routinely used in food production have the greatest rates of resistance, including tetracyclines, sulfonamides, and penicillins, which are also important for animal therapy. As medically critical antibiotics become more widely used, they may



become less effective in the future for sick animals and humans who rely on them to survive. As it is reported, that usage of antibiotics in animal feed would grow by 82% in India by 2030. In India, their usage particularly in poultry is predicted to treble by 2030. More ever a serious problem in Indian animal health care system is that in field is dominated by the para-veterinarians and have meagre knowledge about the antibiotics and their resistance. The para-veterinarians are prescribing the antibiotics indiscriminately that has worsened the problem.

### **SPREAD AWARENESS, STOP RESISTANCE**

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World Antimicrobial Awareness Week (WAAW) is celebrated from 18-24 November every year. The

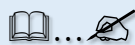
2021 theme, “**Spread Awareness, Stop Resistance**” calls on One Health stakeholders, policymakers, health care providers, and the general public to be Antimicrobial Resistance (AMR) Awareness champions. There is an urgent need to combine human, animal, and environmental health specialists in order to get a better knowledge of illnesses caused by interactions between humans, animals, and the environment. The indiscriminate use of the antimicrobials in food animals are threat to the humans equally. The antimicrobial resistance that is increasing at an alarming level in animals is passing to humans. Resistant bacteria occur in cattle and can be transmitted to humans in two ways: directly from the animals on the farm, or by handling or ingesting meat contaminated with resistant germs. The farmers having the less

knowledge about the drug resistance and withdrawal time of drugs are milking the animals and even during the withdrawal time. To assess the possible implications on animal and human health, a better knowledge of the repercussions of unrestricted rise in veterinary antimicrobial intake is required. Antibiotics must be used prophylactically as well as therapeutically in the livestock industry. Antimicrobial prophylaxis should be discontinued, and there should be guidelines for antimicrobial therapeutic usage. Developing recommendations for antimicrobial use in animals will aid in giving antimicrobial usage guidance. This guideline paper is now unavailable. The Indian Council of Agricultural Research has promised to resolve this issue as quickly as possible.

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# A QUICK OVERVIEW OF INDIA'S POULTRY INDUSTRY



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may be observed as a result of rising urbanization; moreover, as per capita income rises, awareness of balanced and nutritious eating habits will raise demand for chicken and eggs in the upcoming years in this country. Two poultry products, eggs and chicken, are most profitable as they are popular, have no religious obligations and are economically most appropriate for the common man purchasing capacity in the country.

The population of India is 1.25 billion and every year it grows. The priority is on "development," which includes good quality food, better health, and better living standards for everyone. When Indians earn more money, they spend more money on food. Almost every community accepts eggs and poultry and is accessible at cheap costs. India has risen to third in egg production and fifth in broiler production on the worldwide poultry production rankings during the previous two decades, owing to rising consumer demand for egg and chicken.

According to available data (2018), egg production has increased from a few millions to 82 billion eggs in the last 20 years, while broiler production has increased to 4.3 million tonnes. In India, 22 million tonnes of chicken feed are produced. Poultry is the fastest emerging animal agriculture sector, with a market value of Rs one lakh crores (US\$15.38 billion). Layers grow at a rate of 5-6% per year, while broilers increase at a rate of 8-9% per year, compared to a 3% growth rate for agriculture as a whole. The trend of younger generations moving from vegetarianism to non-vegetarianism is expected to boost poultry production and consumption in India in the upcoming years. This pattern

Broiler meat consumption patterns indicate that 62% of meat is consumed in ten major cities, with the remaining 38% consumed in smaller cities, including a small percentage consumed in villages.

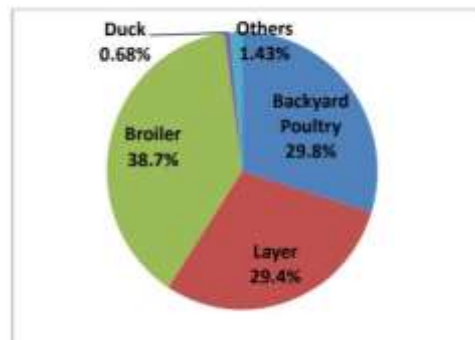
## Growth of Indian Poultry Production:

India has the highest poultry growth rate at 9%, followed by Brazil at 7%, the United States of America at 2.1%, and China at about 2%.

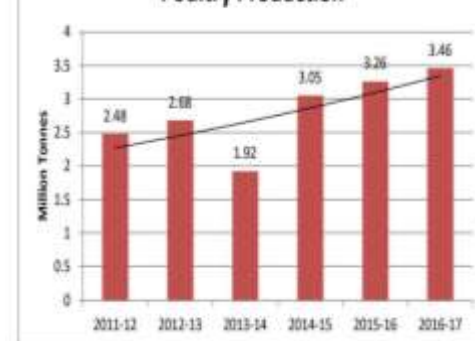
According to available data and the National Institute of Nutrition's guideline, per capita consumption should be 180 eggs and 11 kg meat. In these sectors, however, India is still trailing and is supplied with 64 eggs and 3.9 kg per person per year. In reference to other countries, the United States consumes the most eggs per capita (253) followed by China (206), Pakistan (115), and Bangladesh (96).

Commercial poultry farms produce about 85% of egg production, with the remaining production (about 15%) coming from household/backyard poultry. Transportation, waste management, conversion of waste into bio-gas energy, use of solar energy, disease diagnosis, and other

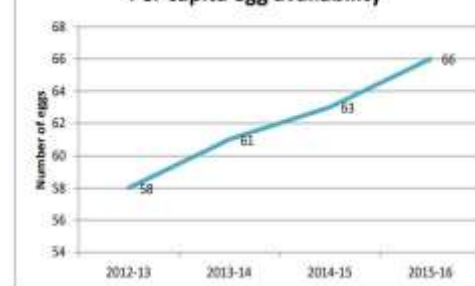
Distribution of Poultry population



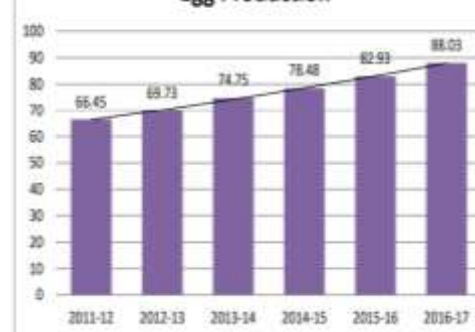
Poultry Production



Per capita egg availability



Egg Production



challenges must be overcome in order to achieve further growth. At the present, some difficulties like as a proposal ban on cage rearing and the negative involvement of certain Animal Welfare Organizations are also present. India's position differs from that of the United States and Europe. (Image Sources: Ministry of Agriculture & Farmers Welfare)

### The Role of Different Poultry Associations

The Role of Different Poultry Associations Several Poultry Associations, such as the Poultry Federation of India (PFI), the Compound Livestock Feed Manufacturers Association (CLFMA), the National Egg Coordination Committee (NECC), the Indian National Federation of Animal Health (INFAH), the Broiler Coordination Committee (BCC), and several other national and regional associations, played an important role in providing guidelines to poultry farmers and consumers. To improve nutritional security, several state governments have decided to offer boiled eggs (the cheapest form of digestible protein) to schoolchildren as part of Mid-Day Meal Schemes.

Poultry India, under the brand "Poultry Protein," conducted road shows around the country to encourage egg and chicken consumption. During their own road shows, other Poultry Associations also gave boiled eggs to students and common people. These Associations' campaigns got a resounding response from customers.

### Disease Scenario

In India's Maharashtra state, bird flu first appeared in the Nandurbar district in 2006. In West Bengal, a severe Bird Flu outbreak was observed in 2008. The H5N1 subtype of the Influenza. A virus was responsible for the outbreak, which impacted 13 districts in West Bengal. In 2017, the state of Karnataka saw the most recent outbreak of AI. AI virus was identified after samples

were submitted to Bhopal's National Institute of High Security Animal Diseases for testing. The role of state governments and the Department of Animal Husbandry, Dairy and Fisheries of the Government of India in controlling bird flu outbreaks deserves credit.

As per the Office International Epizooties (OIE) regulations, advisories were issued and teams of specialists were deployed to the affected regions to help in control and containment operations. The relevant state governments had carried out activities in accordance with the 'Action Plan on Avian Influenza Preparedness, Control, and Containment.' The issue may be managed without losing time due to the help of the Government of India's Department of Animal Husbandry, Dairy and Fisheries. Similarly, state governments and the Indian government have given information and instructions to poultry producers on how to implement bio security in their farms in order to avoid additional outbreaks.

### Research

At the moment, research is focusing on the use of certain feed additives that may be able to slow the spread of highly virulent avian influenza. Feed additives are a supplement, and birds require a healthy and balanced diet to boost their immunity, prevent diseases, and achieve maximum production. Nutraceuticals (60%), biological/vaccines (25%), and medicinal feed additives are the most valued types of products in animal health (15%). Farmers will pay greater attention to preventative health care in the near future due to the pressures of regulatory issues and animal welfare concerns. At all times, good sanitation and bio security precautions must be maintained on the farm.

Antioxidants and immunomodulators have been found to be effective in decreasing the severity of

Avian Influenza (AI). Immunity boosters and antioxidants including vitamin A, vitamin E, vitamin C, selenium, zinc, and others are highly suggested as feed supplements. Zinc and selenium have recently been discovered to have antiviral properties in addition to their antioxidant properties.

The use of acidifiers and probiotics as a preventative measure is highly recommended. Probiotics should be given to day old chicks in the first water they are given when they arrive, and should be given daily for at least 15-20 days. Through competitive exclusion, probiotics prevent harmful bacteria from populating the gut and enhance immunity. After that, acidifiers in feed / water can be used to keep the pH below 7 to avoid subsequent *E. coli* infections, avoiding the need of antibiotics and resolving antimicrobial resistance problems.

In terms of *E. coli's* involvement in poultry, it is the most common secondary bacterial invasion / infection, and *E. coli* resistance to generally used antibiotics is increasing. As a result, using effective and useful probiotics and acidifiers in both water and feed is extremely helpful in treating *E. coli* infection. Acidifiers also inhibit bio film production, which reduces the adherence potential of *E. coli*, Salmonella, and Clostridium.

### Integration in Poultry operations

In the operations of the broiler industry, a paradigm shift occurs because of uncertainty about broiler rates. Farmers are accepting integration in their farming practices, which is helping them avoid losses due to market uncertainty. Many poultry companies provide support and services to farmers in the integration process, bringing the poultry industry to a fully modern commercial level. This not only ensures fair pricing for farmers, but also protects them from market fluctuations, resulting in better farm



management, FCR, and the production of high-quality chicken. All of the main integration firms have already started processing and marketing through their store outlets.

### **Chicken processing in India**

In the next decade, the entire Indian agriculture value chain will shift dramatically, with food processing becoming one of the country's main industries. India's food processing business is one of the world's largest in terms of market size, with production estimated to reach \$ 535 billion by 2025-26. It is at the core of the Indian government's Make in India initiative, and it reflects Prime Minister Narendra Modi's demand for "vocal for local." The industry has been increasing at a rate of 10% to 12% yearly.

With higher agricultural production, improved storage facilities, more food processing, and changing consumer food tastes, the farm to kitchen chain will evolve in India, as it would elsewhere. In terms of India's

potential, only around 10% of farm produce is processed in the country, resulting in a lot of waste, and the government is working hard to boost food processing. There are several fiscal incentives for the firms, including preferential loans under priority lending sector. "The food processing sector is open to 100% FDI (foreign direct investment), and inflows have increased by 40% in the last year.

Traditional cold storages owned and controlled by local firms, with the majority of them located in Uttar Pradesh, Gujarat, Punjab, and Maharashtra, dominate the Indian cold chain system, which is unorganized and dominated by traditional cold storages owned and controlled by local companies. This sector is expected to grow under the present government. With the introduction of Foreign Direct Investment (FDI), foreign investors will also participate into this venture since there is considerable scope and enticing future prospects.

Government measures to increase the quality of storage and transportation facilities, as well as technological advancements, will aid the market. The market will see a transition between traditional cold storage systems and fully integrated projects in the cold chain, bringing the efficiency and productivity of cold chain firms. With growing exports of seafood, dairy products, and other perishable commodities, major players will improve their facilities to keep a wider range of products across a wider temperature range, and this market will exceed INR 470 billion by 2022. The poultry sector will play a significant role in the Government of India's policy initiatives targeted at doubling farmer income by 2022. With a growth rate of 7-9%, the poultry sector is the most organized of all agricultural sectors in India, and it is growing into a rapidly evolving and advanced sector.

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# BREEDING FOR QUALITY TRAITS IN RAPESEED- MUSTARD



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Quality refers to the suitability or fitness of an economic plant product in relation to its end use. Agriculture must now focus on a new paradigm that will not only produce more food, but deliver better quality food as well. Physical properties, nutritional quality and industrial applications of oils are determined chiefly by the type and proportion of fatty acids present in their triglycerides. Therefore, the particular use of oil for different purposes depends upon its fatty acid compositions.

Rapeseed-mustard comprising Indian mustard (*Brassica juncea*), rape (*Brassica campestris* var. yellow sarson, var. brown sarson, var. toria), gobhi sarson (*Brassica napus*), karan rai (*Brassica carinata*), white mustard (*Sinapis alba*), taramira (*Eruca sativa*), banarasi rai (*Brassica nigra*), are the second most important groups of oilseed crops in India after groundnut and play pivotal role in Indian economy. Breeding for high oil content and improved oil quality are two key breeding objectives in oilseed mustard. The oil quality in Brassica oilseeds is determined chiefly by relative proportions of different fatty acids compositions. Fatty acids are mainly classified as saturated such as palmitic (C16:0), stearic (C18:0) and unsaturated such as oleic (C18:1), eicosenoic (C20:1),

erucic (C22:1), linoleic (C18:2), and linolenic acid (C18:3). Erucic acid (C22:1) is a long-chain monounsaturated fatty acid and having major fraction (~50%) of the seed oil in Brassica species. Presence of high erucic acid content has been shown to be anti-nutritional due to detrimental effects on heart muscle functions. Canola (00) cultivars are having oil with < 2% erucic acid and defatted seed meal with < 30 µmoles/g of glucosinolates (Mag, 1983). Indian cultivars possess high erucic acid (About 50 %) and high glucosinolates (100-280 µmoles/g defatted seed meal).

useful feed for animals as it possesses well balanced amino acids composition of proteins. In addition to the low erucic acid and low glucosinolate, yellow seed coat colour is another desired characteristic and in recent years, the concept of '00' is being expanded to '000' which is also, one of the major breeding objective for brassica oilseeds breeders. Yellow seeds contains 1-2 per cent extra oil in the embryo because the yellow seeds possess a thinner seed coat with lower fibre content.

Our objective is to develop the varieties

Zero erucic acid

Increased oleic acid level

To reduce the level of blood cholesterol

To reduce the level of blood cholesterol

**Table 1: Fatty acid composition in traditional varieties vs in quality lines**

Fatty Acids		Percent of total fatty acids	Ideal Fatty acid (%)
Saturated Fatty Acids	Palmitic acid (16:0)	1-3	<3
	Stearic Acid (18:0)	0.4-3.5	<3
Mono/ Poly Unsaturated Fatty Acids	Oleic acid (18:1)	12-24	65
	Linoleic acid (18:2)	12-16	20
	Linolenic acid (18:3)	7-10	9
	Erucic acid (22:1)	40-55	<2

Glucosinolates is anti-nutritional factor that lowers the feed value of seed meal, otherwise could be a



### Breeding objectives for quality traits

- ❖ Low erucic acid in oil (<2%).
- ❖ Low glucosinolate content in defatted cake (<30 PPM).
- ❖ High linoleic acid.
- ❖ Low linolenic acid.
- ❖ High erucic acid (for industrial purposes).
- ❖ Yellow seed coat color.

### Breeding approaches for oil quality improvement

Sources of zero erucic, low linoleic, low glucosinolate and high oleic genotypes are available and some single and double low cultivars are now under cultivation in Canada, China, European Unions and Indian Sub-continent (Table-2). There are various breeding approaches like introduction, selection, hybridization, mutation and marker assisted selection schemes were used for development of quality varieties in

Rapeseed-mustard (Table-3). One of the major reasons for the low acceptability of quality mustard in India is its lower seed yield and oil content as compared to traditional cultivars so we need advanced breeding schemes to break this linkage drag. Genetic engineering approaches may be a potential option with engineering of Fatty Acyl Desaturases (FAD-2 & FAD-3) genes for production of high oleic and low linolenic lines.

**Table 2: Rapeseed-mustard quality germplasm donor sources registered in India**

S.No.	National identity	Other name	Special characteristics
1.	IC 296501	Heera	Low glucosinolate content (16.96 μ moles/g of seed) and low erucic acid in oil (0.1%)
2.	IC 296507	NUDHYJ 3	Low glucosinolate content (9.3 μ moles/g of seed) and low erucic acid (0.1%).
3.	IC 296684	TERI-Swarna	Zero erucic acid, yellow-seeded
4.	IC 405233	TERIGZ 05	High oleic and linoleic acid, yellow seed and double low material
5.	IC 546947	PRQ-2005-1	Low erucic acid with yellow seed
6.	EC223759	Zem-1	Low erucic acid
7	EC223760	Zem-2	Low erucic acid

**Table 3: Breeding approaches were used for quality improvement in Rapeseed-mustard**

Breeding Approach	Variety	Pedigree	Trait	Content
Selection and Backcross	Pusa Karishma	Pusa Basanti x Zem-1	Erucic acid	0.85%
			Oleic acid	42.30%
	Pusa Mustard - 21	Pusa Bold x Zem-2	Erucic acid	0.70%
			Oleic acid	42.1%
Hybridization	Hyola-401 ( <i>B. napus</i> )	40002A x 4154R	Erucic acid	0.9%
			Glucosinolate	17.7 μ mole/g
Mutation	NUDB 26-11 ( <i>B. napus</i> )	mutatant of Westar	Erucic acid	1.30%
			Glucosinolate	27.5 μ mole/g
MABC*	ZE <sup>#</sup> -Varuna	HE <sup>\$</sup> Varuna x Heera	Erucic acid	1.3%

Here \* is Marker assisted back cross, # - Zero erucic, \$ - High erucic.

### Conclusion

Quality strains of Rapeseed-mustard have lower seed yield and oil content as compared to traditional

cultivars. Therefore, more emphasis are required in India for improvement of oil and meal quality as well as seed yield and oil content in Rapeseed-mustard through extensive breeding work. Advanced breeding methods

viz. molecular marker assisted selection needs to be standardized to transfers quality genes in to novel and high yielding backgrounds.

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# SOCIO-ECONOMICS OF LIVESTOCK DISEASES IN INDIA



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Livestock sector plays a critical role in the welfare of India's rural population. This enterprise provides a flow of essential food products, draught power, manure, employment, income, and export earnings. As it is an important component in poverty alleviation programmes, continuous emphasis is being laid on this sector for enhancing the quality of the primary and secondary products, which in turn demands safe animal health for better products. Therefore, livestock development programmes cannot succeed unless a well-organized

animal health service is built up and protection of livestock against diseases and pests particularly against the deadly infections is assured.

India has achieved eradication of Rinderpest (RP), Contagious Bovine Pleuro Pneumonia (CBPP), AHS and Dourine. However, there are several other infectious and non-infectious diseases prevailing in the country causing huge economic loss annually. Prevention, control and eradication of the animal diseases need a thorough understanding of the epidemiology as well their economic impact.

Early warning of disease incidence or outbreaks and the capacity of prediction of risk of spread to new areas is an essential pre-requisite for the effective containment and control of epidemic animal diseases.

Vaccination is considered as an important strategy to reduce the socio-economic losses due to morbidity and mortality in ruminants. This becomes more important in developing countries like India because, livestock farming is of subsistence type, unlike commercial farming in developed countries.

## Economic losses due to various disease

The major animal diseases prevailing in India are Foot and Mouth Disease (FMD), Haemorrhagic Septicaemia (HS), Peste des Petits Ruminants (PPR), Brucellosis, Anthrax, Rabies, Glanders, Highly pathogenic Avian Influenza, and New Castle Disease (NCD), etc. During the period Jan. 2016- Dec. 2016, there was a total of 749 outbreaks of these disease in India. The annual economic loss due to Foot and mouth disease is 12000-14000 crore. Economic losses due to HS are Rs. 3755.95/animal. As far as buffaloes are concerned, it costs Rs. 4262.57/ buffalo while, for cattle, it was Rs. 5583/ cattle. The estimated annual economic loss due to PPR is Rs. 8895.12 crores, of which Rs. 5477.48 crores are in goats and Rs. 3417.64 crores in sheep. Annual economic loss due to Anthrax in cattle is 18.94 lakh. Brucellosis costs around the US \$ 3.4 billion loss in Indian livestock.

## Conclusion

There is need to strengthen the National Animal Disease Reporting System (NADRS) with the aim that the reporting of the disease outbreaks can be on a real-time basis. Another intervention can be the administration of the vaccination program for all vaccine preventable diseases, targeting all the susceptible species of the livestock. Government of India has also launched a National Animal Disease Control Programme to control the FMD and Brucellosis in animals.

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**Vaccination Schedule**

Sno	Disease	Animal	Vaccine	Dose	Immunity	Time of vaccination
1	Foot & Mouth Diseases (FMD)	All cloven footed animals	Polyvalent FMD vaccine	3 ml S/C	1 Year	February & December
2	Hemorrhagic Septicemia (HS)	Cattle, Buffalo	HS Vaccine	5 ml S/C	6 month & 1 Year	May-June
3	Black Quarter (BQ)	Cattle, Buffalo	BQ Vaccine	5 ml S/C	6 month & 1 Year	May-June
4	Anthrax	All species of animals	Anthrax Spore Vaccine	1 ml S/C	1 Year	May-June
5	Enterotoxaemia (ET)	Sheep & Goat	ET Vaccine	5 ml S/C	1 Year	May-June
6	Contagious Caprine Pleuro Pneumonia (CCPP)	Sheep & Goat	IVRI Vaccine	0.2 ml S/C	1 Year	-
7	Peste Des Petitis Ruminants (PPR)	Sheep & Goat	PPR Vaccine	1 ml S/C	3 Year	-
8	Brucella	Female cattle & buffalo Calf age 4-8 months only	Brucella Vaccine	2 ml S/C	1 Year	-
9	Theileriosis	Cattle & calves above 2 months of age	Theileria Vaccine	3 ml S/C	1 Year	-
10	Rabies	All species of animals	Rabies Post Bite Vaccine	1 ml S/C	1 Year	0, 3,7,14,28 & 90 days



# FLOWER SEED PRODUCTION

## A PROFITABLE APPROACH



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The Commercial flower seed production of F<sub>1</sub> hybrids and open pollinated is considered a profitable venture and, hence, it is popular amongst farmers on limited scale. Earlier, seed production was being done on limited scale in Sri Nagar and plains of North India and in other localities due to limited demand.

Mr. Man Mohan Attawar of M/s Indo American Hybrid Seeds, (India) Pvt. Ltd., and Bengaluru has began out generating F<sub>1</sub> hybrid seeds of Petunia for 100% export at some point of mid-sixties. However, flower seed production in open-pollinated flower plants became modernized via way of means of Mr. Avtar Singh, M/s Beauscape Farms, Sangrur, and Punjab who began out seed production in flower plants related to farmers on big scale.

At present many businesses generating flower seeds on huge scale for export to Holland, USA, U.K., Germany, France, and Japan etc. At present in India, flower seed generating in 600-800 ha area. In India flower seeds generating especially in Punjab (Sangrur, Patiala, and Ludhiana); Haryana (Panipat, Sirsa); Karnataka

(Bengaluru, Rani Banur); Himachal Pradesh (Kullu Valley); J & K (Sri Nagar Valley); and West Bengal (Kalimpong). The total cost of seed production in flower crops per ha varies from Rs. 10,000 to 15,000 and generate a net profit of Rs. 25,000 to 75,000. Farmers have started using advanced methods for harvesting seed as well as their cleaning which made the flower seed production more easy and profitable. However, flower seed production is labour intensive.

It has been observed that for wheat and paddy seed manufacturing the labour requirement is 50 people/acre at the same time as for flower seed production the desired labours varies among 120-366 peoples in line with crop. In an inspection performed in Ludhiana District of Punjab it's been observed that farmers mainly choose the ones plants which can be clean to harvest, easy and whose seed length is larger however this choice appears to haven't any cost as they must develop the ones plants which the businesses suggest.

### Climatic Requirement for Seed Production

Seasonal as term indicate are divided in to three seasons- Summer, Rainy and Winter season. Summer and Rainy seasonal in India are available in limited number whereas winter annuals are rich in kinds and available in large range of colours and height and bring riot of colours in the garden and, hence, very popular amongst gardeners.

Thus from seed manufacturing view factor additionally wintry weather annuals cowl big area. Ideal weather circumstance for seed manufacturing is lengthy period of cool and dry season which facilitates

in exact seed placing of ambitious size. While immoderate warm and dry season hampers seed placing of summer time season annuals in north Indian plains. Excessive rain on the time of flowering washes away pollen grains ensuing in terrible seed set. According to climatic requirements, the production of flower seed is divided in following climatic zones.

1. Mild climate (Kashmir Valley, Kullu Valley etc.)- Delphinium, Giant Pansy, Zinnia, etc.
2. Sub-Topical area- Antirrhinum, Anchusa, Ageratum, calendula, Brachycome, Linaria, Californian poppy, Candytuft, Carnation, Dianthus, Daisy, Dimorphotheca, Nasturtium, Petunia, Portulaca, etc.
3. Tropical- Tagetes, Salvia, Ipomea, etc.

### Mode of Pollination

For a success seed production of flowering plants, it's far essential to recognise whether or not the precise flower is self, often cross or cross pollinated crop. To discover whether or not a selected flower is self or cross pollinated, the quite simple technique of bagging or developing in entire isolation can be followed. A quantity of flowers are grown in flower mattress and while plant life are approximately to open a number of them can be blanketed with muslin baggage and tied nicely at the bottom in order that no insect can enter.



Fig-1. Seed production in China Aster





**Fig-2. Marigold seed production**

If the vegetation or flowers which have been protected with muslin bags produce seeds, then it's miles obvious that variety or species is self-pollinated. If the bagged flowers do not produce seeds, it's miles an illustration that flowers ought to be hand pollinated. Sometime this isn't always authentic of certain species or varieties.

**Table-1 Mode of pollination in different flower crops**

Self-pollinated	Often cross pollinated	Preferential outbreeds	Cross pollinated
Balagam	Antirrhinum	Ageratum	Alyssum
Cleome	Aster	Corn Flower	Calendula
Lupin	Dahlia	Delphinium	Cineraria
Sweet pea	Salvia	Marigold	Gazania
	Wall	Verbena	Stock
	Flower	Chrysanthemum	Zinnia
	Linum		
	Linaria		

or special methods e.g. collection of pollen grains with vacuum pump in petunia, use of floor guns etc. or use of male sterile line for seed production are followed to produce seeds in cross pollinated crops.

### Conclusion

At present so many farmers growing flowers for seed production. Because of cost benefit ration in flower seed production is very high as compare other crop production and because of high demand of flower crops seeds it is most profitable approach.

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For production of pure seeds numerous devices are adopted for cross pollination. Most common method is to grow them in isolation. This means to grow two species/variety or strain of the same species at certain distance from one another. Other methods such as bagging flowers, growing them under nets or in glass houses, emasculation



# THE INCIDENCE OF SPOTTED POD BORER: A PIGEOPEA



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**P**igeonpea (*Cajanus cajan* L.) is a major pulses crop in India and insect pests inflict heavy yield loss. Six insect pests viz., leaf webber, blister beetle, spotted pod borer, pod bugs, gram pod borer and pod fly more infested infested in pigeonpea. Spotted pod borer (SPB), *Maruca vitrata* Fabricius is a serious pest that causes severe leaf, flower and pod damage.

### Introduction

More than 250 species of insects have been found feeding on pigeonpea, although only a few of these viz., spotted pod borer (*Maruca vitrata* Fabricius), gram pod borer (*Helicoverpa armigera* Hübner) and tur pod fly (*Melanagromyza obtusa* Malloch) cause significant and consistent damage to the crop. The spotted pod borer, *M. vitrata* inflicts heavy yield loss (84.68% in MN1) by damaging the flowers, pods and seed. Several insecticides have been tested against spotted pod borer in pigeonpea. However, due to concealed nature of

feeding of the pest, it necessitates deployment of insecticide having fumigant action (i.e. DDVP) to contain this pest in pigeonpea. Hence there is a dire need for identifying a tolerant or resistant pigeonpea genotype to prevent the damage caused by this notorious insect pest.

**Spotted pod borer or maruca:** *Maruca vitrata* G.; Pyralidae: Lepidoptera

**Economic Importance:** This pest is wide-spread in tropical and sub-tropical regions of the world.

**Marks of Identification:** The moth has a white cross band on the dark brown forewings and a dark border on the white hind wings. The larva is green with a brown head, short dark hairs and black warts on the body.

**Host Plants:** It is an important pest of pigeonpea, cowpea, green gram, black gram, soybean etc. Legume pod borer is reported to feed on 39 host plants.

**Nature of Damage:** The larva webs together the flowers and feed on them and also bore into pods and feed on the seeds resulting in appreciable loss in yield of seeds.

Larvae damage stems, peduncles, flowers and pods of several tropical and sub-tropical grain legumes. Hence damage was observed from seedling to podding stages. Singh and Allen (1980) estimated losses to range from 20 to 60 per cent in cowpea. According to Patel and Singh (1976), in pigeon pea the larvae caused 10 per cent damage to fruiting bodies and pod damage ranged from 25 to 40 per cent. Vishakantaiah and Jagadeesh Babu (1980) estimated the

infestation levels to range from 9 to 51 per cent under Bangalore conditions in pigeon pea. Karel (1993) also observed more larvae (52.3%) on flowers than on pods (37.8%), and leaves (9.9%). In Sri Lanka, Dharmasena *et al.* (1992) reported about 84 per cent pod borer damage in pigeon pea. Ganapathy (1996) estimated an avoidable loss of nearly 50.0% and flower drop damage ranging from 9.4 to 12.7% in short, medium and long duration pigeon pea cultivars in Tamil Nadu, India. In pigeon pea, first-instar larvae prefer flowers over pods and leaves while third instar larvae prefer pods compared to flowers and leaves.

**Life History:** The eggs are laid singly in the flowers or buds or on the pods of the host plants. Pupation takes place in the plant debris on the surface of ground. The total life cycle is completed within 4 to 6 weeks. Incubation period: 6 – 8 days, Larval period: 2 – 4 weeks, Pupal period 1-2 weeks.

### Conclusion

*Maruca vitrata* is a major pest of pigeonpea having a potential to cause severe damage to the reproductive parts of the crop and yield loss. Differences in crop agro-climatic conditions may influence the incidence of *M. vitrata*. Therefore, understanding the incidence of the pest in the crop is most important for formulating IPM strategies for effective management of the pest. Controlling this pest became difficult due to its nature of feeding inside the web. Therefore, effective management strategies have to be developed to reduce the losses caused by the pest as well as to protect the crop. Identification of weak points for control amongst all the life stage and the sequence of management practices can be formulated by using this study.

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# AN INTRODUCTION OF RICE

## DISEASE: BLAST CROP



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The disease was first recorded in China in 1637. In Japan, it is believed to have occurred as early as in 1704. In Italy the disease called “brusone” was reported in 1828 and in USA in 1876. The disease was first recorded from Tanjore district of Tamil Nadu in 1918.

### Economic importance

The pathogen cause yield loss ranging from 30-61 per cent depending upon the stage of infection. In severe cases, losses amounting to 70-80 per cent of grain yield are reported.

### Symptoms

The fungus attacks the crop at all stages from seedlings in nursery to heading in main field. The typical symptoms appear on leaves, leaf sheath, rachis, nodes and even the glumes are also attacked.

**Leaf blast:** On the leaves, the lesions start as small water soaked bluish green specks, soon enlarge and form characteristic spindle shaped spots with grey center and dark brown margin. The spots join together as the disease progresses and large areas of the leaves dry up and wither. Similar spots are also formed on the sheath. Severely infected nursery and field show a burnt appearance.

**Node blast:** In infected nodes, irregular black areas that encircle the nodes can be noticed. The affected nodes may break up and all the plant

parts above the infected nodes may die (Node blast).

**Neck blast:** At the flower emergence, the fungus attacks the peduncle which is engirdled, and the lesion turns to brownish-black. This stage of infection is commonly referred to as rotten neck/neck rot/neck blast/panicle blast. In early neck infection, grain filling does not occur and the panicle remains erect like a dead heart caused by a stem borer. In the late infection, partial grain filling occurs. Small brown to black spots also may be observed on glumes of the heavily infected panicles.



**Leaf blast**



**Node blast**



**Conidia**

### Etiology

The causal organism was first detected by Cavara in 1891 from Italy. Mycelium of the fungus, is hyaline to olivaceous, septate and highly branched. Conidia are produced in clusters on long septate, olivaceous slender conidiophores. Conidia are pyriform to obclavate or somewhat top shaped, attached at the broader base by a hilum. Conidia are hyaline to pale olive green, usually 3 celled. The perfect state of the fungus is *M. grisea*. It produces perithecia. The ascospores are hyaline, fusiform, 4 celled and slightly curved. The pathogen produces few toxins namely,  $\alpha$ -picolinic acid, Pyricularin and pyriculol.

### Disease cycle

Mycelium and conidia in the infected straw and seeds are important sources of primary inoculum. The seed borne inoculum fails to initiate the disease in the plains due to high soil temperature in June. In both tropical and temperate regions, the fungus over-winters in straw piles or grain. In tropics, one method of survival is through infection of collateral hosts such as *Panicum repens*, *Digitaria marginata*, *Brachiaria mutica*, *Leersia hexandra*, *Dinebra retroflexa*, *Echinochloa crusgalli*, *Setaria intermedia* and *Stenotaphrum secundatum*. The most probable source of perennation and initiation of the disease appear to be the grass hosts and early sown paddy crop. The disease cycle is short and most damage is caused by secondary infections. Air can carry the conidia for long distances. The conidia from these sources are carried by air currents to cause secondary spread. Most conidia are released at night in the presence of dew or rain.

### Favourable Conditions

Application of excessive doses of nitrogenous fertilizers, intermittent drizzles, cloudy weather, high relative humidity (93-99 per cent), low night temperature (between 15-20°C or less than 26 °C), more number of



rainy days, longer duration of dew, cloudy weather, slow wind movement and availability of collateral hosts.

### Forecasting

Forecasting blast of rice can be made on the basis of minimum night temperature range of 20-26°C in association with a high relative humidity range of 90 per cent and above lasting for a period of a week or more during any of the three susceptible phases of crop growth, viz., seedling stage, post transplanting tillering stage and neck emergence stage. In Japan, the first leaf blast model was developed and named as

### Blast

Later based on different field experiments various models were developed namely, pyricularia,

pyriview, blastam, and P. blast. A model to forecast the disease called "Epi- Bla" has been evolved in India.

### Management

- a) Use of seeds from a disease free crop
- b) Grow resistant varieties like Simhapuri, Tikkana, Sriranga, Phalguna, Swarnadhan, Swarnamukhi, MTU 7414, MTU 9992, MTU 1005, Swathi, IR 64, IR 36, Sravani, Jaya, Vijaya, Ratna, RP 4-14, IET 1444, IR20, TKM 6, MTU-3 & 5 and NLR 9672 & 9674 in different tracts of Andhra Pradesh.
- c) Remove and destroy the weed hosts in the field bunds and channels.

- d) Split application of nitrogen and judicious application of nitrogenous fertilizers
- e) Treat the seeds with Captan or Thiram or Carbendazim or Carboxin or Tricyclazole at 2 g/kg.
- f) Seed treatment with biocontrol agent *Trichoderma viride* @ 4g/kg or *Pseudomonas fluorescens* @ 10g/kg of seed. Avoid close spacing of seedlings in the main field.
- g) Spray the nursery with Carbendazim 25 g or Edifenphos 25 ml for 8 cent nursery.
- h) Spray the main field with Edifenphos @ 0.1% or Carbendazim @ 0.1% or Tricyclazole @ 0.06% or Thiophanate Methyl @ 0.1%.

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# INTEGRATED PEST MANAGEMENT IN BRINJAL



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**B**rinjal is one of the important vegetable crops cultivated in the Southeast Asian region. Amongst the vegetables, brinjal or eggplant (*Solanum melongena* Linn.) is a self-fertilized, solanaceous crop, native to India. Brinjal is worldwide known and is the most popular and principal vegetable crop hence regarded as “King of vegetables”. In India, Brinjal is cultivated in an area of 6.69 lakh hectares with a production of 12400 MT with average productivity of 18.5t/ha. Brinjal (*Solanum melongena* L.) fruit is a rich source of iron, phosphorus, calcium, and vitamins A, B, and C. It is cultivated round the year due to the availability of water and its high consumer preference. Therefore, it is very susceptible to many insect pests and diseases throughout its growth period some important are discussed in the following text.

## INSECT PESTS

### 1. Shoot and fruit borer: *Leucinodes orbonalis*



It is the key pest and most obnoxious, a destructive pest of brinjal. Damages shoot buds stems and fruits. The damaging stage is larva which bore inside the shoots petioles and fruits and reduces the crop yields up to 80 percent damage to fruits. This causes hindrance to the farmers in brinjal cultivation on a commercial scale.

### Management

- Use sex pheromone traps at the height of 0.6 m above crop canopy for the maximum number of moth catches. Sixteen traps/acre is sufficient for maximum moth catches and less fruit damage.
- Soil application of Neem cake @ 1.0 t/ha of 5 percent NSKE is the most effective botanical.
- The pheromones on integration with *Trichogramma pretiosum* releases imparts a better control. The pheromone trapping plays a vital role in preventing the mating of adult moths, which leads to reduced egg load on the crop.
- Spinosad 45 SC is one of the effective insecticides in reducing shoot and fruit damage, novaluron 10EC also quite effective. Novaluron and Carbofuran 3G is the insecticide that provides pest suppression and is cost-effective.

### 2. Hadda/Spotted beetle: *Henosepilachna vigintioctopunctata*

It is one of the important foliage pests and causes serious damage, distributed throughout the country, and causes considerable loss to many crops including cucurbitaceous, solanaceous, and leguminous crops. The study of seasonal incidence reveals its prevalence in the winter is something lower in comparison to the



monsoon season. The affected plants are not able to get bloom and proper canopy which leads to a reduction in productivity.

### Management

- Profenophos (0.01%) is one of the effective insecticides to control Hadda beetle infestation in Brinjal.
  - To reduce the spray load of insecticides on brinjal and to minimize the pesticide hazards to the consumers. Hadda beetle may be controlled by the application of *Beauveria bassiana* at the concentration of  $1 \times 10^8$  spores/ml.
  - Larval parasitoid (*Pediobius foveolatus*), pupal parasitoids (*Brachymeria* sp.) are quite effective in suppressing the pest in the ecosystem. These parasitoids are abundant in the Gangetic plains of India.
  - Collect damaged leaves with grubs and egg masses and destroy them, shake plants by moving rope to dislodge grubs, pupae, adults to destroy.
- 3. Ash weevils: *Myloccerus subfasciatus*, *M. discolor*, *M. viridanus***

The grub stage of the weevil is able to cause damage to the roots resulting in wilting, drying, and death of the infested plants. The adults cause leaf damage which can be recognized by the characteristic leaf notch symptom. Insect causes damage to the brinjal throughout the year. The soil and foliar application of insecticides can be done to manage the grubs and adult damage in brinjal. The subterranean nature of grubs and



pupae make it difficult to manage and lead to increased plant protection cost. Although it's not a serious pest in most places but somewhere it causes damage.



#### Management

- The application of Entomopathogenic nematode (EPN), *Steinernema carpocapsae* (DD 136) and *Heterorhabditis indica* is the ideal combination to combat ash weevil incidence in brinjal.
- Apply Neem cake @ 500 kg/ha at the time of the last ploughing.
- In endemic areas, apply carbofuran 3 G @ 15 kg/ha, 15 days after planting
- Spray carbaryl 50 WP @ 3g + wettable sulphur 2g/litre of spray water.

#### 4. Sucking Pests

**Whitefly:** *Bemisia tabaci*,

**Aphid:** *Aphis gossypii*,

**Jassids:** *Amrasca biguttula*,

**Mealybug:** *Centroccoccus insolitus*



Brinjal is attacked by a number of sucking pests like whitefly, aphid, leafhopper, and mealybug. These are the sucking pests that suck the vital cell sap and make plants weaker ultimately plants lose their vigour which leads to yield loss. The secretion of these insects is deposited on the leaf surface in the forms of honeydew which favours the growth and development of sooty mold which interfere in photosynthesis and ultimately reduced yield.

#### Management

- Among the botanicals, neem-based formulations are quite effective like NSKE, Neem oil, Neemexcel and Neemarin (neem: *Azadirachta indica* based products).
- The first line of defense is prevention. Monitor the incidence on plants regularly.
- Avoid high-nitrogen fertilizers, which create young leaf succulence which favours these insects.
- For whiteflies and aphid monitoring, hang yellow sticky traps close to the top of the plant canopy. Whiteflies are attracted to the color yellow, and once they land will be stuck and die.
- Encourage natural enemies in the garden, such as ladybird beetles and lacewing bugs, by plant diversity and not spraying pesticides in 20 percent of the area.
- Aphids can easily be removed from a plant by knocking them off with a stream of water along with detergent from a hose. Once off, they tend not to climb back up.

#### 5. Red Spider Mite: *Tetranychus urticae*

Brinjal (*Solanum melongena* L.) crop is attacked by various insect and mite pests, among them red spider mite is one of the important. The incidence of mites is higher in the dry season and dusty climates.



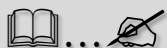
#### Management

- Azadirachtin based formulation can be used as a mixture with other botanical extracts to provide better results.
- Propagate 1ml/l spray can reduce the mite population drastically but some of the insecticides like Endosulfan/ Chlorpyrifos/ Profenophos are also effective to suppress the pest. To manage the mites spray should be added with any one surfactant or even cheap quality detergent powder 1 g/l of spray which makes it quite effective.
- Acaricides like Dicofol (0.05%) and Wettable Sulphur (0.3%) also give effective control of mites.
- Collection and burning of severely infested plant parts reduce further multiplication of pests. Proper irrigation and clean cultivation are essential to keep the pest population under control.

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# EFFECTIVE BIOCONTROL OF FALL ARMYWORM, *Spodoptera frugiperda* BY ENTOMOPATHOGENIC NEMATODES



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**F**all armyworm has spread across more than 100 countries worldwide, setting unprecedented challenges for farmers of world as well as in India. Agricultural crops like maize (*Zea mays*), sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*) etc. are main cereal crops of India which are subjected to many biotic and abiotic factors. Recently, fall armyworm (*Spodoptera frugiperda*) is most damaging insect-pest of various crops which is native to Central and South America. It causes serious economic damage to various crops from last few years. Its rapid spread to more than 90% of maize-growing areas of diverse agro-ecologies of India within a span of 16 months presents a major challenge to smallholder maize farmers, maize-based industry as well as food and nutritional security.

## Economic impact

*S. frugiperda* is found widely throughout the warmer parts of the world. Damage results from leaf-eating and healthy plants usually

recover quite quickly, but a large pest population can cause defoliation and resulting yield losses; the larvae then migrate to adjacent areas in true armyworm fashion. Due to lack of management and natural enemies, fall armyworm can cause significant yield loss in maize and other crops. A reported on maize attacked by this pest resulted into 26.4 and 55.9% infestation which causes 11.57% yield loss in single season. Some researchers have reported leaf, silk and tassel damage levels ranging between 25 and 50% and grain yield decrease of 58%.

## Symptoms caused:

## Biological management:

Rarely any chemical pesticide is proved effective against this pest due to the development of pesticide resistance as well as environmental contamination. So, use of biological control strategies are considered quite effective and sustainable as good alternate to chemicals. Among them, entomopathogenic nematodes (EPNs) are soil-dwelling natural enemies for many underground insect-pests including lepidopteran caterpillars. The mode of action of EPNs (*Heterorhabditis* spp. and *Steinernema* spp.) is to penetrate the host insect through natural openings, such as the mouth, anus, and spiracles, and then release the mutualistic bacteria that they carry (*Photorhabdus* spp. and *Xenorhabdus* spp. in *Heterorhabditidae* and *Steinernematidae*, respectively). This bacteria reproduce and generate various metabolites and toxins that kill the host insect through septicemia or toxemia.



In conclusion, *S. frugiperda* was highly susceptible at larval and pupal stages to various EPNs including *Sterinernema carpocapsae* and *Heterorhabditis indica*. These EPNs, therefore, could potentially be used as biological control agents to sustainably manage the overlapping generations of *S. frugiperda* in the environment.



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# AUTOMATED SYSTEM FOR PLANT DISEASE DIAGNOSIS BY USING IMAGE PROCESSING



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The diseases in plants can be determined by observing specific patterns in plants, but it is difficult to obtain these patterns in order to maintain plant's health. There are various techniques available such as spectroscopic and imaging technology which can be used to obtain patterns. Farmers can make use of automation techniques and tools to integrate knowledge, product and services to improve productivity, grade and yield with the help of smart farming. Disease diagnosis based on the detection of early symptoms is a usual threshold taken into account for integrated pest management strategies. Early Phytosanitary treatment minimizes yield losses and increases the efficacy and efficiency of the treatments.

Study on the image processing techniques used to identify and classify the disease symptoms affected on different agriculture/horticulture crops. Computers have been used to mechanization, automation and to develop decision support system for taking strategic decision on the agricultural production and protection research. The plant health monitoring is still limited by the human visual capabilities because most of the first symptoms are microscopic. As Plant

health monitoring is still carried out by humans due to the visual nature of the plant monitoring task, computer vision techniques seem to be well adopted. One of the areas considered here is the processing of image of disease affected agriculture/horticulture crops. The quantity and quality of plant products gets reduced by plant diseases. The goal is to detect, to identify and to accurately quantify the first symptoms of diseases.

## Automated image analysis

- Powerful alternative to visual assessments.
- Automation provides - calibrated image analysis.
- Automation allows high throughput phenotyping.

## Image processing

It involves the four following steps.

### ➤ Image Acquisition

The action of retrieving an image from some source, usually a hardware – based source, so it can be passed through whatever processes needed to occur afterward

### ➤ Image Pre-processing

It is the name for operations on images at the lowest level of abstraction whose aim is an improvement of the image data that suppress undesired distortions or enhances some image features important for further processing.



### ➤ Image segmentation

Process of partitioning a digital image into multiple segments.

### ➤ Feature extraction

It is a part of the dimensionality reduction process in which an initial set of the raw data is divided & reduced to more manageable groups.

## Phenomic assessment tools

- Detect specific phenotyping reactions occurring during plant-pathogen interaction.
- Faster approach is the selection of genetic material when resistance for specific pathogen or strains.

## Imaging Technology

Imaging technology has contains the six different following methods.

### 1. Digital imaging in visible electromagnetic spectrum (RGB Device)

Digital cameras used to detection, identification & quantification of plant diseases. Plant pathosystems and diseases assessed by the optical sensors.

**Eg:** Cotton – Bacterial angular

## Softwares

- ASSESS 2.0
- Custom- made module
- Leaf Doctor
- Scion Image

## Mobile applications

Planticus, Agrosight, Plantix, Plant disease, Plant disease identification app, AgroAl

### 2. Chlorophyll Fluorescence Imaging (CFI)

CFI is a well-established method for investigating effects of pathogens on photosynthetic metabolism of host plants at the whole - plant, detached leaf and leaf disks levels.

### 3. Hyper Spectral imaging

Hyperspectral imaging is a relatively new technology that involves the acquisition of electromagnetic spectra at every pixel in an image, thus combining spatial and spectral information. It measures



reflected light from plants in hundreds of narrow bands across the electromagnetic spectrum as a hypercube. HS sensors collect information as set of images which then combines and forms into 3 dimensional data cube for processing and analysis

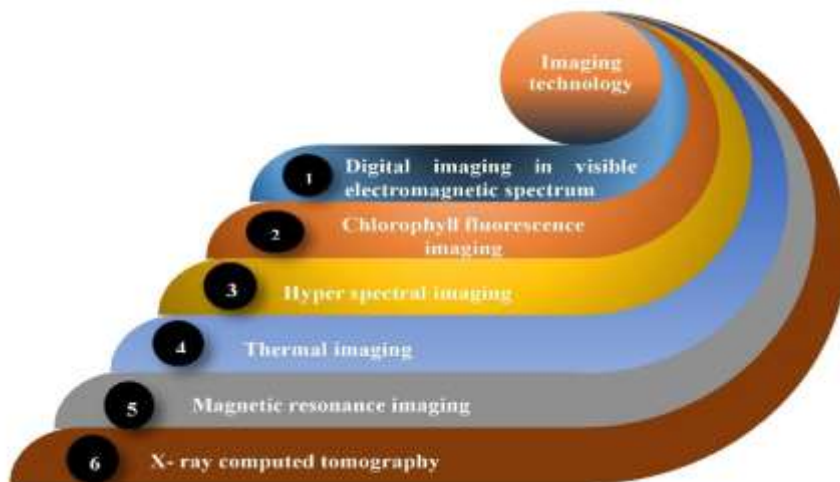
#### 4. Thermal imaging (Infra-Red Thermography)



Cameras used for far - infrared imaging (thermal imaging) usually detect electromagnetic radiation with the wavelength from 9 to 14 μm

#### 5. Magnetic Resonance Imaging (MRI)

➤ MRI uses strong magnetic fields and radio waves to form three - dimensional (3D) images of the objects.



➤ MRI can be used to evaluate internal tissue structure and water distribution in plants.

#### 6. X- ray computed tomography

- X-ray imaging systems with high spatial resolution that can be used for studying plant pathogen at subcellular level in 3D. Wave length (10-100 pm)
- X-ray has been tested for detection of fungal infection with *Aspergillus niger* and *Penicillium* spp. in harvested wheat kernels.

1. Controlled environment phenotyping
2. Ground based phenotyping
3. Aerial based phenotyping

#### Conclusion

- Characterization of different pathogen group is necessary
- The impact of mixed infections on the optical properties of plants has to be investigated
- The interaction between foliar pathogens & soil borne pest such as nematodes has to be evaluated.
- The interaction between biotic & abiotic stress has explored.

#### Phenotyping platforms

Based on working nature the devise will be classified on 3 types.

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# CURRY LEAVES

## (*Murraya koenigii*): A VERSATILE MULTI- POTENTIAL MEDICINAL PLANT



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**B**ecause of tremendous increase in human population which is thought to reach about 9.6 billion by 2050, it becomes a need of the hour to promote the use of plant based products or their extracts for the benefit of mankind. Indians regard food (vegetables, fruits, spices, medicinal plants) as a source of supporting system for body's healing processes. Traditional system of Indian medicine, known as Ayurveda play an important role in the treatment of wide variety of diseases. There has been tremendous growth in field of herbal medicine as therapeutic agents. Today it is gaining popularity in western countries because of negligible side effects, low costs, easy availability and rapid rate of biodegradability. All the plants are thoroughly studied before they can be employed for Ayurvedic pharmacopeia. One such plant of Indian origin, *Murraya Koenigii*, is known to possess ethnomedicinal properties and has been used for centuries in the Ayurvedic system of medicine.

### Introduction

*Murraya koenigii*, commonly known as curry leaf or karipatta in Indian dialects, belonging to Family Rutaceae which represents more than 150 genera and 1600 species (Satyavati *et al.*, 1987). *Murraya koenigii* is a valuable plant for its

characteristic aroma and medicinal value. It is an important export commodity from India as it fetches good foreign revenue. A number of chemical constituents from every part of the plant have been extracted.

The most important chemical constituents responsible for its intense characteristic aroma are Pgurjunene, P-caryophyllene, P-lemene and O-phellandrene. The plant is rich source for carbazole alkaloids. Bioactive coumarins, acridine alkaloids and carbazole alkaloids from family Rutaceae were reviewed by Ito, 2000. *Murraya koenigii* is widely used in Indian cookery from centuries and have a versatile role to play in traditional medicine. The plant is credited with tonic and stomachic properties. Bark and roots are used as stimulant and externally to cure eruptions and bites of poisonous animals. Green leaves are eaten raw for cure of dysentery, diarrhoea and vomiting. Leaves and roots are also used traditionally as bitter, anthelmintic, analgesic, curing piles, inflammation, itching and are useful in leucoderma and blood disorders. Several systematic scientific studies are also being conducted regarding the efficacy of whole plant or its parts in different extract forms for the treatment of different diseases. *Murraya koenigii* contains a number of chemical constituents that interact in a complex way to elicit their pharmacodynamic response. A number of active constituents responsible for the medicinal properties have been isolated and characterized. This plant has been reported to have anti-oxidative, cytotoxic, anti-microbial, antibacterial, antiulcer, positive inotropic and cholesterol reducing activities. Therefore the present review summarizes the available literature till date on isolation of phytoconstituents, biological activities of the isolated compounds and pharmacological actions of

extracts along with the clinical studies. *Murraya koenigii* (Rutaceae) commonly known as Meethi neem, is an aromatic more or less deciduous shrub or a small tree up to 6 m in height found throughout India up to an altitude of 1500 m and are cultivated for its aromatic leaves. In traditional system of Medicine, it is used as antiemetic, antidiarrhoeal, dysentery, febrifuge, blood purifier, tonic, stomachic, flavoring agent in curries and chetneys. The oil is used externally for bruises, eruption, in soap and perfume industry. The phytoconstituents isolated so far from the leaves are alkaloids viz., mahanine, koenine, koenigine, koenidine, girinimbiol, girinimbine, koenimbine, O-methyl murrayamine A, Omethyl mahanine, isomahanine, bismahanine, bispyrayafoline and other phytoconstituents such as coumarin glycoside viz., scopotin, murrayanine, calcium, phosphorus, iron, thiamine, riboflavin, niacin, vitamin C, carotene and oxalic acid. The essential oil from leaves yielded di- alpha phellandrene, D-sabinene, D-\_-pinene, dipentene, D-\_-terpinol and caryophyllene . It is reported to possess antioxidant, antibacterial, antifungal, larvicidal, anticarcinogenic, hypoglycemic, anti-lipid peroxidative, hypolipidemic, antihypertensive activity and proactive effect against carbon tetra chloride-induced hepatic damage in rats<sup>38</sup>. It is also reported to contain 5, 8-dimethylfuranocoumarin, 1- al, 3[6', 6' dimethyl 5-hexene] carbazole and -sitosterol.

### Plant description and habitat

The plant is distributed and cultivated throughout India. It is found wild from Himalaya's, Uttarakhand, Sikkim to Garhwal, Bengal, Assam, Western Ghats and Travancore- Cochin. Propagation is done by seeds, which germinate freely under partial shade. Is also available in other part of Asian region like in moist forests of 500- 1600 mheightin Guangdong, S Hainan, S Yunnan (Xishuangbanna), Bhutan, Laos, Nepal, Pakistan, Sri Lanka,



Thailand, Vietnam, and South India. Together with South Indian immigrants, curry leaves reached Malaysia, South Africa and Réunion Island. Outside the Indian sphere of influence, they are rarely found. *Murraya koenigii* is an unarmed, semi deciduous aromatic shrub or small tree with slender but strong woody stem and branches covered with dark grey bark, leaves are imparipinnate, glabrous, and very strongly aromatic. Leaflets 9-25 or more, short stalked, alternate, gland dotted and strongly aromatic. The stem of *Murraya koenigii* is an aromatic and more or less deciduous shrub or small tree upto 7 meters in height and 14 to 42 cm in diameter. The main stem is dark green to brownish. The bark of the stem can be peeled off longitudinally which exposes the white wood underneath. Flowers are small, white, fragrant, ebracteate, calyx deeply five cleft, pubescent. Petals five, free, whitish, glabrous and with dotted glands. Fruits occur in close clusters, small ovoid or subglobose, glandular, thin pericarp enclosing one or two seeds having spinach green color.

#### Traditional uses

Fresh leaves, dried leaf powder, and essential oil are widely used for flavouring soups, curries, fish and meat dishes, eggs dishes, traditional curry powder blends, seasoning and ready to use other food preparations. The essential oil is also utilized by soap and cosmetic aromatherapy industry. Curry leaves are boiled with coconut oil till they

are reduced to blank residue which is then used as an excellent hair tonic for retaining natural hair tone and stimulating hair growth. It is traditionally used as a whole or in parts as antiemetics, antidiarrheal, febrifuge, blood purifier, antifungal, depressant, anti-inflammatory, body aches, for kidney pain and vomiting.

#### Pharmacological studies

##### Antibacterial activity

The essential oil from *Murraya koenigii* leaves showed antibacterial effect against *B. subtilis*, *S. aureus*, *C. pyogenes*, *P. vulgaris* and *Pasteurella multocida*. The pure oil was active against the first three organisms even at a dilution of 1: 500. The acetone extract of the fresh leaves of *Murraya koenigii* on fractionation gives three bioactive carbazole alkaloids named as mahanimbine, murrayanol and mahanine, which has shown mosquitocidal, antimicrobial and topoisomerase I and II inhibition activities.

##### Antifungal activity

The essential oil from leaves of *Murraya koenigii* showed antifungal activity against *C. albicans*, *C. tropicalis*, *A. niger*, *A. fumigates*, *Microsporium gypseum* and *Murraya koenigii* was effective against *C. albicans* even at a dilution of 1:500. The ethanolic extract of the leaves showed fungitoxicity against *Colletotrichum falcatum* and *Rhizoctonia solani*. The ethanolic extract of the roots and also the whole plant excluding roots of *Murraya*

*koenigii*, however, did not show any antifungal activity against *Cryptococcus neoformans*, *Trichophyton mentagrophytes* and *Microsporum canis*.

##### Antiprotozoal activity

Ethanolic extracts (55 %) of *Murraya koenigii* whole plant excluding roots (extract A) and roots alone (extract B) were screened for their pharmacological actions. Extract A showed anti-protozoal action against *Ent. Histolytica*, antispasmodic effect on isolated guinea pig ileum, whereas extract B showed antiprotozoal activity against *Ent. Histolytica* and as well as antihypertensive activity in cat/dog (table 1).

#### Conclusion

Keeping in view the tremendous pharmacological activities and availability of literature, *Murraya koenigii* may be utilized to alleviate the symptoms of variety of diseases as evident from the pre-clinical data. Although crude extract from various parts of *Murraya koenigii* have numerous medical applications, modern drugs can be developed after extensive investigation of its bioactivity, mechanism of action, pharmacotherapeutics, toxicity and after proper standardization and clinical trials. The available literature and wide spread availability of *Murraya koenigii* in India thus makes it an attractive candidate for further pre-clinical and clinical research.

**Table-1. Active compounds of *Murraya koenigii* and their activities**

<i>M. koenigii</i> compounds	Source	Biological activity
Lutein	Leaves	Antioxidant activity
Tocopherol	Leaves	Antioxidant activity
	Leaves	Hepatoprotective
Carotene	Leaves	Antioxidant activity
Koenimbine	Leaves	Antioxidant activity
Isomahanine	Leaves	Anticaries
Mahanine	Stem and bark	Antimicrobial
Murrayanol	Leaves	Mosquitocidal
	Leaves	Anti-microbial
Murrayanine	Stem bark	Antifungal
Girinimbine	Stem bark	Anti-cancer
	Stem bark	Antifungal and antibacterial
	Leaves	Hepatoprotective





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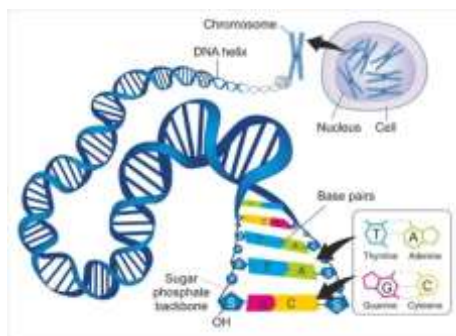
**D**NA isolation is an essential technique in molecular biology. Good quality DNA is a prerequisite for all experiments of DNA manipulation. Isolation of high molecular weight DNA has become very important with increasing demand for DNA fingerprinting, RFLP, construction of genomic or sequencing libraries and PCR analysis in research laboratories and industry. There have been continuous modification and standardization in DNA isolation protocol as various plant species are biochemically heterogenous in nature.

The most commonly used basic plant DNA extraction protocols are those of Dellaporta et al. 1983 and Saghai Maroof et al., 1984 along with many others that are modifications of the components of these protocols to suit a particular tissue type. Most of the plant DNA isolation protocols used now-a-days are modified versions of hexadecyltrimethyl-ammonium bromide (CTAB) extraction procedure.

### Principle

Deoxyribonucleic acid (DNA) extraction is the process by which DNA is separated from proteins, membranes, and other cellular material contained in the cell from which it is recovered. All plant DNA extraction protocols comprise of the basic steps of disruption of the cell wall, cell membrane and nuclear membrane to release the DNA into solution followed by precipitation of DNA while ensuring removal of the contaminating biomolecules such as

the proteins, polysaccharides, lipids, phenols and other secondary metabolites. This is brought about by disruption of the tissue in a mortar and pestle aided by liquid nitrogen and the various components of the homogenization or extraction buffer followed the precipitating and purification methods employed. Since DNA can be extracted from various types of tissues such as seedlings, leaves, cotyledons, seeds, endosperm, tissue culture callus, roots etc., the tissue type along with the concentration of DNA finally required determine the methodology of DNA extraction to be followed by the experimenter.



### Protocol of DNA isolation

Many of the available DNA extraction procedures have common elements. Indeed, the extraction of DNA generally follows three basic steps:

1. Lyse (break open) the cells.
2. Separate the DNA from the other cell components.
3. Isolate the DNA.

### MATERIAL AND REAGENTS:

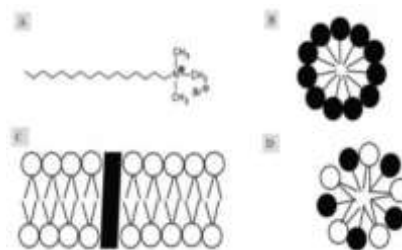
#### 1. CTAB Buffer

The CTAB buffer mainly includes CTAB, sodium chloride (NaCl), and ethylenediaminetetraacetic acid (EDTA) Tris-2-amino-2-hydroxymethyl-1,3 propanediol (TRIS), polyvinylpyrrolidone (PVP), and  $\beta$ -mercaptoethanol.

- **CTAB:** CTAB, a cationic detergent, constitutes a long hydrophobic hydrocarbon chain



and a hydrophilic head. It forms micelle in water because of the amphipathic nature. During DNA extraction, under aqueous condition, CTAB comes in contact with the biological membrane, captures the lipids and results in the release of nucleus, which is devoid of membrane.



- **NaCl:** NaCl helps to remove proteins that are bound to the DNA. It also helps to keep the proteins dissolved in the aqueous layer so they do not precipitate in the alcohol along with the DNA by neutralizing the negative charges on the DNA so that the molecules can come together.
- **Tris buffer:** When the cell wall and membranes are broken during tissue grinding, compartmentalization ends, cytoplasmic material is released, because of which the pH gets altered, and consequently the stability of biomolecules like nucleic acid is disturbed. The buffer plays a major role under such situations, and the Tris buffer (hydroxymethyl) amino-methane with the molecular formula  $(\text{HOCH}_2)_3\text{CNH}_2$ , which is an effective buffer between pH 7 and 9. Maintains the pH of the solution.
- **EDTA:** EDTA ( $\text{C}_{10}\text{H}_{16}\text{N}_2\text{O}_8$ ) chelates divalent cations, such as  $\text{Mg}^{2+}$  and  $\text{Ca}^{2+}$  which is present in



the enzymes and reduces the enzyme activity of DNase and RNase.

- **β mercaptoethanol:** Plants are rich in phenolics compounds and to get a good quality of DNA these compounds should be removed. β-Mercaptoethanol (HOCH<sub>2</sub>CH<sub>2</sub>SH) added most of the time in extraction buffers and is a strong reducing agent to clean tannins and other polyphenols present in the crude plant extract.
- **PVP:** PVP is added to remove phenolic compounds from plant DNA extracts. During grinding of the tissue, compartmentalization breaks and PPO convert polyphenols into quinone, which gives brown coloration. PVP removes polyphenolic contamination by binding it through hydrogen bond. Thus, it prevents polyphenol oxidation, and thereby browning of DNA samples.

## 2. Phenol chloroform extraction

Nucleic acid solutions commonly contain undesirable contaminants that are chiefly made of proteins. A classic method of purifying is phenol – chloroform extraction by which the nucleic acid solution is extracted by successively washing with a volume of phenol (pH 8.0); a volume of phenol: chloroform: isoamyl alcohol (25: 24: 1) and chloroform: isoamyl alcohol (24:1). Centrifugation is performed intermittently and the upper aqueous phase is transferred to a new tube while avoiding the interphase. The contaminants are denatured and accumulate in the organic phase or in the marginal layer between the two phases and the nucleic acids are preserved in the aqueous phase.

## 3. Ribonuclease A

Genomic DNA should be treated with Ribonuclease A (RNase A) to remove the contamination of RNA for DNA purification.

## 4. Isopropanol

Alcohol is used to precipitate the DNA out of the extraction solution, so we can wash all those salts and chemicals away and then dissolve it in our final solvent usually water or some variant of Tris-EDTA solution. DNA remains dissolved in aqueous solution because DNA has phosphodiester backbone, which is hydrophilic in nature. Water molecule forms hydration shell around DNA by forming hydrogen bonds. Isopropanol/ ethanol is used in precipitation of DNA, which breaks the hydration shell.

## 5. Sodium acetate/ ammonium acetate/potassium acetate/ sodium chloride/ lithium chloride/ potassium chloride

The role of the salt in the extraction protocol is to neutralize the charges on the sugar phosphate backbone of the DNA. Sodium acetate with pH 5.2 is commonly used for precipitation of nucleic acid along with ethanol.

## 6. Ethanol

DNA precipitate is washed again with 70% ethanol to rinse excess salt that might come along with the extraction buffers from the pellet, centrifuged and ethanol is discarded, leaving DNA in the precipitate. Precipitate is air dried or vacuum dried. Over drying should be avoided as DNA converts B form to D form which might be difficult to dissolve later.

## 7. Tris-EDTA (TE) buffer/sterile water

In older times in DNA isolation methods, DNA used to be stored dry and diluted when required. Nowadays, for long-term storage, it is prudent to store DNA in a buffer that maintains its pH and keeps it from getting degraded. TE buffer contains Tris (10 mM) and EDTA (1 mM), where Tris is the buffering component and EDTA the chelating component. For DNA

isolation, the pH is usually set to 7.5–8.5, the slight alkalinity of TE buffer also prevents chances of acid hydrolysis that may further disrupt the stability of DNA stored in water. Sterile water can be utilized for short-duration storage of DNA.

## Procedure

- ❖ Preheat 10ml CTAB buffer (add 10µl β-mercaptoethanol to each 10ml CTAB) in 50ml centrifuge tube at 60-65 °C.
- ❖ Remove and discard midribs and gently crumble about 5 g of leaf tissue over cold pestle with liquid nitrogen.
- ❖ Scrape powder into dry tube and add pre-heated buffer and mix gently. Avoid leaving dry material around rim of tube. Adjust CTAB volume to give a slurry-like consistency, mix occasionally.
- ❖ Incubate for 60 min at 60°C.
- ❖ Add equal volume of chloroform/ iso-amyl alcohol (24:1), Mix for about 3min; Spin at 8,000rpm for 10min.
- ❖ Remove supernatant with wide-bore tip (cut off tip) to clean tube, repeat chloroform extraction once or twice. Supernatant should be clear, though may be colored.
- ❖ Precipitate DNA with 0.66 vol. of cold isopropanol (can leave overnight in isopropanol)
- ❖ Spool out or spin down DNA, 2min at 4,000rpm.
- ❖ Wash the DNA pellet with 70% alcohol.
- ❖ Dry briefly (can be left overnight for drying) and re-suspend in 0.5-1.0 ml T.E.
- ❖ Add 1µl 10mg/ml RNase to each 1ml T.E. /DNA mixture and incubate for 3-4hrs. at 37°C.

## Storage of DNA

For short-term storage (24-48 hours) of the DNA, 2-8°C is recommended. For long-term storage, -20°C or lower temperature (-80°C) is recommended. Avoid repeated freezing and thawing of the sample which may cause denaturing of DNA.



### Precautions

- ✓ Material finely ground in liquid nitrogen should be immediately transferred into the extraction buffer and must not be allowed to 'sweat'.
- ✓ **In chloroform:** isoamyl alcohol extraction, the aqueous phase should be carefully removed and organic phase re-extracted to ensure full recovery of DNA. If no separation is observed between the two phases, may be due to high concentration of DNA and /or cell debris in aqueous phase, dilution with more digestion buffer and re-extraction is the solution.
- ✓ Care should be taken to do the operations as gently as possible. Vortexing, pipetting using fine tips etc. should be avoided to prevent the shearing of DNA.
- ✓ DNA should not be over dried as re-suspension in TE become difficult.
- ✓ All the glassware, plastic ware, pestles and mortars etc. should be decontaminated properly. Care should be taken to prevent cross-contamination.
- ✓ Blank extraction controls are carried out along with normal extractions to check for any contamination.

### CONCLUSION

Plant species are chemotypically heterogeneous in nature, thus, a single Deoxyribose nucleic acid (DNA) isolation protocol may not be suitable for various plant species. A general difficulty in isolation of DNA from plant cells is the presence of a cell wall. It is necessary to degrade plant cell walls, either physically or

enzymatically, in order to effectively isolate plant DNA. There have been continuous modification and standardization in DNA isolation protocols. Most of the protocols used today for isolation of plant DNA are modified versions of hexadecyltrimethylammonium bromide (CTAB) extraction procedure. Modification is usually done in the concentration of chemicals used during the extraction procedure according to the crop plant and plant part used. Thus, understanding the role of each chemical (e.g. CTAB, NaCl, PVP, ethanol, and isopropanol) used during the DNA extraction procedure will benefit students and researchers to set or modify their protocols for more precisions.

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# SYNTHETIC THEORY OF NATURAL SELECTION



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**D**arwin's theory of natural selection was accepted. The strong supporters of Darwinism are Wallace, Huxley, Haeckel, and Weismann. Darwin's theory lacked an input of modern concepts of genetics and the mechanisms how characters appear and persist in a population. In the light of recent researches, the theory was modified. Several experimental evidences have gone in favor of Darwinism. Based on those facts and statistical data a synthetic theory of evolution was proposed. This is modified theory of Darwinism. This is called Neo-Darwinism.

The Synthetic theory emerged by the synthesis of the original idea given by Charles Darwin and addition of new knowledge of genetics, population dynamics, statistics, and heredity to the theory. This is the most modern theory of evolution and has been constantly improved during 20<sup>th</sup> century by the contribution of the following scientists such as R.A. Fischer, J.B.S. Haldane, Ernst Mayr, Julian Huxley, and G.G. Simpson contributed with their studies on population dynamics. T. Dobzhansky, H.J. Muller, H. DeVries, G.L. Stebbins added information on genetics and mutation. G.H.

Hardy, W. Weinberg, Sewall Wright did extensive work on population genetics and statistics, which helped to understand the mechanism of heredity.

According to Neo-Darwinism the following factors operate for the formation of new species.

- Variations
- Mutations
- Natural selection
- Genetic drift
- Isolation of species.

Over production, struggle for existence, and universal occurrence of variation will take place as usual. But in the synthetic theory the formation of variations and mutations were discussed with experimental evidence for evolution which Darwin was unable to explain.

## Variations

During Darwin's time little was known about genetic variations. During Meiosis and crossing over synapsis will take place. Because of this regrouping of genes will take place. Because of which genetic variation will appear or chromosomal aberrations will take place. The chromosomes may lose a bit or gain in a bit or order may be changed, or chromosomal bits may be exchanged between two chromosomes. These aberrations will become heritable variations.

Now and then the sets of chromosomes will increase or decrease. This is called ploidy.

Because of this polyploidy heritable variations will arise they will be carried to number of generations. This may result in the origin of new species.

## Mutations

Any change in the nucleotide sequence of DNA and if one pair of nucleotides is replaced mutations will arise. These mutations are called point mutations. These are caused spontaneously in nature. They can also be brought by induction. Mustard gas, x-rays, gamma rays, electric shocks, temperature shocks etc. will bring mutations. These mutations are rare. They are sudden and heritable. They may be harmful or beneficial. Most of the mutant genes are recessive. They can be expressed only in homozygous state.

Because of these sudden mutations new species are formed. For evolution, variations and mutations will be the raw material.

## Natural Selection

Natural selection includes all forces both physical and biotic factors and determine how and in what direction an organism is to change. Natural selection has no favoritism. But it is obvious that the organisms which are suited for environmental conditions will survive over power in the force of competition. Because of this better survivors are retained in the nature.

## Genetic Drift

In small inter breeding population heterozygous gene pairs will tend to become homozygous. Because of this, disadvantage characters may be expressed and those organisms will be weeded out. Such genetic



drifts are not theoretical. They operate in small populations of Islands. This genetic drift will provide a way to determine the line of evolution.

a) **Isolation:** In Darwin's time nothing to known about isolation. Isolation is very important part in evolution. Usually, the organisms of a population will be segregated into several populations because of physiological or geographical Isolation.

Mutations large stretches of water may separate a population in the separated groups one group may change. Because of this new species will be developed. Thus, geographical isolation will bring evolution.

The effects of natural selection in different environments will give different species. Thus, the old Darwin's concept is re-organized with experimental proofs, New- Darwinism was proposed.

### **Examples of natural selection**

#### **The industrial melanic moth**

*Biston betularia*, the industrial melanic moth, is a gray colored moth that perfectly camouflages on tree trunks covered with lichen in England and escapes predation by birds. With industrial revolution in England in the middle of 19th century, lichens on tree trunks got killed due to smoke belching out of factories. Tree trunks were

now bare and dark and made the light gray moth prominent to the predatory birds. Now natural selection favoured dark coloured moths, which could camouflage on bare tree trunks. Since the moth has only one generation in a year, in less than 50 generations, the natural selection replaced gray population with black population.

#### **Resistance in mosquitoes and houseflies**

DDT was used extensively, sometimes by airplanes over large areas. Initially it killed 99% of mosquito population but at the same time put a lot of pressure on the surviving individuals to mutate. Mutant resistant strains survived DDT application and became the parents of the next generation. Natural selection preserved the resistant populations and eliminated the susceptible ones. This can be called an artificial selection by man, due to which today not only mosquito and housefly but also many agricultural pests have become resistant to most of the available insecticides.

#### **Liederberg's replica plating experiment**

Liederberg (1952) conducted experiment on *Escherichia coli* by exposing the susceptible strains to penicillin repeatedly. As the generation time of the bacterium is 20-30 minutes only, hundreds of generations could be cultured and exposed to

penicillin within a short time. He found that mutations for resistance appeared instantly and quickly replaced the susceptible populations by natural selection.

#### **Fluctuation test experiment**

Salvador Luria & Max Delbruck (1943) cultured a population of *E. coli* in one flask along with bacteriophage viruses. He then cultured samples from the flask on agar plates and found similar growth on all agar plates. He found that in some flasks instant mutations had appeared for resistance against viruses while in others susceptible strains died out. This experiment proved that in populations exposed to environmental extremes, either the mutants appear or hidden recessive mutations express and get exposed to natural selection and save the population from the possible extinction.

### **Conclusion**

Natural selection is a phenomenon that forces the species to keep improving generation after generation so that they remain in the fittest state to survive in a particular environment. Random genetic changes provide raw material that causes variations and gives natural selection a chance to operate.

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# PROPERTIES OF QUALITATIVE AND QUANTITATIVE TRAITS



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## Qualitative traits

The traits usually determined or controlled by single or few pairs of major genes have sharp distinction among phenotype, exhibits discontinuous variation, can't be measured by any unit of measurement highly heritable and least affected or not affected by environment. A qualitative trait is a feature, that is either present, or not present, depending on whether the gene responsible for that trait is present (or functional) or absent (or non-functional). Qualitative traits are usually encoded by one gene or sometime by a few numbers of genes. These traits usually do not change in response to the environment. Since qualitative traits are discrete values, they can be analyzed by counts and ratios.

## Quantitative traits

The traits which are controlled or determined by many pairs of minor genes or poly genes, exhibits continuous variation, can be measured by unit of measurement low to medium heritable and largely affected by environment because the effect of minor genes modified by the environment. Quantitative traits are usually determined by a larger number of genes. These traits can change under the influence of the

environment. Since quantitative traits are spread over a range of values, they cannot be analyzed by counts and ratios, but must be analyzed statistically.

## Properties of Qualitative traits

There are following properties of qualitative traits-

1. **Genes:** These traits controlled by one or few pairs of major genes. The effect of single gene can be deducted.
2. **Heritability:** These traits shows high heritability.
3. **Environment effect:** Environ-ment factors such as age, nutrition, management, climate, disease have very little or no effect on the traits.
4. **Analysis:** Statistically these traits can be analyzed by making counts and ratio.
5. **Distribution:** Quantitative trait follow binomial distribution.
6. **Variation:** Quantitative traits exhibits discontinuous variation. Variation is mainly in genetic.
7. **Measurement:** These traits can not be measured by any unit of measured by any unit of measurement. These are the character of kind.
8. **Example of the traits:** In many beauty mental or psychological qualities, way of working behavior, blood group, coloured vs albino individuals. In farm animals, Body colour eg. coat colour pattern in different species eg. Black and red coat colour in Angus cattle; Red, white and roan in short horn cattle, horned & polled or, presence

or absence of horn in cattle and sheep.

9. **Improvement:** Quantitative trait can be improved through genetically.

## Properties of Quantitative traits

There are following properties of quantitative traits-

1. **Genes:** These traits controlled by many pairs of minor genes or poly genes. The effect of single gene can not be deducted.
2. **Heritability:** These traits shows low to medium heritability.
3. **Environment effect:** These traits are highly affected by environmental factors such as feeding, housing management, health care etc.
4. **Exposed:** Quantitative trait can be described by mean median & mode, variance and covariance.
5. **Distribution:** Quantitative trait follow normal distribution.
6. **Variation:** Quantitative traits shows continuous variation. Variation is genetic and non-genetic both.
7. **Improvement:** Quantitative trait can be improved through environment management.
8. **Statistically:** These traits can be analyzed by measures of central tendency and measures of dispersion.
9. These traits are economic traits for example - milk yield, lactation length, birth weight, weaning weight etc.

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# UBIQUITOUS NATURE OF EDIBLE MUSHROOMS

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Mushrooms have been considered as ingredient of gourmet cuisine across the globe; especially for their unique flavor and have been valued by humankind as a culinary wonder. More than 2,000 species of mushrooms exist in nature, but around 25 are widely accepted as food and few are commercially cultivated. Mushrooms are considered as a delicacy with high nutritional and functional value, and they are also accepted as nutraceutical foods; they are of considerable interest because of their organoleptic merit, medicinal properties, and economic significance. The most cultivated mushroom worldwide is *Agaricus bisporus*, followed by *Lentinus edodes*, *Pleurotus* spp., and *Flammulina velutipes*. Mushroom production continuously increases, China being the biggest producer around the world. However, wild mushrooms are becoming more important for their nutritional, sensory, and especially pharmacological characteristics.

## Nutritional Value

The nutritional value of edible mushrooms is due to their high protein, fiber, vitamin and mineral contents, and low-fat levels. They are very useful for vegetarian diets

because they provide all the essential amino acids for adult requirements; also, mushrooms have higher protein content than most vegetables. Edible mushrooms are a good source of protein, 200–250 g/kg of dry matter; leucine, valine, glutamine, glutamic and aspartic acids are the most abundant. Mushrooms are low-calorie foods since they provide low amounts of fat, 20–30 g/kg of dry matter, being linoleic (C18:2), oleic (C18:1) and palmitic (C16:0) the main fatty acids. Edible mushrooms contain high amounts of ash, 80–120 g/kg of dry matter (mainly potassium, phosphorus, magnesium, calcium, copper, iron, and zinc).

## Nutraceuticals

In addition to the nutritional components found in edible mushrooms, some have been found to comprise important amounts of bioactive compounds. Many species of edible wild-grown mushrooms, that is *Tricholoma matsutake*, *Lactarius hatsudake*, *Boletus aereus*, are appreciated as food and also in traditional Chinese medicine. The rich amount of proteins, carbohydrates, essential minerals, and low energy levels contributes to considering many wild-grown mushrooms as good food for the consumer, which can virtually be compared with meat, eggs, and milk.

## Carbohydrates

Polysaccharides are the best known and most potent mushroom derived substances with antitumor and immunomodulating properties. Some specific carbohydrates with these properties have been quantified in different mushrooms: rhamnose, xylose, fucose, arabinose, fructose,

glucose, mannose, mannitol, sucrose, maltose, and trehalose.

## Proteins

Bioactive proteins are an important part of functional components in mushrooms and also have great value for their pharmaceutical potential. Mushrooms produce a large number of proteins and peptides with interesting biological activities such as lectins, fungal immunomodulatory proteins, ribosome inactivating proteins, antimicrobial proteins, ribonucleases, and laccases.

## Main Edible Mushrooms Worldwide

### *Agaricus bisporus*

*A. bisporus*, from the *Agaricus* genera, is the most cultivated mushroom worldwide (Figure 1). This group of edible mushrooms is nowadays widely used and studied for its medicinal and therapeutic properties. A lectin from *A. bisporus* and a protein from *A. polytricha* have been found to be potent immune stimulants; thus, these macromolecules may be considered for pharmaceutical utilization and these fungi may be classified as healthy food. *A. bisporus* extract has been shown to prevent cell proliferation in breast cancer.



**Figure 1:** *Agaricus* species, the most cultivated mushroom world wide

### *Lentinus edodes*

*L. edodes* or “shiitake mushroom” has been used for many years to investigate functional properties and to isolate compounds



for pharmaceutical use; this is because of its positive effects on human health (Figure 2). It has been utilized to alleviate the common cold for hundreds of years and some scientific evidence have provided experimental information about the aqueous extracts of *L. edodes* as potential sources of antioxidant and anticancer compounds. These extracts significantly decreased cell proliferation on tumor as well.



**Figure 2: Lentinus edodes or “shiitake mushroom.”**

***Pleurotus***

This genus, also known as oyster mushrooms, has approximately 40 species. In addition to their nutritional value, they possess medicinal properties and other beneficial effects and health-promoting effects. (Figure 3). *Pleurotus* species have been used by human cultures all over the world for many years. These species have been

used as medicinal mushrooms for long time since they contain several compounds with important pharmacological/nutraceutical properties.  $\beta$ -glucans isolated from *Pleurotus pulmonarius* demonstrated an anti-inflammatory response in rats with colitis, and *P. ostreatus* inhibited leukocyte migration to acetic acid-injured tissues. An extract from *P. florida* suppressed inflammation.



**Figure 3: *Pleurotus* or “oyster mushroom” possesses medicinal properties and health-promoting effects.**

***Ganoderma***

The “mushroom of immortality,” commonly known as Lingzhi or Reishi, has been used in traditional Chinese medicine to improve health and longevity for thousands of years, as well as in the

treatment of neurasthenia, hypertension, hepatopathy, and carcinoma (Figure 4).



***Ganoderma* the “mushroom of immortality”**

It is one of the most popular medicinal mushrooms in China, Japan, and Korea. It has been under modern biochemical and pharmacological research during the last decades. Modern pharmacological tests have also demonstrated some important characteristics of this fungus, such as immunomodulating, antiallergic, antiradiation, antitumor, anti-inflammatory, antiparasitic, and antioxidant properties.

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# STATUS AND SCOPE FOR MAIZE IN INDIA

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**M**aize (*Zea mays*) is an emerging future cereal crop due to its high genetic yield potential, wider adaptability to soil and climatic conditions. It is the only crop which can be grown in Rabi, Kharif and Spring, with food, feed, fodder and industrial value making it a candidate crop for increasing the farmer's income. India has less standards in terms of yield as compared to the world, thus huge push is needed to close the gap between the demand and the supply. Growing demand for poultry feed, growing urbanization leading to increased demand for processed food, growing livestock population increases the demand for maize-based concentrates and rising international prices due to diversion of maize grain towards biofuel production makes it a high demanding crop for the world.

## Introduction

Maize (*Zea mays* subsp. *mays*) is 'queen of cereals' and is one among the prime three cereal crops i.e., rice, wheat and maize due to its higher genetic yield potential. Being, C4 plant, maize give higher productivity in shorter period of time than any other food grain crop. There are 6 major types of maize i.e., dent corn (grain corn), flint corn (Indian corn), popcorn, pod corn, flour corn and sweet corn. It is the most versatile emerging crop with wider

adaptability and is the only cereal crop which can be cultivated in different seasons namely *Rabi*, *Kharif* and *Spring*. It has a potential for doubling the farmer's income as every part of maize has its own economical value. In addition to food directly consumed by humans, it serves as raw material for more than 3500 products including starch, beverages, oil, food sweeteners, cosmetics, film, gum, pharmaceuticals etc. thus provides larger opportunities for value addition. The multiple utilities of maize crop as food, feed and fodder make it more unique and demand friendly and thus less vulnerable against low demand situations.

## Status of maize in world

Global maize production reaches up to 1147.7 million MT from an area of 193.7 million ha with productivity 5.75 tonne/ha (FAO, 2020). US and China are the two largest producer and consumer countries of the world with 30 per cent and 23 per cent contribution to the global maize production respectively. Whereas, in terms of export Argentina and Brazil are leading the place (Indiastat, 2020).

## Status of Maize in India

Maize is the third major cereal crop after wheat and rice. In 2020, its production was 30,250 thousand tonnes from an area of 9.2 million ha with productivity 2965 kg/ha (Koema, 2020 and DACNET, 2020). Globally, India ranks at 4<sup>th</sup> with 4 per cent contribution to the total area and 7<sup>th</sup> with 2 per cent contribution to the total maize production. In India, there are mainly 8 states contributing ¾ area to the maize production namely, Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Tamil Nadu. Among them, Madhya Pradesh

(15.13 lakh ha) and Karnataka (13.82 lakh ha) are the two states with maximum area under maize cultivation. Maize is mainly consumed under three categories viz: food, feed and fodder, 63 per cent maize is consumed under the poultry and cattle feed whereas only 8 per cent is consumed by humans. Under All India Coordinated Maize Improvement Project more than 417 maize cultivars for *Rabi*, *Kharif* and *Spring* have been released in India till now (IIMR, 2021). Immense scope of improvement is present in the strategically important crop as India stands almost half of the global standards. Thus, it is necessary to have a merger of strategies and interventions around technological innovations, promoting producer aggregation and linkages, forgoing public-private partnership relations and enabling supporting infrastructure. The country has exported 2.879 Mn MT of rupees 4,675.78 crores in 2020-21 (Apeda, 2021).

## Importance in agribusiness ecosystem:

Maize cultivation generates employment to 15 million farmers for 650 million person-days. There is quite striking difference between the yield of India and the World i.e., 130 per cent. Thus, huge efforts are needed for improving the yield and total production

- NITI Aayog has identified 7 sources of growth, which could help in doubling farmers' income by 2022: 1) Increase in productivity of crops, 2) Increase in production of livestock, 3) Improvement in efficiency of input use, 4) Increase in crop intensity, 5) Diversification towards high value crops, 6) Improved price realization by farmers, 7) Shift of cultivators to non-farm jobs. On all these 7 identified growth parameters, Maize has visible potential to qualify.
- Maize is rich source of starch (71-72%), protein (9-10%), fibre (4-45



%), sugar (2-3 %) and minerals (1.4 %) of dry matter.

- It is only food cereal crop that can be cultivate under varied soil condition, have wider adaptability and can be sown in different seasons as well. Being a C4 plant it uses 3-fold less water, can grown under stress condition for water, temperature and carbon-dioxide limitations.
- By cultivating maize, farmers can protect the decreasing quality of soil, save 90 per cent of water and 70 per cent of power as compared to paddy
- It is a multi-utility crop when compared with rice and wheat, maize can be use as food (7Mn MT), feed (14 Mn MT), Fuel (1.2 Mn MT) and for industrial purpose (1.8 Mn MT) where wheat and paddy has no usage for fuel and industrial purpose they are mainly consumed as food.
- India is always a feed starved country with largest livestock population. Besides Indian poultry industry specifically eggs and poultry meat is growing at a CAGR of around 6 per cent and 9 percent. Poultry feed accounts 47 %, livestock feed accounts 13 %, food accounts 20 % and processed food accounts 7 % to the total maize

consumption (NCML report, 2016).

### Maize vision 22 developed by FICCI strategies

Production of maize need to grow at 15 % CAGR to suffice the domestic demands. It should reach up to 45 Mn MT by 2022.

### Strategies

- To bridge the yield gap, rapid relinquishment of new technologies interms of hybridization, molecular breeding, next generation mutation techniques adoption of RNAi technology are priorities.
- Seed cold storage, maize silos, maize value adding unit should be created.
- With high impetus on promotion of FPOs / FPCs in Budget 2018, seed production clusters in select pockets of countries, especially in Telangana, could arise as formal institution like Seed Producers' Companies (SPCs) / Seed Producers' organizations (SPOs). Once a formal institution is created, it would be facilitated by both public and private players in effective manner
- Framing innovative public-private partnership models for

ensuring the availability of quality seeds.

- Enabling policies intervention can provide considerable push to this sector eg. Setting up maize dryers by govt, of Punjab in all mandis, 50 per cent subsidy to maize growers on its purchase, Rashtriya Krishi Vikas yojna, National food security mission etc.

### Conclusion

Maize is a potential future cereal crop. It not only increases the farmer's income but also is a source of raw material for various agricultural products. Changing climate which is negatively affecting the yield of numerous crops, in that case maize can perform better as it is a C4 plant. In India farmers growing more wheat and paddy in non-traditional areas leading to depletion of ground water table and soil declination whereas, maize can be a solution to similar situations as it saves 90 per cent of water and 70 per cent of the power. This crop needs further impetus and support from all stakeholders for better economic growth.

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### Approaches of Maize vision 22

**Back end approach:** focused on doubling the current yield of crop. Areas touched in value chain would be Seed, Farm mechanization, Research and Development, Irrigation, Crop insurance and other farm inputs.

**Front end approach:** It is market specific. Improves the price realization for maize farmers. Areas covered processing / milling, procurement and storage, retailing etc.





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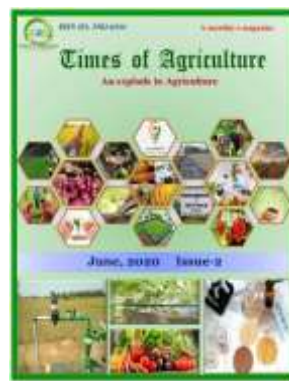
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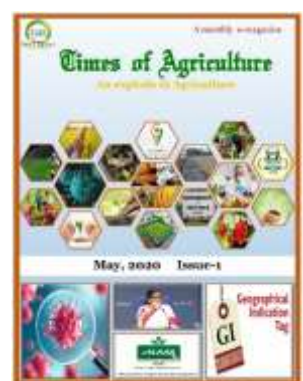
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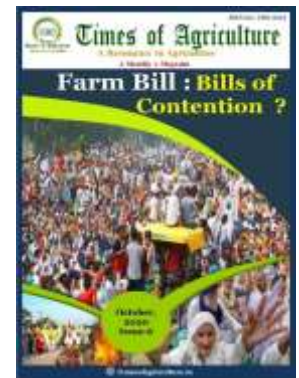
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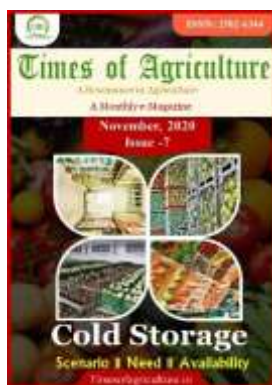
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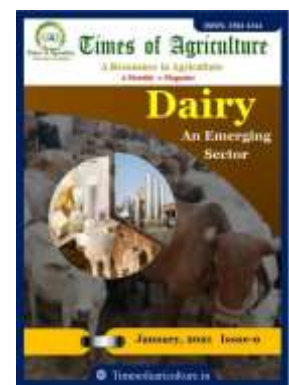
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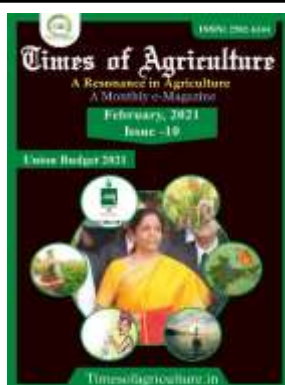
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8-December



9-January



10-February



11-March



12-April